THE STATE
OF THE WORLD's

FOREST GENETIC RESOURCES

COUNTRY REPORT

FINLAND

This country report is prepared as a contribution to the FAO publication, The Report on the State of the World's Forest Genetic Resources. The content and the structure are in accordance with the recommendations and guidelines given by FAO in the document Guidelines for Preparation of Country Reports for the State of the World's Forest Genetic Resources (2010). These guidelines set out recommendations for the objective, scope and structure of the country reports. Countries were requested to consider the current state of knowledge of forest genetic diversity, including:

- Between and within species diversity
- List of priority species; their roles and values and importance
- List of threatened/endangered species
- Threats, opportunities and challenges for the conservation, use and development of forest genetic resources

These reports were submitted to FAO as official government documents. The report is presented on www. fao.org/documents as supportive and contextual information to be used in conjunction with other documentation on world forest genetic resources.

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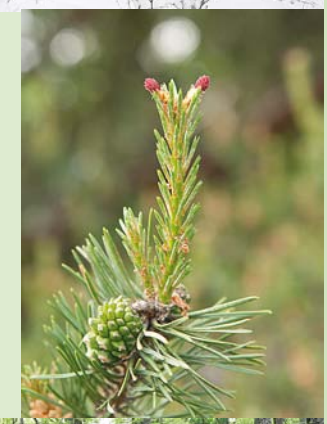
FAO State of the Forest Genetic Resources in Finland 2011



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FAO State of the Forest Genetic Resources in Finland 2011

Finnish Forest Research Institute 2012

Ministry of Agriculture and Forestry 1/2012

Title of publication:
1/2012 FAO State of the Forest Genetic Resources in Finland 2011

Publisher:
Ministry of Agriculture and Forestry & Finnish Forest Research Institute (Metla)

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ISBN 978-952-453-735-3 (Printed version)
ISSN 1238-2531 (Printed version)

ISBN 978-952-453-736-0 (Electronic version)
ISSN 1797-397X (Electronic version)

Layout: Anna-Kaisu Korhonen and Anne Siika, Finnish Forest Research Institute (Metla)

This report in its printed form is an amended and shortened version of the original report delivered to the FAO in December 2011. Some globally meaningful parts which have little relevance in Nordic countries have been completely left out and other parts of the text have been condensed for this publication. The original report is available on the FAO Forest Genetic Resources web pages or by request from the editor M. Rusanen at the Finnish Forest Research Institute .

Printed by Juvenes Print Tampereen Yliopistopaino Oy

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Foreword

The Food and Agriculture Organization of the United Nations (FAO) has recognised the value of genetic resources in agriculture and forestry for decades. At its Eleventh Regular Session, the FAO Commission on Genetic Resources for Food and Agriculture acknowledged the urgent need to conserve and sustainably utilise forest genetic resources to support poverty alleviation and environmental sustainability. As a practical measure, the Commission approved the inclusion of forest genetic resources in its Multi-Year-Programme of Work. It also agreed to the preparation of a country-driven first report on the State of the World's Forest Genetic Resources.

Finland recognises the role of genetic resources in sustainable forest management as well as in the use of forest for the benefit of people, through both traditional wood production and various ecosystem services. Finland welcomes the active role the FAO has taken by preparing a global status report on forest genetic resources.

Although the conservation of genetic resources has been regularly monitored at the international level, the FAO initiative entitled The State of Forest Genetic Resources in Finland is the first report that comprehends the various aspects of management and conservation in a wider framework. The process of preparing the country report has been a fruitful exercise for the national stakeholders, extending the thinking beyond the traditional gene conservation work done by the Finnish Forest Resource Institute (Metla).

I would like to express my warmest thanks for those contributing to this report. I hope that the valuable content of this report will be used when strengthening the forest genetic resources conservation work and raising the political awareness of the value of genetic resources.

Juha Ojala

Director General
Department of Forestry, Ministry of Agriculture and Forestry

State of Forest Genetic Resources in Finland 2011 – Summary

Forests are Finland's primary natural resource. Three-quarters of the land area of Finland is covered by forests. The forest area, 22.2 million hectares, has remained almost unchanged over the last 50 years, whereas the volume of the growing stock has increased by more than 40% in the same period. The growing stock was 2.2 million cubic metres at the end of 2010. Finland's forests represent the country's most significant renewable natural resource and they are managed and utilised in accordance with the principles of sustainable development. The forests are currently growing at a rate of 100 million cubic metres per year when the total drain is approximately 69 million cubic metres. The vast majority of the forest in Finland is owned by private persons, mainly families, and the properties are generally quite small.

The objective of the Finnish forest policy is to ensure the welfare founded on the sustainable use of forests while maintaining the diversity of the forest nature. The tools of forest policy are legislation, public funding and organisations, and informational means. Sustainable forest management has several dimensions: economic, environmental, social and cultural sustainability.

The National Plant Genetic Resources Programme (2001) lists 15 native tree species included in the genetic conservation strategy and for each species sets the main targets and measures, according to the priorities and the level of threat. The strategy was prepared in 2001 and has been implemented with slight modifications, as needed, according to the changes in the operational environment and increasing knowledge. The implementation of the programme is guided and supervised by the National Advisory Body for Genetic Resources. The Advisory Body has members from several ministries as well as from other interest groups, and it is chaired by the Ministry of Agriculture and Forestry. The duties of the Advisory Body also include Nordic and international issues involving plant genetic resources, including international legislation.

The Genetic Resources Programme defines a principal method of gene conservation for each tree species. *In situ* conservation is used mainly for species that are fairly common, have continuous distribution and extensive gene flow. *In situ* conservation is carried out through gene reserve forests which are especially selected for gene conservation purpose. A basic requirement for a gene reserve forest is that it is of local origin and has been either naturally regenerated or regenerated artificially with the original local seed source. The general objective is that a gene reserve forest of a wind-pollinated species should cover an area of at least 100 hectares, in order to secure sufficient pollination within the stand. In the management of gene reserve forests, the principal aim is to ensure abundant regeneration and a wide gene pool. In general, the management does not differ significantly from normal forestry practices used in Finland. Most important aspect is to support natural regeneration and when this is not possible, collect seed from the very same stand to be used in sowing or planting. Special attention is also paid to creating and maintaining a roughly even distribution of different age classes, in order to ensure stability on the long run.

Ex situ -conservation is applied to species that are rare and grow either mixed with other species or in small stands. Often the distribution is fragmented and the genetic differentiation among populations is higher than with the major species. In the *ex situ* programme, the gene pool is primarily maintained in living trees. Material is collected from several small, natural stands and grown in an intensively managed collection. The collections are designed in a way that will make it possible to collect seed at a later stage, to be used in landscaping or small-scale forestry. However, there is no breeding involved, since the material is not selected according to any productive traits. The sampling is designed to capture the natural genetic variation as effectively as possible.

The National Plant Genetic Resources Programme is an internal programme of the Ministry of Agriculture and Forestry and therefore provides no broader legal basis for the work. This is an obvious weakness of the present arrangement. Under economic constraints, it is hard to ensure the long-term continuation of the work. Furthermore, there are cases where nature conservation and gene conservation have conflicts of interest as regards the management of certain areas. One practical difficulty in implementing the *in situ* programme is the lack of state-owned land in certain regions, which creates a need to turn to the private sector. An area of work where more attention has to be paid is raising the political awareness of the value of genetic resources and awareness among professional foresters. There is also a need for capacity-building to ensure the long-term continuation of the work. In the coming years the national programme will be revised and updated according to the modifications that have already been made and the changes taken place in the working environment over the past ten years.

The National Forest Programme (NFP) of Finland is the cornerstone and strategic base of the Finnish forest policy. The NFP aims to ensure forest-based work and livelihoods, biodiversity and vitality of forests, and opportunities for recreation for all citizens. The implementation of the NFP is coordinated by the Ministry of Agriculture and Forestry with the help of the Forest Council and its Secretariat and Working Groups. Forest genetic resources are included in the tasks of the WG Environmental Benefits, as one of the objectives for this group is to halt the decline of forest habitat types and species and establish a favourable trend in the state of biodiversity.

Based on the experience gained during the ten-year period that the national plant gene resources programme has been in force, there is a clear need to strengthen the forest genetic resources conservation work by establishing a legal framework for it. This could be done through a separate act addressing the special nature of genetic conservation, or it could be done by amending the existing legislation. Genetic conservation of forest trees is a field where good cooperation between the two ministries, the Ministry of Agriculture and Forestry and the Ministry of the Environment, is needed. Finland sees cross-border considerations on the topic of genetic resources as being extremely valuable, and the national programme has greatly benefited from the co-operation at Nordic, European and global levels.

Gene reserve forest of Norway spruce in southern Finland

Introduction to Finland and Its Forestry Sector

Forestry sector in Finland

Geographically, Finland lies in an intermediate zone between maritime and continental climates, belonging for the most part to the boreal vegetation zone. Finland is situated between the northern latitudes 60° and 70°, but because of the warming effect of the Gulf Stream, the climate is in many respects more favourable than in areas at similar latitudes in Canada and Russia, for instance. Conditions for growth vary considerably between the southern and northern parts of the country, which is also an important factor in the use of forest regeneration material. Towards the north, the climate gets increasingly colder and more humid, and the precipitation exceeds evaporation. The growth period is about five months in the south and three months in the north. The average increment of growing stock in southern Finland is 6.1 cubic metres per hectare, twice the increment in northern Finland.

Three-quarters of the land area of Finland is covered by forests. The forest area, 22.2 million hectares, has remained almost unchanged over the last 50 years, whereas the volume of the growing stock has increased by more than 40% in the same period. The growing stock was 2.2 million cubic metres at the end of 2010. Finland's forests represent the country's most significant renewable natural resource and they are managed and utilised in accordance with the principles of sustainable development. The forests are currently growing at a rate of 100 million cubic metres per year when the total drain is approximately 69 million cubic metres.

The vast majority of the forest in Finland is owned by private persons, mainly families, and the properties are generally quite small. Private forest owners own two-thirds of forest land, equalling 12 million hectares: the state owns five million hectares, companies two million hectares and others (municipalities, parishes and other public corporations) one million hectares of forest land. The state forests are administered by the state enterprise Metsähallitus.

Forest industry

Forests are Finland's primary natural resource. Despite owning only 0.5 per cent of the world's forest resources, Finland is the world's sixth largest producer of paper and paperboard. As regards the production of softwood sawn goods, Finland is the seventh largest producer in the world.

In 2010, forestry accounted for 1.9% of GDP and forest industry production for 2.8%. In employment, forestry accounted for 0.9% and the forest industry for 1.9% of the workforce.

The Finnish forest industry is also highly export-oriented, and in most sectors of the industry, 65% to 90% of production goes abroad. Finland is a major exporter of sawn softwood and paper, particularly graphic papers.

Over the last decade, forest industries have undergone considerable centralisation and internationalisation, and both trends are likely to continue. Companies which are Finnish or have their head office in Finland have expanded their operations in Europe and other continents, though they may not yet be regarded as global companies. At the same time, their ownership has spread to become global.

Forest policy

The objective of the Finnish forest policy is to ensure the welfare founded on the sustainable use of forests while maintaining the diversity of the forest nature. The tools of forest policy are legislation, public funding and organisations, and informational means. Sustainable forest management has several dimensions: economic, environmental, social and cultural sustainability. Their reconciliation is a great challenge to which forest policy needs to respond. Success can be evaluated through the criteria and indicators for sustainable forest management.

The basic principle of Finnish forest legislation is the prevention of forest destruction. According to the Forest Act (1093/1996), it is obligatory to regenerate the forest after harvest. The timing of the final harvest has also been regulated. At the moment, the Forest Act is under reform and it seems that in the future there will be less strict provisions and more options for the forest owner to choose how and when to manage his or her forest.

The principal policy document in forest issues is the National Forest Programme (NFP), the implementation of which is approved by the government. Other key ongoing strategies are regional Forest Programmes under NFP and the Forest Biodiversity Programme for Southern Finland (METSO).

In recent years, forest policy debate and measures have focused on the use of forest energy and bio products as a corollary to the renewable energy and climate change debate. With the structural change in the forest industry, research into wood as a raw material for bio products and renewable energy solutions has been stepped up. The forest organisation subordinate to the Ministry of Agriculture and Forestry will be restructured as of 2012 with the aim of clarifying their functions and raising affectivity.

A private forest owner may receive financial support from the state for forest management and improvement work and for nature management. The objective of state support is to encourage forest owners to take measures with long-term impacts, whose benefits will be enjoyed after several decades. Public funding for forestry is based on the Act on the Financing of Sustainable Forestry. Forest management and improvement work which may be eligible for support includes the tending of young stands, harvesting and chipping of energy wood, ditch cleaning, supplementary ditching and the construction of forest roads. Support may also be granted for the prevention of *Annosus* root rot, remedial fertilisation and prescribed burning. Forest regeneration may be supported if the costs are higher than the harvesting income to be obtained. In the future, the use of the state support will be reorganised.

Nature management in commercial forests is promoted through environmental support and forest nature management projects. Environmental support may be granted for additional costs and income losses due to the preservation and management of habitats of special value. The works to be designed and implemented in nature management projects are defined in further detail in the legislation. Most of the forest nature management projects are of special regional importance. Apart from habitats of special value, they may concern landscape management, preventing damage to waters and restoration of ditched areas.

Forest management practices

Forest treatment regimes are planned and implemented at the stand level. A stand is defined as a contiguous part of a forest in terms of site type, treatment or the growing stock's stage of development. In southern Finland, stand sizes vary from less than one hectare to a few hectares. Other factors to be considered when determining stand boundaries include forest regeneration, forest biodiversity, landscape values, and multiple-use needs. Valuable habitats are marked out according to their natural boundaries. The basic premise in forest regeneration is to favour those indigenous tree species that are best suited to the site in question.

Valuable habitats are preserved when managing and using commercial forests. Structural characteristics important for biodiversity are also considered. These include rare broadleaved trees, charred and decaying wood and large and over-mature individual trees. The aim of habitat preservation is to maintain conditions favourable to organisms dependent on specific habitats.

Forest treatments are applied so that they merge in with the landscape. The boundaries of regeneration felling operations are designed to comply with the contours of the terrain and untreated corridors are employed. The needs of various user groups are taken into account when dealing with recreational forests.

Biological diversity

Forest management oriented to biological diversity by mitigating the natural development cycle of forests has been a statutory requirement in Finland for 15 years, ever since safeguarding biological diversity was enshrined as a parallel goal with wood production in the Forest Act in 1997.

The main methods for safeguarding biological diversity in commercial forests are the protection of valuable habitats and biotopes, favouring of mixed tree stands in the management, and increasing the amount of decayed wood. The practice when implementing increment and regeneration felling is to set aside small groups of specific "retention" trees, often aspen and noble broadleaved trees (oak, linden, etc.). On average, between five and ten living retention trees per hectare are left standing on regeneration sites to eventually die and produce coarse decaying debris. Regardless of species, old and dead trees are important for maintaining biodiversity. Additional methods sometimes used for preserving biodiversity are prescribed for burning and specific watercourse protection technology.

Strict forest protection is very much emphasised in Finland. There are various protection programmes and decisions and the total area of protected forest is currently 2.2 million hectares, corresponding to 9.6% of all forest land. The percentage of strictly protected forests is 5.2%, these being unevenly distributed throughout the country. In southern Finland, where the percentage of strictly protected forests varies between 1% and 3.6%, biological diversity and protection is promoted through the Forest Biodiversity Programme for Southern Finland (METSO). The programme involves developing silvicultural methods, compensations for voluntary measures by private forest owners, and restoration management of protected areas in state ownership.

The above-mentioned protection programmes do not pay attention to gene conservation as such. Sometimes it may be possible to include genetic aspects in the existing nature conservation programmes, but most often the statutes are written for species or habitat conservation and it is not possible to take the needs of genetic conservation into account in the management plans of nature conservation areas. The gene conservation programme is separate from nature conservation and based on contracts which are not legally binding. Genetic conservation is mostly done in forests which are harvested and managed, with only some special requirements. Mostly this functions well, but there remains a clear need for gene conservation and species conservation to find closer cooperation and mutual understanding.

Table 1. Forest characteristics and areas.

Main forest characteristics	Area (ha)
Primary forests	0
Naturally regenerated forests	16 252 000
Planted forests, reforestation	5 904 000
Planted forests, afforestation	n.s.

Table 2. Forest ownership and area.

Forest ownership	Area (ha)
Public	7 090 240
Private	15 066 760
Others	0
Total	22 157 000

Protective forest

The land is flat in Finland and there are hardly any problems caused by soil erosion, avalanches or shifting of the ground. Forests have a protective function, mainly in the timberline area in Lapland. The total area of protective forest in the northernmost part of Finland is 3.3 million hectares. In these areas, fellings are restricted by law to prevent the timberline from receding further south. According to the monitoring of forest regeneration in these areas, there has been no change in the receding of the timberline so far.

Because of the great number of peatland forests and waterways in Finland, issues relating to waterways receive special attention in forest management. Measures that may burden waterways include final fellings, soil preparation, drainage and fertilisation. Natural peatlands are no longer drained for commercial use in Finland, but those already drained peatland forests which have growth potential are maintained and improved by the cleaning of ditches.

Role of Forest Genetic Resources

The supply of well-adopted forest reproductive material of high quality is essential for Finnish forestry and consequently the whole forest sector.

1 The Current State of Forest Genetic Resources

The main value of forest genetic resources

The Forest Act sets the rules for the species to be used in forest regeneration. It is permitted to use seeds or seedlings of *Pinus sylvestris, Picea abies, Betula pendula, Betula pubescens* and *Populus tremula.* The geographic origin and other characteristics must be suitable for the regeneration area in question. In addition, other native species *Alnus glutinosa, Acer platanoides, Tilia cordata, Ulmus glabra, Ulmus laevis, Fraxinus excelsior and Quercus robur* may be used. Only two exotic species, namely *Populus tremula x tremuloides* and *Larix sibirica,* are accepted.

Table 3. Major forest type categories as applied in SoEF2007 and main tree species.

Major forest types	Forest area 2010 (1000 ha)	Main tree species for each type
Predominantly coniferous forest	17 403	*Pinus sylvestris* *Picea abies*
Predominantly broadleaved forest	1 630	*Betula pendula* *Betula pubescens*
Mixed forest	3 051	*Picea abies* *Betula sp.*

Table 4. Priority tree species.

Priority species			Reasons for priority
	Tree (T) or other (O)	Native (N) or Exotic (E)	
Pinus sylvestris	T	N	economic importance
Picea abies	T	N	economic importance
Betula pendula	T	N	economic importance
Betula pubescens	T	N	economic importance
Populus tremula	T	N	economic importance

Pinus sylvestris is dominant species in 70% of the total forest area (22 157 000 ha), Picea abies is dominant in 20% of the forest area, and the share of deciduous trees as dominant species is only 10%.

Table 5. Forest tree species currently used in Finland.

Species	Native (N) or Exotic (E)	Current uses	Type of management
Pinus sylvestris	N	Solid wood products, Pulp and paper, Energy (fuel)	artificial and natural regeneration
Picea abies	N	Solid wood products, Pulp and paper, Energy (fuel)	artificial and natural regeneration
Betula pendula	N	Solid wood products, Pulp and paper, Energy (fuel)	artificial and natural regeneration
Betula pubescens	N	Solid wood products, Pulp and paper, Energy (fuel)	natural regeneration
Populus tremula	N	Solid wood products, Pulp and paper, Energy (fuel)	artificial and natural regeneration
Populus tremula x tremuloides	E	Pulp and paper	plantation
Alnus glutinosa	N	Solid wood products	artificial and natural regeneration
Larix sibirica	E	Solid wood products	plantation

Table 6. Main forest tree species providing environmental services or social values.

Species	Native (N) or Exotic (E)	Environmental service or social value
Pinus sylvestris	N	Recreational and health values
Picea abies	N	Recreational and health values
Betula pendula	N	Recreational and health values
Betula pubescens	N	Recreational and health values
Alnus glutinosa	N	Recreational and health values Soil fertility
Acer platanoides	N	Recreational and health values Biodiversity conservation
Populus tremula	N	Recreational and health values Biodiversity conservation
Tilia cordata	N	Recreational and health values Biodiversity conservation
Ulmus glabra	N	Recreational and health values Biodiversity conservation
Ulmus laevis	N	Recreational and health values Biodiversity conservation
Fraxinus excelsior	N	Recreational and health values Biodiversity conservation
Sorbus aucuparia	N	Recreational and health values Biodiversity conservation
Quercus robur	N	Recreational and health values Biodiversity conservation

Native forest trees in Finland

According to the Finnish statistical yearbook of forestry, the tree species that are native to Finland are:

Pinus sylvestris
Picea abies
Juniperus communis
Taxus baccata
Acer platanoides
Alnus glutinosa
Alnus incana
Betula pendula
Betula pubescens
Fraxinus excelsior
Populus tremula
Prunus padus
Quercus robur
Salix caprea
Salix pentandra
Sorbus aucuparia
Tilia cordata
Ulmus glabra
Ulmus laevis

Threatened and protected tree species in Finland

The assessment of threatened species is made every tenth year in Finland, one assessment taking approximately four years to accomplish. The results were published in 2010 as the Red List of Finnish Species. Both indigenous elm species, namely *Ulmus laevis* and *Ulmus glabra,* are red-listed and also *Malus sylvestris* which can be found in Finland only as individual trees in the south-west. In addition, some bush type *Salix* species are listed, namely *Salix arbuscula*, *Salix lanata* subsp. *Glandulifera*, *Salix pyrolifolia* and *Salix triandra*. Tree species which are protected under the Nature Conservation Decree, are *Ulmus laevis*, *Ulmus glabra* and *Malus sylvestris*.

No specific evaluation has been carried out where a genetic conservation point of view has been targeted and there is no official list of genetically threatened species. Thus the information in Table 7 should be seen as indicative. Naturally the species that are considered rare or threatened at species level have also reduced within-species variation. Furthermore, the rare species live in Finland at the northernmost margins of their distribution, and climate is clearly a limiting factor for their growth and regeneration. The prioritisation for the gene conservation programme has been made based on general knowledge of the species biology and distribution, as explained in chapters 2 and 3.

System for documenting forest reproductive material

The trade of forest reproductive material is regulated through legislation implementing EC directive 1999 /105 on the trade of forest reproductive material. The relevant domestic legislation includes the Act on Trade in Forest Reproductive Material 241/2001 and the Decree of the Ministry of Agriculture and Forestry on the marketing of forest reproductive material (1055/2002). The responsible supervising authority is the Finnish Food Safety Authority Evira. Regular field inspections are made as part of the supervision chain.

The aim of supervision is to ensure:

- the high quality of basic material used for producing forest reproductive material
- the compliance of seeds and seedlings on the market with the regulations in force
- that buyers gain the necessary information in support of selecting material suitable for a specific purpose.

The forest reproductive material information system contains control registers maintained by Evira, such as the forest reproductive material supplier register, the basic material register and the master certificate register. The forest reproductive material supplier register contains information on registered places of business and users registered as eService system users. Suppliers obliged to register include suppliers of forest tree seeds and seedlings, alongside marketers and importers of forest reproductive material.

The basic material register contains information on approved basic material. Basic material comprises forest tree seed orchards, seed collection stands and clones approved for vegetative propagation. The master certificate register contains information on all master certificates granted in Finland.

Evira publishes maps of the utilisation areas of registered seed orchards, regions of provenance maps and a map showing thermal conditions (days of degree) on its website. These are used for defining the utilisation areas.

For the purpose of compiling statistics, Evira collects information annually on the numbers of seedlings delivered for planting, the production areas of forest tree nurseries and the amounts of seed used in forest tree nurseries. This information is collected from seedling producers belonging to the forest reproductive material supplier register. National seedling production statistics are compiled on the basis of the information. No producer-specific information is published.

Current state of forest reproductive material

The quantity of forest reproductive material is monitored as the quantity of seed used in nurseries and in direct seeding, by the categories according to the OECD and the EU directive. The number of seedlings produced early is also available, but not the specific OECD categories for seedlings.

Table 7. List of tree species considered to be threatened in all or part of their range from genetic conservation point of view.

Species	Distribution: widespread (W), rare (R), local (L)	Type of threat	Threat category		
			High	Medium	Low
Ulmus glabra	R	habitat fragmentation; pests and diseases		X	
Ulmus laevis	R	habitat fragmentation; pests and diseases	X		
Malus sylvestris	R	habitat fragmentation	X		
Taxus baccata	L	habitat fragmentation		X	

Table 8a. Annual quantity of seed used in 2010 by OECD-categories.

Species		Total quantity of seed used (kg)	Tested seed (kg)	Selected seed (kg)	Qualified seed (kg)	Source-identified seed (kg)
Scientific name	Native (N) or Exotic (E)					
Pinus sylvestris	N	2 321	53		2 262	6
Picea abies	N	818				818
other species		176			123	53

Table 8b. Annual number of seedlings planted in 2010.

Species		Total quantity of seedlings planted
Scientific name	Native (N) or Exotic (E)	
Pinus sylvestris	N	49 252 000
Picea abies	N	104 519 000
Betula pendula	N	4 246 000
Betula pubescens	N	71 000
other species		630 000

Table 9. List of forest species for which genetic variability has been evaluated.

Species		Morphological traits	Adaptive and production characters assessed	Molecular characterisation
Scientific name	Native (N) or Exotic (E)			
Pinus sylvestris	N	X	X	X
Picea abies	N	X	X	X
Betula pendula	N	X	X	X
Betula pubescens	N	X	X	
Populus tremula	N	X	X	X
Populus tremula x tremuloides	E	X	X	
Alnus glutinosa	N		X	
Larix sibirica	E	X	X	
Acer platanoides	N	X		X
Fraxinus excelsior	N			X
Quercus robur	N	X	X	X
Tilia cordata	N	X		X
Ulmus glabra	N	X		
Ulmus laevis	N	X		X

Factors influencing the state of forest genetic diversity in Finland

The main tree species in Finland (*Pinus sylvestris, Picea abies, Betula pendula, Betula pubescens*) all have continuous distribution and are widespread. Furthermore, they produce vast amounts of both pollen and seed which are effectively spread by the wind. These species contain a lot of genetic variation, and populations are differentiated in adaptive traits but not to any great extent in other characteristics. The differentiation in adaptive traits such as the length of the growing period is important in forest regeneration and is taken into account in the use of reproductive material. It is expected that the level of variation in the main species will remain at the same level in the future. Thus these species have sufficient potential to cope with possible changes in the climate, although some changes in the species composition are expected.

The rare broadleaved species grow in southern Finland at the northern margin of their distribution area. They grow as individual trees or form small populations, and their distribution area is fragmented. Many of the rare species also have limited seed production and some of them (*Acer platanoides, Tilia cordata*) are insect pollinated. Typically the rare broadleaves are demanding as regards the soil and the microclimate, and in the past they have suffered from the expansion of agriculture. Today the natural populations are protected under the Forest Act, which states that the management and utilisation measures applied shall be carried out in a manner that preserves the special features of the habitats.

Future needs and priorities

The future of Finnish forests is greatly influenced by the expected changes in the climate. These include changes in the temperature and precipitation and the emergence of pathogens and pests new to the area. Therefore, information needs are related to the genetics of climatic adaptation and resistance. In the case of resistance research in particular, cross-sectoral studies should be encouraged. It would be useful to include genetic aspects more explicitly in both silvicultural and environmental research. Changes in the environment and in the trade of reproductive material emphasize the need to raise the awareness of the nature of forest genetic resources among forest owners.

2 The State of *in situ* Genetic Conservation

The National Plant Genetic Resources Programme

The Forest Act lists twelve native and two exotic tree species which can be used in forest regeneration. Altogether there are 19 native tree species growing in Finland, as listed in Statistical Yearbook of Forestry (2010), but the number of woody specie is close to 30. The National Plant Genetic Resources Programme (2001) lists 15 native tree species included in the genetic conservation strategy and sets the main targets and measures for each species, according to the priorities and the level of threat. The conservation of the genetic resources of *Alnus incana, Populus tremula* and *Sorbus aucuparia* have not been considered to require any special action because these species occur in large numbers in Finland, they are widely distributed outside commercial forests and they are not demanding on their habitat requirements. Consequently, no principal method has been selected for these species. However, it may be that the statuses of the species, especially *Alnus incana*, have to be reassessed in the coming years. Four tree species, namely *Salix caprea*, *Salix pentandra*, *Prunus padus* and *Taxus baccata,* are not included in the strategic plan and their potential threats and possible needs will have to be reconsidered in the future. *Larix sibirica* is an exotic species in Finland and therefore not given high priority, but it is listed in the strategy because it has some economic value, it is nearly native, and there are some established seed sources that are well adapted to the Finnish climate. Woody forest species other than trees are not included in the current gene conservation programmes.

The strategy was prepared in 2001 and has been implemented with slight modifications, as needed, stemming from increasing knowledge or changes in the operational environment. The action plan will be revised in the near future. The implementation of the programme is guided and supervised by the National Advisory Body for Genetic Resources (see details in Chapter 5).

The reasoning behind the selection of principal methods has been that *in situ* conservation is used for species that are fairly common, have continuous distribution and extensive gene flow. Therefore, *in situ* conservation is used as the principal method for *Pinus sylvestris, Picea abies, Betula pendula* and *B. pubescens.* These species are also the main commercial species in Finland. For *Pinus sylvestris* and *Picea abies,* the network of gene reserve

The choice of methods for gene conservation of Finnish tree species. In each method-column the left part is the strategic original plan (2001) whereas the right part states what actions are underway in 2011.

	Conservation method						
Tree species	**Nature conservation areas**	**Gene reserve forests**		**Collections**		**Breeding populations**	
Pinus sylvestris	C	P	P	C		C	C
Picea abies	C	P	P	C		C	C
Juniperus communis	P			C	C		
Betula pendula	C	P	P	C		C	C
Betula pubescens	C	P	P				
Alnus glutinosa	P			C			
Alnus incana	C			C			
Populus tremula	C			C		C	C
Sorbus aucuparia	C			C	C		
Tilia cordata	C	C	C	P	P		
Fraxinus excelsior	C	C	C	P	P		
Quercus robur	C	C	C	P	P		
Acer platanoides	C	C	C	P	P		
Ulmus glabra	C			P	P		
Ulmus laevis	C			P	P		
Larix sibirica				C			

P = principal conservation method
C = complementary conservation method

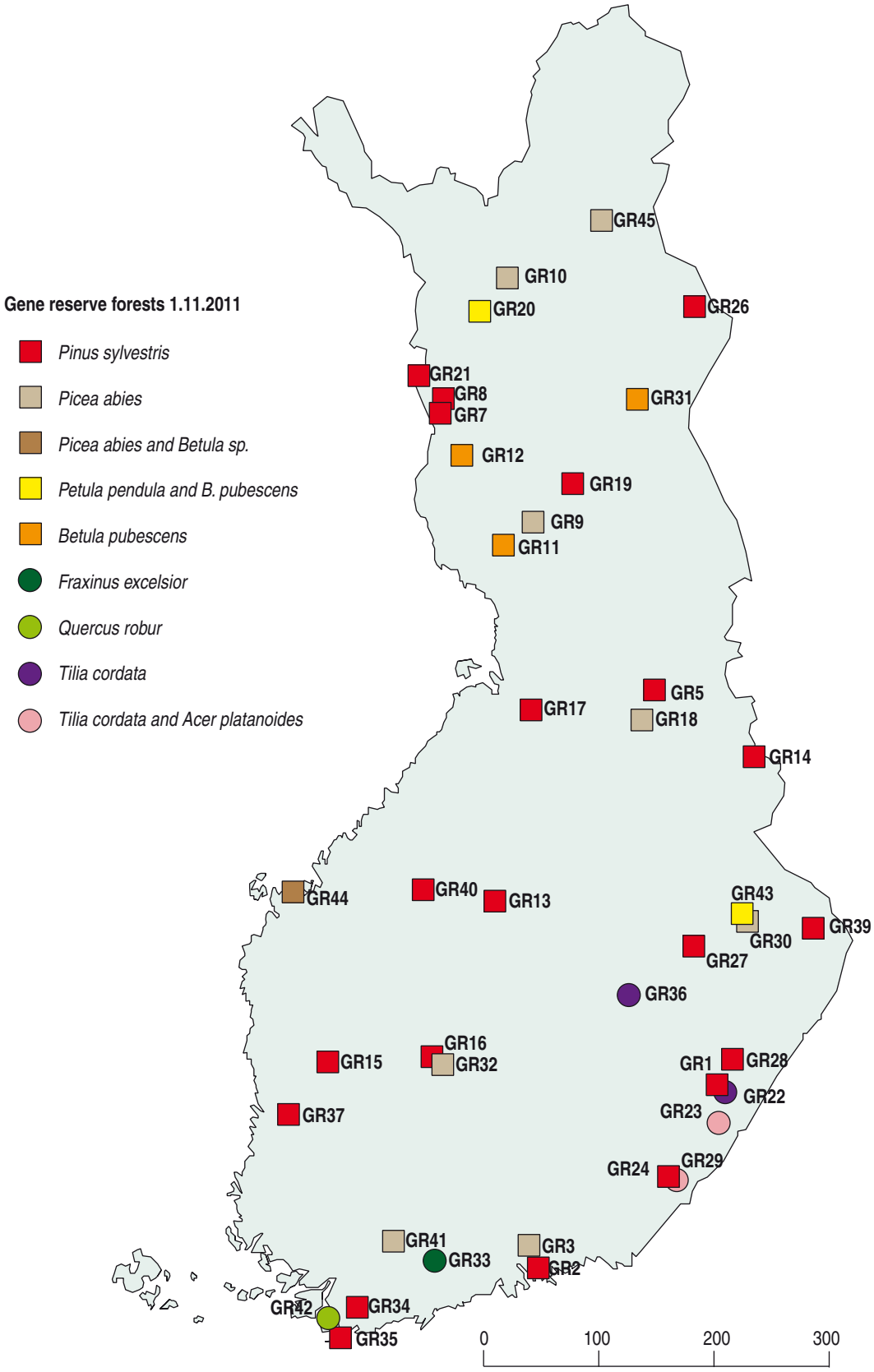


Figure 1. The locations of gene reserve forests in Finland (1.11.2011)

forests is almost complete, capturing the adaptive variation within the species in Finland. However, there are some regions where it has turned out to be difficult to find suitable areas and the process is still ongoing. In addition to the network of gene reserve forests for the main species, some gene reserve forests have been established as a supportive measure for rare species where the principal conservation method is *ex situ.* These species are *Tilia cordata, Fraxinus excelsior, Quercus robur* and *Acer platanoides.* The *Circa situ* method is not used, as agroforestry is not practised in Finland.

Gene reserve forests

The *in situ* genetic conservation of tree species in Finland is based on gene reserve forests, which are especially selected for gene conservation purposes. A basic requirement for a gene reserve forest is that it is of local origin and has been either naturally regenerated or regenerated artificially with the original local seed source. The general objective is that a gene reserve forest of a wind-pollinated species should cover an area of at least 100 hectares in order to secure sufficient pollination within the stand, but smaller units have been approved in particular for birch species. The *in situ* units for rare broadleaves are much smaller as a rule.

Ownership of gene reserve forests

Gene reserve forests are preferably on state land, but some have also been established on private land due to goodwill and co-operation between some forest enterprises. Most of the state-owned land is in northern Finland, and in some southern regions it is not easy to find suitable stands on state land, even for the most common species: for rare broadleaves this is impossible. The conservation units are selected by the Finnish Forest Research Institute Metla. Metla also keeps an official national register of conservation units and compiles the respective data for the pan-European EUFGIS database. The gene reserve forests on state land are administered by Metsähallitus, a state enterprise that administrates all the state–owned forests in Finland. These gene reserve forests are managed by the staff of Metsähallitus according to the instructions given by Metla.

Management of gene reserve forests

In the management of gene reserve forests, the principal aim is to ensure abundant regeneration and a wide gene pool. For the major species, management does not differ significantly from normal forestry practices used in Finland. The most important aspect is to support natural regeneration, and when this is not possible, to collect seed from the very same stand to be used in sowing or planting. Special attention is also paid to creating and maintaining roughly even distribution of different age classes, in order to insure steady continuation.

Normally, a stand is selected as a reserve for a certain species, but in some cases a single unit may serve for the conservation of two species that grow naturally as mixed species in Finland. This has to be taken into consideration when reading the statistics for the number of units per species on one hand and the total area of conservation on the other. The total number of gene reserve forests in Finland in November 2011 was 41, and the total area reserved for *in situ* gene conservation is 6 537 ha.

The gene reserve forests are included in the owner's normal forest management planning system, which includes a detailed inventory and database to help the follow up. In addition, the stands are inspected by Metla staff at intervals of three years, and the necessary amendments in management plan, based on gene conservation aspects, are negotiated and made.

Table 10. Target forest tree species included within in situ conservation programmes/units. Note that the number of populations and the total area can not be added together to get the total amounts, because some conservation units have several target species.

Species (scientific name)	Purpose for establishing conservation unit	Number of gene reserve forests for the species	Total area
Pinus sylvestris	Genetic conservation	21	3990
Picea abies	Genetic conservation, nature conservation	9	1819
Betula pendula	Genetic conservation, nature conservation	4	597
Betula pubescens	Genetic conservation, nature conservation	5	572
Tilia cordata	Genetic conservation	4	34
Fraxinus excelsior	Genetic conservation	1	30
Quercus robur	Genetic conservation, nature conservation	1	22
Acer platanoides	Genetic conservation	2	15

Information stand in a gene reserve forest

Nature conservation areas

Valuable genetic resources also exist on strict nature conservation areas, but in Finland these areas are not considered to be part of the gene conservation programme. Nature conservation areas have their own management protocols for species and habitats conservation or special targets such as old-growth forest protection. Most often it is not possible to include genetic aspects in these management plans. An exception is the Koli National Park in eastern Finland, where traditional slash-and-burn agriculture is kept alive and the special type of management provides an opportunity for birch genetic resources conservation. In addition, for some species, such as *Juniperus communis*, the protected habitats are essential for species conservation and also for the maintenance of within-species genetic variation.

Special, systematic inventories of forest genetic resources have not been made in Finland, but the gene conservation programme has made use of inventories such as the National Forest Inventory and several specific inventories created by the Ministry of Environment. The detailed information of the species composition and management history in the database for the state-owned forests has also greatly facilitated the preliminary work in detecting and selecting suitable areas for gene conservation purposes.

Constraints and future needs

The National Plant Genetic Resources Programme is an internal programme in the Ministry of Agriculture and Forestry and therefore provides no legal basis for the work. This is an obvious weakness of the present arrangement. Under economic constraints, it is hard to ensure the long-term continuation of the work, which definitely cannot be suspended for even a short period. Furthermore, as described above, there have been cases where nature conservation and gene conservation have conflicts of interest as regards the management of certain areas. In these cases, gene conservation has had to compromise its targets because functions that rest on statutes, such as nature conservation areas, have a stronger position.

The first priority for the further development of gene conservation in Finland is to create a stronger statutory basis for the work. This could be done by a separate act addressing the special nature of genetic conservation or by amending the existing legislation. For example, the Nature Conservation Act in Finland has a clear objective of conserving biodiversity, but there is no reference to genetic diversity anywhere in the legislation. Neither is genetic diversity mentioned as a conservation target in any of the statutes behind the existing protected areas. Genetic conservation of forest trees is clearly a field where good cooperation between the Ministry of the Environment and the Ministry of Agriculture and Forestry is needed.

One practical difficulty in implementing the *in situ* programme is the lack of state-owned land in certain regions, which creates a need to turn to the private sector. It is clear that the commitments made by private persons or forest enterprises, although valuable as such, can never be truly secure in the long run. Currently there is no funding for purchasing properties for gene conservation purposes.

Currently the greatest challenge is to raise the political awareness of the value of genetic resources and thereby create better possibilities for funding and opportunities to establish a legislative background for the work. A second challenge is to complete the *in situ* networks for *Picea abies* and *Betula* species, when the last missing parts seem to be very hard or even impossible to find. In the coming years the national programme will be revised and updated according to the modifications that have already been made and the changes that have taken place in the working environment over the past ten years. Currently the economic constraints are heavy within the responsible institute, Metla, which means that in the coming years it will be difficult but extremely important to secure the availability of competent staff.

3 State of *ex situ* Genetic Conservation

Current *ex situ* conservation

Ex situ conservation is applied to species that are rare and grow either mixed with other species or in small stands. Often the distribution is fragmented and the genetic differentiation among populations is higher than with the major species. In the *ex situ* programme, the gene pool is primarily maintained in living trees. Material is collected from several small, natural stands and grown in an intensively managed collection. The collections are designed in a way that will make it possible to collect seed at a later stage, to be used in landscaping or small-scale forestry. However, there is no breeding involved, since material is not selected according to any productive traits. The sampling is designed to capture the natural genetic variation as effectively as possible.

Currently there are living gene conservation collections for *Acer platanoides*, *Fraxinus excelsior*, *Juniperus communis, Quercus robur*, *Sorbus aucuparia*, *Tilia cordata*, *Ulmus glabra* and *Ulmus laevis*. In addition, to complement the original action plan, *ex situ* gene conservation of *Prunus padus* has been initiated on a small scale. There is also a pilot project for developing cryopreservation protocol for *Fraxinus excelsior*, because of some recently emerged pathological threats.

The gene reserve collections are established either with seedlings or with grafts, depending on the species. This is because some of the species produce very little seed in Finland and even if there is seed available, it may only be in a couple of trees per stand, which reduces the genetic basis of the material. Seedlings have been used for *Acer platanoides*, *Fraxinus excelsior* and *Quercus robur*, for other species scions have been collected from the original natural stand and grafted to be grown in the clonal collection. The original plan was to sample ten trees per each natural population included in the scheme, but for practical reasons the realised number of sampled trees/population is lower.

The rare broadleaved species under the *ex situ* conservation programme have a very limited natural distribution in Finland and therefore there has been no need to define separate provenances for these species. The geographical distribution of the sampled material for *Acer platanoides*, the place of the gene conservation collections and the limit of the natural distribution are presented in Figure 2.

All the information on the collections is stored in the Forest Genetic Register. The information on accessions in *ex situ* collections consists of data on collection date, amount of collected material, mode of reproduction, location of the collection site and size of the collected population. The material on the field is labelled in order to ensure traceability, but because of nature conservation restrictions it has not been possible to label the original trees in natural stands. The material in collections is characterised by oenological observations, but no systematic analysis of genetic markers, e.g. microsatellites, has been conducted. However, some genetic analyses on the natural populations of *Quercus robur*, *Acer platanoides* and *Ulmus laevis* were available when the original sampling plan was constructed.

The *ex situ* gene conservation in a strict sense is comprised of the actions under the National Programme for Gene Conservation. In addition, some genetic resources are conserved in

Table 11a. *Ex situ* conservation by species and by method.

Species		Field collections		Germplasm bank					
Scientific name	Native (N) or exotic (E)	Collections, provenance or progeny tests, arboreta or conservation stands		Clone banks		In vitro (including cryo conservation)		Seed banks	
		No. stands	No. acc.	No. banks	No. clones	No. banks	No. acc.	No. clones	No. acc.
Acer platanoides	N	2	262					0	
Fraxinus excelsior	N	3	84					0	
Juniperus communis	N			2	192			0	
Quercus robur	N	1	132					0	
Sorbus aucuparia	N	2	69					0	
Tilia cordata	N			1	120			0	
Ulmus glabra	N			2	92			0	
Ulmus laevis	N			1	120			0	

Table 11b. Number and area of gene conservation collections for each species.

Species	Field collections		Material included		
	No	Area. ha	Stands	Clones/Families	Ramets/Seedlings
Acer platanoides	2	1.19	41	262	1836
Fraxinus excelsior	3	0.74	17	84	1177
Juniperus communis	2	0.44	60	192	1529
Prunus padus	1	0.04	6	11	76
Quercus robur	1	0.46	17	132	895
Sorbus aucuparia	2	0.79	20	69	690
Tilia cordata	1	2.05	81	341	458
Ulmus laevis	1	0.81	19	120	225
Ulmus glabra	2	1.79	36	92	177
Total	15	8.31	297	1303	7063

universities' botanical gardens and private arboretums. The arboretums have been valuable actors in developing collections abroad and testing exotic tree species or provenances. However, in the conservation of local provenances of native species, their role is limited.

Infrastructure and future needs

In order to implement the national *ex situ* conservation, it is essential to have available land which is suitable for the given species in terms of climate and soil. In the Finnish programme this means that we have to acquire land in southern or south-western Finland, where the proportion of state-owned land is at its smallest. Furthermore, the soil has to be fairly rich and fresh, but adequately drained. The conservation project as such doesn't have any funds for purchasing land and therefore the good will of the state enterprise Metsähallitus is essential for establishing any new collections. Although the amount of new material needed is very small, there is a need to multiply the existing collections to a second place, as a back-up function.

Skilled technical staff are needed for both the maintenance of the existing collections and for establishing the new (back-up) collections. Maintenance is fairly intensive, including regular inspections and management as needed. At Metla there is a lack of technical working staff and due to the difficult economic situation of the state, there is a risk of having to reduce the staff even further. In addition, it is important to maintain the knowledge and skills that have been acquired over the first ten years of the programme.

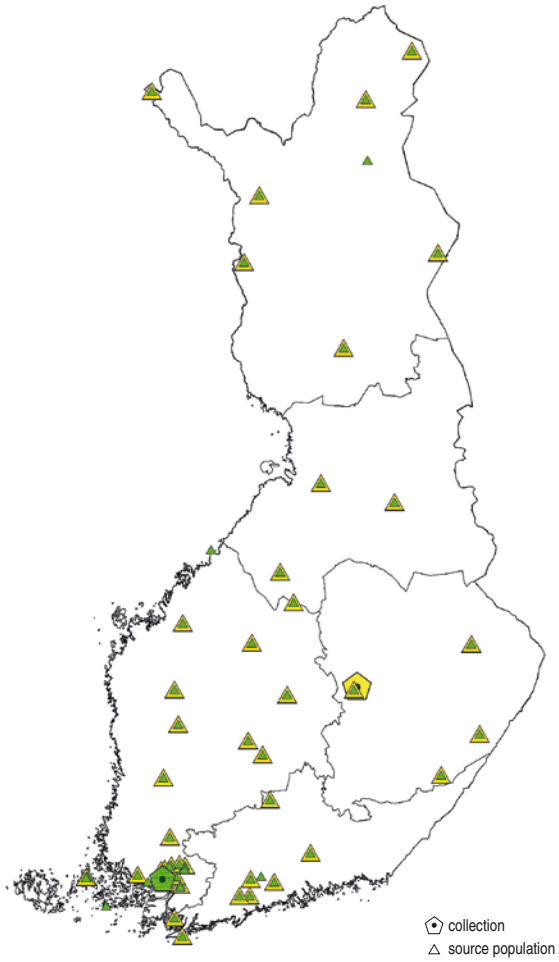
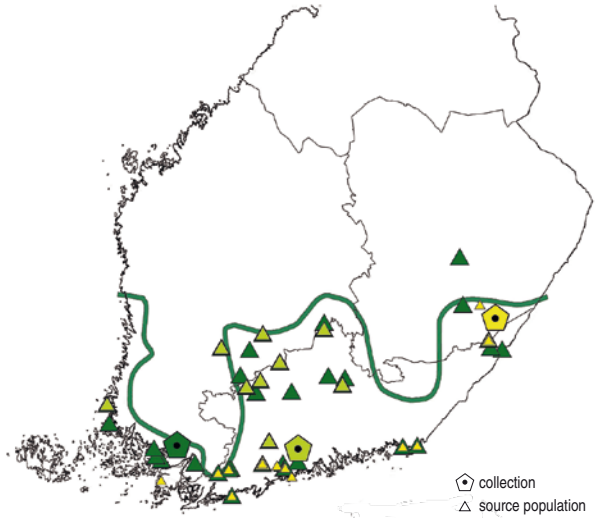
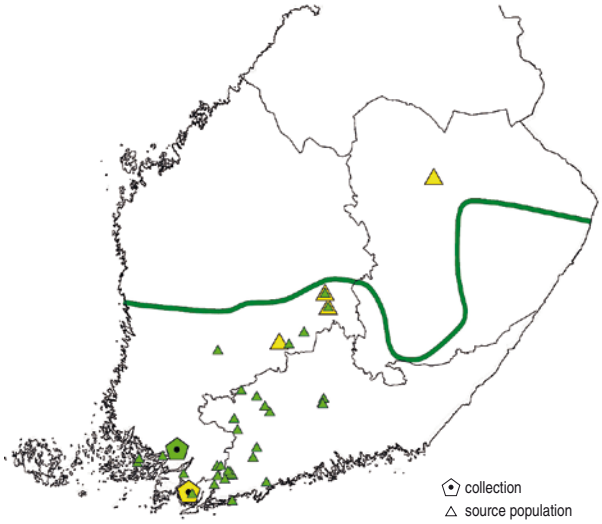


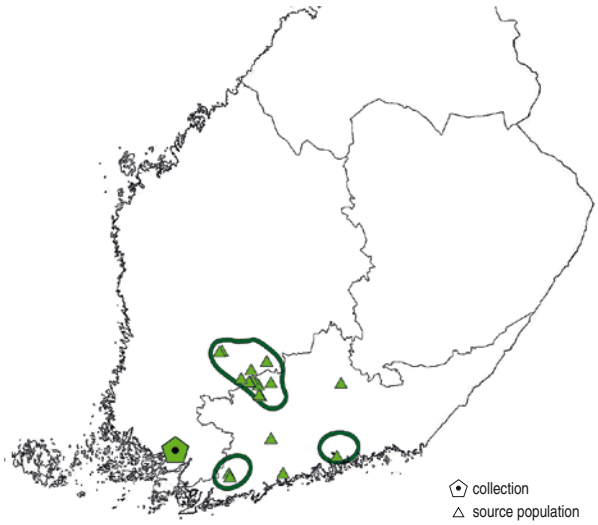
Figure 2. The locations of gene reserve collections and source populations by species a) *Juniperus communis.*



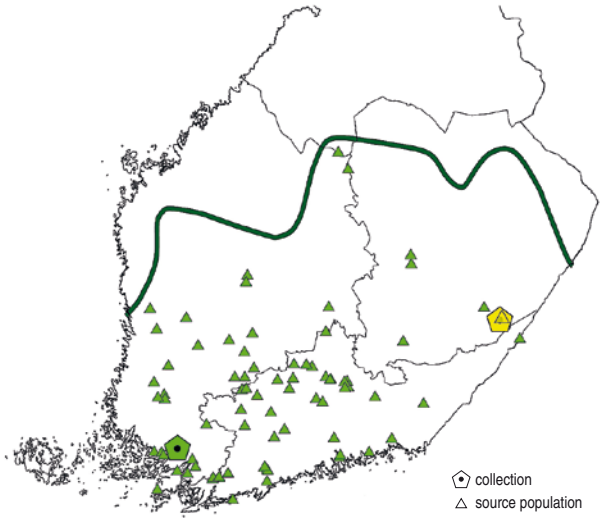
b) Acer platanoides



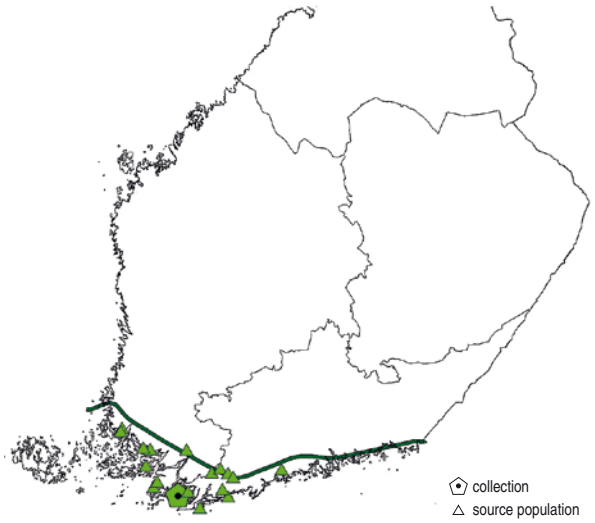
c) Ulmus glabra



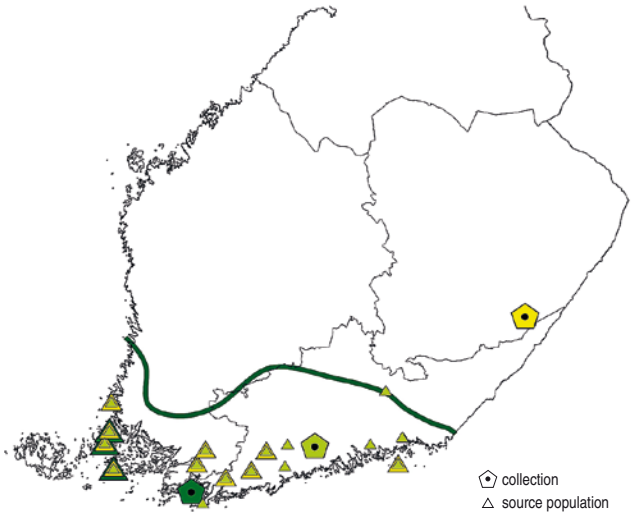
d) Ulmus laevis



e) Tilia cordata



f) Quercus robur



g) Fraxinus excelsior

Figure 2. Continued

4 The State of Use and Sustainable Management of Forest Genetic Resources

The forest genetic resources managed in Finnish forestry comprise well-known stand origins or farmed materials of native tree species. All trade of forest reproductive material occurs within the European Union, mostly with the nearest neighbouring countries of Sweden and Estonia. The following statistics only take account of reproductive material used in forestry; no records are available for material intended for horticultural use.

Long-term tree improvement programme

There is an ongoing long-term tree improvement programme for six tree species, namely Norway spruce *(Picea abies*), Scots pine *(Pinus sylvestris)*, silver birch (*Betula pendula)*, Siberian larch *(Larix sibirica*), black alder *(Alnus glutinosa*) and hybrid aspen (*Populus tremula* x *tremuloides*). Except for Siberian larch and hybrid aspen, all of the species are indigenous to Finland. The main attention in the programme is focused on the genetic improvement of spruce and pine, the two of which together comprise over 80% of the total volume of the growing stock of Finland's forests and over 90% of the annual reforestation area. The forest tree breeding programme is managed by the Finnish Forest Research Institute as a state-funded public service.

Breeding goals for all species include high volume production on a per area basis, excellent timber quality and improved adaptedness to various sites and climates. The goals and their relative weighting depend on tree species and region. Finland is divided into six target regions of breeding, from south to north on the basis of the average annual temperature sum. Cold hardiness is the most important goal in the northern regions where conditions for forest productivity are considerable harsher than in the south of Finland.

Tree improvement in Finland started in the late 1940s with the selection of plus-trees from natural stands. Over the next decades nearly 14 000 plus-trees were selected and grafted into 3300 hectares of first-generation clonal seed orchards which were established in the 1960s and the 1970s. The progeny testing of the plus-trees was based on open-pollinated families. The large progeny testing programme consisted of about 1800 prog-

Table 12. The annual quantity of seed transferred internationally in 2010

Species		Quantity of seed (kg)		Number of seedlings		Purpose
Scientific name	Native (N) or Exotic (E)	Import	Export	Import	Export	
Picea abies	N	58	68	9 200 130	3 580 276	forestry
Pinus sylvestris	N		47	1 370 415	622 680	forestry
Betula pendula	N		4			forestry
Betula pendula var. carelica	N		0,5			forestry
Betula pubescens	N			800		forestry
Larix sibirica	E		49	5 000		forestry
Populus x wettsteinii	E			2 000		forestry
Quercus robur	N			600		forestry
Other tree species		8	5			forestry

Table 13. Tree improvement programmes

Species		Improvement programme objectives				
Scientific name	Native (N) or Exotic (E)	Timber	Pulpwood	Energy	Multi-purpose	Non-wood product
Picea abies	N	X				
Pinus sylvestris	N	X				
Betula pendula	N	X				
Larix sibirica	E	X				
Alnus glutinosa	N	X				
Populus tremula x tremuloides	E	X	X			

eny trials which occupied nearly 2700 hectares of land. Most of the first-generation progeny trials have already come to the end of their term. The breeding materials tested in contemporary progeny and clonal trials represent second generation families of tested parents. Data on plus-trees, field trials and their genetic entries, clonal archives and field measurements, etc. are stored in an extensive information system (MySQL database) maintained by the Finnish Forest Research Institute Metla.

Production of improved regeneration material

In the 2000s, the first-generation qualified seed orchards comprising phenotypically selected plus-trees have produced 50–60% of the seed used by forest nurseries. The nurseries produce some 160 million seedlings (mostly Norway spruce and Scots pine) every year. The amount of qualified orchard seed collected annually has varied from about 1500 to 6500 kg in Scots pine and from zero to 1500 kg in Norway spruce. Most of the improved Scots pine seed is consumed in direct seeding. Nurseries use 500-600 kg of qualified Scots pine and 1000 to 1300 kg of seed qualified Norway spruce seed annually.

The production of the first-generation seed orchards is gradually diminishing, and they are being replaced by 1.5 generation elite seed orchards which comprise the 25–35 best progeny-tested plus-trees of the region. In Finland, private companies and semi-private forestry organisations have established about 500 hectares of elite seed orchards since 1997. These have been clonal seed orchards except for 43 hectares of Norway spruce seedling seed orchards. According to the state-run forest seed procurement programme, some 240 more hectares of elite seed orchards will be established by 2025.

Thus far, the elite seed orchards have produced some 600 kg of seed. Nurseries deliver around 160 million seedlings for planting every year, in addition to which some 10–20 million seedlings have been imported from Sweden in recent years.

Improved seed is available for commercial use on a market-price basis and for research as part of domestic and international cooperation.

Table 15. Seed orchards and the OECD-category for the produced seed

Species Scientific name	Seed orchards		
	Number	Category	Area (ha)
Alnus glutinosa	2	Qualified	4
Betula pendula	2	Qualified	0,26*
Betula pendula var carelica	1	Qualified	0,1*
Picea abies	27	Qualified	311
Pinus sylvestris	93	Qualified	1590
Pinus sylvestris	10	Tested	183
Larix sibirica	8	Qualified	59

* Seed orchards of *Betula* are in greenhouses.

Table 14. Tree improvement trials

Species		Plus trees	Provenance trials		Progenies trials		Clonal testing and development			
Scientific name	Native (N) or Exotic (E)	Number	No. of trials	No. of prov.	No. of trials	No. of families	No. of tests	No. of clones tested	No. clones selected	No. of clones used
Picea abies	N	7929	134	377	118	2201	106	3122	-	-
Pinus sylvestris	N	9618	88	474	666	10811	5	30	-	-
Betula pendula	N	*(2360)	18	77	68	1896	29	162	38	17
Larix sibirica	E	298	4	9	11	68	-	-	-	-
Alnus glutinosa	N	287	-	-	2	11	-	-	-	-
Populus tremula x tremuloides	E	301	-	-	-	-	24	266	40	6

* number of plus-trees if only first generation seed orchards have been established

Table 16. Type of reproductive material available

Species	Type of material	Available for national request		Available for international request	
		Commercial	Research	Commercial	Research
Pinus sylvestris	seed	X	X	X	X
Picea abies	seed	X	X	X	X
Betula pendula	seed	X	X	X	X
Betula pendula var carelica	plants	X	X		
Larix sibirica	seed	X	X	X	X

5 The State of National Programmes, Research, Education, Training and Legislation

National Programme for Forest Genetic Resources

The conservation and sustainable use of genetic resources for agriculture, horticulture and forestry is agreed upon in international agreements (CBD, IU, GPA). In Finland, the body responsible for the conservation and sustainable use of these resources is the Ministry of Agriculture and Forestry. The National Plant Genetic Resources Programme was launched by the Ministry of Agriculture and Forestry in 2001 to promote the conservation and sustainable use of genetic resources. The programme was originally prepared by a large working group consisting of representatives from the public and private sector: inistries, breeding companies, research institutions, universities, plant production control authorities, agricultural producers and forest owners, civil society organisations.

The programme consists of two parts: the actual programme and a background survey. The programme defines the main principles and objectives as well as detailed objectives for conservation, such as the number of gene reserve forests for a given species. However, there has also been room for slight modifications according to the new knowledge that has been gained during the implementation process. The programme lists legislation and international agreements on genetic resources and sets some general objectives in the field of research, information, education and training regarding plant genetic resources.

The responsibility for implementing the gene conservation programme for forest trees rests with the Finnish Forest Research Institute Metla, whereas MTT Agrifood Research Finland is responsible for implementing the programme regarding agricultural and horticultural plants. Metla is also responsible for forest tree breeding in Finland, which brings conservation and sustainable use of genetic resources under the same institute.

The implementation of the programme is monitored by an advisory body, which acts as a link between various ministries, participates in the preparation of legislation concerning plant genetic resources and deals with Nordic and international issues related to plant genetic resources.

Implementation of the programme

The Finnish Forest Research Institute (Metla) is responsible for implementing the Plant Genetic Resources Programme for forest trees. Metla coordinates the work and takes care of the practical steps, such as:

- selecting the individual gene reserve forests
- giving management guidelines for gene reserve forests
- selecting and sampling the material for ex situ collections
- establishing ex situ collections, including grafting, sowing, growing plants and planting
- managing the collections, including intensive protection and care
- making regular inventories in the collections
- characterising the material in collections with phenological observations

The State Forest Enterprise Metsähallitus, which administers all the state-owned land in Finland, is engaged in this work as a main owner of the gene reserve forests. Other gene reserve forest owners (see Chapter 2) are valuable partners on a voluntary basis. All in all there are few actors involved and thus there has been no need to establish specific networks. The Ministry of Agriculture and Forestry supervises the implementation of the programme

Table 17. Institutions involved with conservation and use of forest genetic resources

Name of institution	Type of institution	Activities or programmes	Contact information
Ministry of Agriculture and Forestry	governmental	supervision of implementation of the national programme	Ministry of Agriculture and Forestry PO Box 30, FI-00023 GOVERNMENT Tel: +358-9-16001
Finnish Forest Research Institute	governmental research institute	responsible for implementation of the national programme	Metla Mari Rusanen P.O. Box 18 FI-01301 Vantaa Finland mari.rusanen@metla.fi
Metsähallitus	state enterprise	administers all the state land (approx. 2/3 of the gene reserve forests)	Metsähallitus P.O. Box 94 (Vernissakatu 4) FI-01301 Vantaa Finland Tel. +358 205 64 100

National Advisory Body for Genetic Resources

The implementation of the Plant Genetic Resources Programme, together with the Animal Genetic Resources Programme, is guided by the National Advisory Body for Genetic Resources.

The Advisory Body has members from several ministries as well as from other interest groups. It is chaired by the Ministry of Agriculture and Forestry, and the other ministries represented are the Ministry of Trade and Industry, the Ministry of Foreign Affairs, the Ministry of Finance and the Ministry of the Environment. The other members are from the Finnish Forest Research Institute, Agrifoods Research Finland, Boreal Plant Breeding, Finnish Animal Breeding FABA, the Central Union of Agricultural Producers and Forest Owners, the Central Union of Swedish-Speaking Agricultural Producers in Finland, the University of Helsinki, the Finnish Environment Institute and the Finnish Landrace Association Maatiainen. The broad representation from different ministries, universities, stakeholders and a non-governmental organisation is designed to ensure that different national stakeholders are involved in the planning and implementation of the programme. The Ministry of Agriculture and Forestry appoints the Advisory Body for Plant Genetic Resources for four-year periods of office.

The duties of the Advisory Body are:

- To follow up on and steer the national genetic resources programmes.
- To address Nordic and international issues involving plant genetic resources, including international legislation.
- To act as an inter-ministry cooperation body in questions pertaining to plant genetic resources.
- To prepare Finnish decisions concerning the Nordic Genetic Resource Center (NordGen).
- To prepare matters pertaining to the National Plant Genetic Resources Programme, and to monitor and develop the programme further.
- To participate in the preparation of necessary legislation.
- To share information concerning items related to the conservation and use of plant genetic resources.

The Advisory Body also serves as a meeting place for the coordinators of the three gene conservation sectors (forestry, agricultural plants and farm animals). In recent years the Advisory Body has also established specific working groups for themes such as the implementation of the Bonn Guidelines or securing gene conservation in the long-term and the legislative needs for long-term conservation.

National Forest Programme and other relevant programmes

The National Forest Programme (NFP) of Finland is the cornerstone and strategic base of the Finnish forest policy. The NFP aims to ensure forest-based work and livelihoods, biodiversity and vitality of forests, and opportunities for recreation for all citizens. The programme was prepared as an open process between all stakeholders in forest issues. The cooperation continues in the implementation, follow-up and development of the NFP.

The Finnish government approved the first NFP in 1999, and since 2000 it has been implemented as part of the Government Programme. The first revision of the NFP commenced in autumn 2005 and was made according to the guidelines set out in the Government Programme. Due to strong changes in the whole operating environment of the forest sector and in the structure of the forest industry, the NFP needed to be revised again in 2010. The Finnish government adopted the revised National Forest Programme 2015 through a government resolution on 16 December 2010.

The implementation of the NFP is coordinated by the Ministry of Agriculture and Forestry with the help of the Forest Council and its Secretariat and Working Groups. The Forest Council is an Advisory Body which supports the Ministry of Agriculture and Forestry. Different administrative sectors, forest industries, NGOs and expert organisations have their representatives in the Forest Council. The task of the Secretariat of the Forest Council is to prepare the items for the Council and promote the implementation of its decisions. The working groups set up according to the strategic objectives and cross-cutting themes of the National Forest Programme 2015 assist the Secretariat and Forest Council in preparing the issues. The composition of the working groups is broad-based. Their main task is to promote the implementation of the programme in their own specific fields, make proposals on changes that may be needed to the programme and its implementation, and create new projects as well as report on the progress of the projects to the Secretariat and Forest Council.

Forest genetic resources are included in the tasks of the Environmental Benefits working group, as one of the objectives for this group is to halt the decline of forest habitat types and species and establish a favourable trend in the state of biodiversity. One of the several actions listed in order to achieve this goal is *to ensure the genetic diversity of forest trees in accordance with the National Programme on Plant Genetic Resources in Agriculture and Forestry, taking into account the international obligations laid down in the EUFORGEN programme and guidelines issued by the National Advisory Body for Genetic Resources.*

Assessment of needs for future development

Based on the experience gained during the ten-year period that the national plant gene resources programme has been in force, *there is a clear need to strengthen the forest genetic resources conservation work by establishing a legal framework for it.* There are several options for doing this. A separate law for gene conservation could be a solution, but legal steps at a lower level might also be suitable. There is also a need to assess the role of genetic conservation in relation to the Nature Conservation Act and the relevant policies (e.g. Biodiversity Strategy) under the Ministry of the Environment.

Funding is currently at the minimum level and is forced to compete with research projects for resources within the appointed institute (Metla). Due to the budgetary restrictions, progress has been slow. However, improving the long-term continuation of the programme is even more important than raising the annual budget for forest gene conservation programme.

The funding mechanism for purchasing land for the state or for compensation to private forest owners could be considered in some specific cases, even if the main part of the conservation units are established on state-owned land. So far, no compensation has been paid to the private owners. Sometimes the assisted regeneration with local origin creates extra costs which have been taken care of by Metla doing most of the extra work. Although the extra costs are relatively small, there is still a need for a suitable funding mechanism.

There are few people engaged in the implementation of the gene conservation programme, which makes the work vulnerable to unexpected changes. Thus there is a need for capacity-building to ensure long-term continuation of the work. At the same time it is very important to raise the political awareness of the role of genetic resources and to keep them on the respective agenda.

Genetic research needs many kind of skills

Forest excursions play an important role in raising public awareness

The programme is facing problems in terms of reconciling the conservation objectives of forest genetic resources and other conservation forms, e.g. the conservation of old-growth forests. These need to be solved through positive cooperation between officials in the forestry and environmental sectors.

Trends

The status of the programme for forest genetic resources has strengthened politically since forest genetic resources conservation was included in the National Forest Programme in 2005. However, the funding of the programme and the volume of the practical work has remained about the same.

Education, research and training

Research on forest genetic resources is carried out mainly by one governmental institute (the Finnish Forest Research Institute); in addition, researchers at four universities work periodically with forest tree genomics or genetics. Presently there are six active projects at least partly related to forest genetic resources, three funded nationally and three EU-funded. The annual budget of the publicly funded projects is less than 1% of the total public funding for forest research. In addition to the research projects, there is a fairly large programme on forest tree breeding. The research has not yielded any patents directly related to the genetic resources.

Education in forest genetic resources is offered as a major in Master's level studies in forestry at the University of Helsinki, but in the past few years this field has not attracted students. In addition, basic courses in forest genetics can be included in studies on a voluntary basis but still most foresters graduate with no studies in genetic resources. This regretful situation has been a

source of dialogue, but currently there is no strategy to improve the status of genetic studies. Finnish students can participate in training in other countries, especially Sweden, but information on these opportunities is probably not sufficiently widespread.

Legislation and international commitments

There is no legislation directly related to the conservation of forest genetic resources, and the current legislation for nature conservation does not mention genetic conservation. Finland has, however, implemented Council Directive 1999/105/EC on the marketing of forest reproductive material through the Act on Trade in Forest Reproductive Material (241/2002). One of the principles of Council Directive 1999/105/EC is that the conservation and enhancement of biodiversity of the forests, including the genetic diversity of the trees, is essential to sustainable forest management.

The most important international commitment for forest genetic resources conservation is the Convention on Biological Diversity (CBD) and the resolutions of the MCPFE process (Ministerial Conference for the Protection of Forests in Europe, currently Forest Europe). Resolution 2 of the Strasbourg Conference in 1992 is the basis for the national forest gene conservation actions, which started on practical level in1992 and have been based on an official national programme since 2001.

The Finnish Nature Conservation Act (1096/1996, amended by Acts 144/1999 and 371/1999) and the Nature Conservation Decree (160/1997) implement EU Council directives 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (known as the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Bird Directive), except in the case of animal species mentioned in Article 5 of the Finnish Hunting Act.

The objectives of the Nature Conservation Act are: conservation of biological diversity; preservation of natural scenery and landscape values; support of the sustainable use of natural resources and ecosystems; promotion of public awareness of and interest in nature, and promotion of research into nature. Under the Act, nature conservation must aim for attaining and maintaining a suitable level of protection for biotopes and wild species. The level of protection of a biotope is suitable when its natural distribution range and total area are sufficient to secure its preservation and the structure and functionality of its ecosystem in the long term, and when the level of protection of its characteristic species is suitable. The level of protection of a species is suitable when the species is able, in the long term, to remain viable in its natural habitat. The Nature Conservation Act does not mention anything about conserving diversity within species, although it is indirectly included in the biodiversity concept.

Intellectual property rights (IPR) related to plant genetic resources are addressed in the Act on Plant Breeders' Rights (789/1992, 238/1999), and to some extent in the Patents Act (550/1967). Inventions involving biological material can be patented, provided that they are new, innovative, reproducible, and suitable for industrial use. The practice of agriculture and forestry, for example, is regarded as satisfying the criterion of industrial use. Inventions involving plants and animals can be patented if the technical feasibility of the invention is not restricted to one plant cultivar or breed of animal. So far there have been no cases where material intended for forestry has been protected by either the Act on Plant Breeder's Rights or the Patents Act.

Information system

The Finnish Forest Research Institute Metla has developed and maintains the Forest Genetic Register, which currently has about 190 000 entries, including all genetic material for tree breeding, conservation and genetic research. Information on the material is stored and accurately kept for various needs in the present and in the future. The register also provides information that is necessary for the control of the trade of forestation material, e.g. the descriptors of the approved basic material. The part of the database that includes gene reserve forests is designed to be compatible with Europe-wide EUFGIS database, hosted by the EUFORGEN Secretariat at Bioversity International.

Public awareness

The awareness of gene conservation is limited. The role of the forest genetic resources in the sustainable forest management is known by the small amount of people working on it. However, when it comes to the use of genetic resources in forest regeneration, e.g. the selection of suitable plant or seed material for a given area, the general understanding among forest managers and forest owners has improved in recent years.

It has turned out to be difficult to raise awareness of the value of genetic resources among the general public and also among professionals who are not working strictly with genetic resources, even if their own field of expertise is interlinked with genetic issues.

No special awareness programmes have been initiated, but information is spread through personal contacts and within working groups. The most important target groups at the moment are professionals in the environmental sector and those forest institutes which are invited to participate in the gene conservation work. Hopefully the National Forest Programme will help to raise the awareness and uncover the mutual benefits for the environmental sector and the forest sector.

6 The State of Regional and International Agreements and Collaboration

The Ministry of Agriculture and Forestry in Finland is a member of more than 30 international organisations. As Finland is a member of the European Union, the Ministry is also involved in numerous organisations and participates in their meetings. Among these, the World Trade Organization carries the greatest political weight.

The UN Food and Agriculture Organization (FAO) is an important forum for influencing development policy in the agriculture, forestry and fisheries sectors. In recent years, the Ministry of Agriculture and Forestry has considerably reinforced its role in both the national and international dialogue on development policy issues.

The Organisation for Economic Co-operation and Development (OECD) is an important institute for international economic research and a think tank for policy planning. The OECD committees for agriculture and fisheries and working parties under these bring together the leading civil servants and experts from the 20 member countries. The Ministry of Agriculture and Forestry takes active part in agricultural and fisheries policy research and policy design in the OECD context.

International agreements influence the national forest policy a great deal. It is important for Finland to take an active part in the preparation and implementation of international forest policy. Finland is an active party to all the major multilateral environmental agreements and processes which are relevant to forests, such as United Nations Forum on Forests (UNFF), the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD), as well as the FAO's work on forests. On regional cooperation, the Forest Europe process (formerly MCPFE) is key. Important work in the forest sector is being done at the United Nations Economic Commission for Europe Timber Committee (UNECE/TC) and the FAO. Finland also takes part in the forest cooperation practised under the Nordic Council of Ministers. In addition to the multilateral cooperation, Finland is engaged in bilateral cooperation with several countries. The Advisory Board for International Forest Policy assists the Ministry of Agriculture and Forestry in dealing with international forest policy issues and assessment of their impacts.

In the field of forest genetic resources, Finland participates in two regional networks, namely EUFORGEN at the European level and NordGen at the Nordic level.

EUFORGEN

EUFORGEN is a collaborative programme among European countries for promoting conservation and the sustainable use of forest genetic resources. It serves as a platform for pan-European collaboration in this area, bringing together scientists, managers, policy makers and other stakeholders. The EUFORGEN Secretariat is hosted by Bioversity International. EUFORGEN was established in October 1994 as an implementation mechanism of the Strasbourg Resolution S2 (conservation of forest genetic resources) of the first Ministerial Conference on the Protection of Forests in Europe (MCPFE), held in France in 1990. The programme also contributes to the implementation of other MCPFE commitments on forest genetic resources and relevant decisions of the Convention on Biological Diversity (CBD).

For Finland, EUFORGEN has been a way of contributing to the implementation of our international commitments. It has also been of valuable help in the establishment of the national gene conservation strategy. It has helped in formulating recommendations for policy makers and contributed to the information strategy on forest genetic resources.

NordGen

NordGen – the Nordic Genetic Resource Center – is a Nordic organisation dedicated to the safeguarding and sustainable use of plants, farm animals and forests. NordGen Forest serves as a Nordic meeting place to examine issues in the fields of forest genetics and genetic resources, the supply of seeds and plants, and methods for regeneration. The main goal is to contribute to the establishment of the best possible Nordic forests for the future. NordGen Forest consists of two bodies, each with members from all Nordic countries: the Council members exchange information on regeneration issues, discuss different topics of interest for Nordic forestry and plan future events. The Working Group on Genetic Resources ensures cooperation in conservation and the use of forest genetic resources.

The Council seeks to increase the availability of suitable forest reproductive material and to promote successful forest regeneration in the Nordic countries. This includes both practical and administrative parts of seed and plant supply, regeneration methods, genetics and tree breeding. Its members exchange information on regeneration issues, discuss different topics of interest to Nordic forestry, and plan coming events.

The Working Group on Genetic Resources forms an interface between conservation activities at the national and the European levels (EUFORGEN), and initiates and implements activities that can improve or guide the conservation and use of forest genetic resources. A recent project of the working group was on the access and benefit sharing issue: *Seeking Appropriate Legislation Regulating Access and Exclusive Rights to Forest Genetic Resources in the Nordic Region*, and another current project of NordGen Forest is *Cooperation in breeding of Norway spruce.*

In addition to NordGen Forest, another body within NordGen which is relevant to forest genetic resources is the Environmental Coordination Group. This group is dedicated to strengthening the cooperation between the environmental sector and the agriculture/forestry sector in the Nordic countries, in their work with genetic resources. It handles themes such as the protection of wild crop relatives in their natural environments and the relationship between genetic resources and climate change. The group members also exchange information on national developments on political items, e.g. the national implementation of the Nagoya Protocol.

Financial support

The financial support for international work on forest genetic resources has remained the same over the past ten years. The financial support constitutes of the yearly fee of the EUFORGEN programme and the working time of the respective persons dedicated to international cooperation. The funding of the Nordic cooperation is provided through the Nordic Council of Ministers. Finland has not provided any specific monetary aid for international gene conservation purposes.

Needs and priorities for future international cooperation

Finland is committed to continuing to implement the national conservation programme on forest genetic resources, both *in situ* an *ex situ*. International cooperation at both the European and the Nordic level is needed to give valuable support on technical items such as *ex situ* management practices of species that are rare in Finland but are better known in other parts of Europe. With *in situ* programmes of widely distributed species, it is also essential to have a wider perspective and joint evaluation of the networks of conservation units, as is done within the EUFORGEN programme.

As the community working on forest genetic resources in Finland is small, international cooperation on research and understanding the state of diversity is much needed. The question of monitoring the state and changes in forest genetic resources is something where international cooperation is particularly needed for developing methods, creating political will, and creating a monitoring system.

There are international developments on policies, e.g. on the field of access to genetic resources, which have an effect on forest genetic resources and the use of forest reproductive material. These processes are often driven by sectors other than forestry; therefore it is important that at the international level the forest genetic resources community, through international agencies, participates in the negotiations and influences the developments so that the specific characters and needs of the forest sector will be taken into account.

7 Access to Forest Genetic Resources and Sharing of Benefits Arising from their Use

Access to forest genetic resources

As a signatory state of the Convention on Biological Diversity (1992), Finland is committed to facilitating access to genetic resources for environmentally-sound uses, and taking legislative, administrative or policy measures with the aim of sharing the results of research and development and the benefits arising from the commercial and other utilisation of genetic resources from the providing country in a fair and equitable way.

Bonn Guidelines

In 2002, COP 6 adopted a decision (VI/24) on access and benefit sharing as related to genetic resources (ABS). The Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization state that each country should designate one national focal point for access and benefit sharing and make such information available through the clearing house mechanism. The national focal point should inform applicants for access to genetic resources on procedures for acquiring prior informed consent and mutually agreed terms, including benefit sharing, and on competent national authorities, relevant indigenous and local communities and relevant stakeholders, through the clearing house mechanism. The responsible institutes for ABS mechanisms in Finland are the Ministry of Environment and the Finnish Environment Institute.

As a follow up to the Bonn Guidelines in Finland, a working group was established under the National Advisory Board on Genetic Resources in 2004, its mandate being to address the targets of the Bonn Guidelines and its national implementation, including drafting of the necessary legislation. The working group produced a fairly detailed background survey in 2006, which included alternative models for implementing the Bonn Guidelines, as well as legislative and/or administrative action needed for each of the alternative implementation models. The report also describes different types of genetic resources and the status and value of the national genetic resources. The process of implementing the Bonn Guidelines at the national level is ongoing and currently no specific regulations exist. It regarded as fruitful to wait for certain international developments before making decisions on how to best implement them on a national level.

The restrictions to the movement of forest genetic resources into or out of the country are solely for phytosanitary reasons, or because of regulations on the trade of forest reproductive material, which is free within the European Union but is regulated into or out of the Union. These limitations do not restrict movement of material to be used for research.

Nordic Ministerial Declaration

A Nordic Ministerial Declaration on Access and Rights to Genetic Resources in 2003, so called Kalmar declaration, underlined the importance of genetic resources for sustainable development, and that the efforts aimed at the conservation and sustainable utilisation of genetic resources in the Nordic countries are given higher priority. The Council of Ministries also recommended that the Nordic countries initiate a project with the aim of providing a basis for the Nordic countries' decision regarding the legal status of their forest tree genetic resources, but had not identified any reasons to recommend regulation of access. As a continuation to the Kalmar declaration, NordGen working group on forest genetic resources had a project in 2009-2010 on "Access and rights to forest genetic resources in the Nordic region" which was funded by the Nordic Council of Ministers. The outcome of the project is the FNI Report 9/2011 "Seeking Appropriate Legislation regulating Access and Exclusive Rights to Forest Genetic Resources in the Nordic Region" by Morten Walløe Tvedt.

The traditional practice within Nordic countries and their forest sectors has been close cooperation in breeding and genetic conservation, including joint research projects and the open exchange of information and material. There is also a clear wish to continue with the present open system and maintain the smooth bureaucratic procedures for exchange.

Responsible bodies and other actors

The main body responsible for the implementation of the CBD and its decisions is the Ministry of the Environment. The task is partly the responsibility of the Finnish Environment Institute. Other ministries are also engaged in the process, including the Ministry of Agriculture and Forestry with its subordinate institutes and agencies.

Relevant acts and Everyman's Right

Although there is no act which directly addresses access and benefit sharing of genetic resources, there is existing legislation that contributes to the current practices. In Finland, ownership of the biological material and the land where the material is growing is decisive to the ownership of genetic resources. Based on a constitutional practice called Everyman's Right, access to the forests is free to everyone, as is the right to pick berries, mush-

rooms and cones on the ground, providing that you are not causing any damage to nature. For commercial collections of seeds, for example, one has to have the permission of the land owner.

The policy for access has remained largely the same for the past ten years. Finland does not specifically restrict access to its genetic resources. Most of the forest species are widespread and have extensive gene flow, which makes the gene pool common for Finland and neighbouring countries. When tree breeders were asked if there is any original valuable genetic material to which they would like to regulate access, the only taxon mentioned was *Betula pendula* var *carelica,* which is considered a Finnish variety, rare but fairly intensively studied, and which produces extremely valuable wood for special purposes.

Over the past ten years, Finland has not undertaken any management actions to maintain or enhance access to forest genetic resources located abroad.

Sharing of benefits arising from the use of forest genetic resources

The objective of the Nagoya Protocol is the fair and equitable sharing of benefits arising from the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights to those resources and to technologies, and by appropriate funding, thereby contributing to the conservation of biological diversity and the sustainable use of its components.

Finland is a signatory of the Nagoya Protocol and has started the preparatory work which is a prerequisite for ratification. A specialist in environmental law has been commissioned to carry out a survey of the needs from a legal perspective, and the process will continue under the Ministry of the Environment and will be guided by the Advisory Body for Genetic Resources. The rights of indigenous people, namely the Sami people in Finland, will be given special attention.

Finland has not established any special mechanisms recognising intellectual property rights related to forest genetic resources or mechanisms of sharing benefits arising out of the use of forest genetic resources. The benefits arising from the use of forest genetic resources are realised through forestry and the forest industry, and thus have an influence on the national economy. Forest tree breeding is state-funded and the realised gain through breeding is available to all forest owners.

Wind-borne pollen flyes long distances

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ISSN 1238-2531 (Printed version)
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