



FINLAND:

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INTERNATIONAL TECHNICAL
CONFERENCE ON PLANT
GENETIC RESOURCE**

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Note by FAO

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CHAPTER 1

Introduction to Finland and Its Agricultural Sector

The total area of Finland is 338 145 km² of which 28 160 km² is agricultural land, 233 665 km² forests and other wooded land, 9 390 km² is built-up and related land area, 33 552 km² is water and 33 378 km² is classified as other areas. In 1993 the number of protected land areas was 1 366 comprising of 2 883 406 hectares. There were 29 national parks (720 719 ha), 19 nature parks (151 939 ha), 173 protected peatland areas (414 716 ha), 91 special protected areas (47 372 ha) and 12 wilderness areas (1 487 917 ha). 1 042 nature conservation areas were established on private land comprising of 60 743 hectares.

In 1993, the share of agriculture of the gross domestic product was 3%. The significance of the total food chain in the national economy is much greater than the share of agriculture in the gross domestic product alone indicates. The sectors providing production inputs, transportation, and processing increase considerably the share of food economy in the whole national economy. In 1992, the total food expenditure amounted to FIM 56 billion, and its share of the consumer expenditure was 16%. The food sector employs about 300 000 people, when the production input industry, services, and food industry are included, in addition to agriculture, but the retail trade is left out.

In 1993, the population of Finland was 5 077 900. The share of the employed labour force of agriculture in the whole national economy was 7%. This is considerably larger than the share of agriculture in the gross domestic product. However, the compilation of statistics on the labour force and labour input in agriculture is difficult. Members of the farm family often work outside agriculture as well, and only about half of the incomes of farm families come from agriculture.

In recent years investments in agriculture have dropped to about half of the level of the end of the 1980s. In 1993, the share of agriculture of the investments of the whole national economy was only 3%. Agriculture is a very capital intensive industry. A modern farm requires a lot of land, buildings and machinery, but employs only a couple of people. It is obvious that farmers are not prepared to make investments, especially due to the uncertainty caused by the accession into the EU. The overall economic depression has also affected the production and investment decisions in agriculture. The main consequence of the depression to



agriculture has been that an increasing share of the export costs of overproduction is covered by agriculture itself. Thus, the average product prices in agriculture have decreased, and farmers' incomes have dropped.

Forest is an integral part of a Finnish farm: an average farm has 13,5 hectares arable land and 49 hectares forest. Although forestry income, on the average, accounts for only about 15 % of the incomes of farm families, the positive development in the forestry sector is very important for agriculture. Forestry products' export have increased strongly, and along with this the stumpage prices have risen about 15%. Felling has increased by a third from the previous year. This has made it possible for farmers to obtain additional income to compensate for the possible income losses in agriculture proper.

1.1 THE FINNISH FARM

Practicing agriculture in Finland is possible due to the Gulf stream, which causes the temperature to be 3-4°C higher than usually in these latitudes in other parts of the world.

Finland is about 1,100 km long from south to north, and the climatic conditions vary considerably. In Southern Finland, the growing season is 170 days, but in the north it is only 100 days. There is a lot of variation in the effective temperature sum, too: in the south it is 1 300 and in the north 500 degree days. From time to time there is frost even in the middle of the summer in all parts of the country.

The amount of light in summer reduces the differences in the growing conditions in different parts of the country to some extent. Nights are short, especially in central and northern parts of the country. On the other hand, the radiation conditions restrict the selection of the plant varieties. Breeding of plant varieties that are adapted for the Finnish conditions is needed.

Climatic conditions are decisive for the location of crop production. Cultivation of wheat and oil-seed plants is restricted to Southern Finland. Instead, barley, oats, grass and potatoes can be cultivated in most parts of the country. Because of the shorter growing season, the yield levels of the field crop species are considerably lower in Finland than in the Central European countries. In 1994 the average yields of field crops (kg/ha) were (total yield in parenthesis, 1 000tn): wheat 3 750 (333) , winter rye 2 600 (22), spring oats 3 460 (1 157), spring barley 3 680 (1 861), spring rape 1 610 (108), pea 2 420 (15), potato 19 900 (725) and sugar beet 29 800 (1 000).



In many parts of Finland livestock production, especially dairy production, is the only profitable form of production.

Finnish agriculture is based on family farms. State and municipal institutions like schools and research institutes own a few larger farms, but their significance in Finnish agriculture as a whole is very small. In 1993, private persons owned 78,2 % of farms, heirs and family companies 20,6 %, limited companies and co-operatives 0,4 %, and the state, municipalities, and congregations 0,7%.

According to the Farm Register of 1993 there were altogether 191 853 farms with over 1 hectare, and the average farm size of these was 13,5 hectares. However, agricultural production was practiced on only 116 281 farms, and their average farm size was 18,78 hectares. The small farms in the statistics often distort the discussion on the structure of Finnish agriculture. If only the active, full-time farms are considered, the number of farms is much smaller and, correspondingly, the average farm size is larger. However, even in this case the farm size is quite small, especially in cattle production. It is possible to increase the farm size through renting arable land. This has been on the increase, and in 1993 altogether 401 529 hectares, i.e. 15,5% of the arable land area was rented.

Finnish agricultural production is mainly based on livestock. Only 15 % of arable land area is used for crop production for human consumption. Milk production accounts for about 30 % of the total return of agriculture, and the share of cattle production rises to about half of the total agricultural production when beef production is taken into account. Consequently, the share of hay, silage, and pasture is about a third of the total arable land area.

About half of the farms are engaged solely in crop production. In 1994, the total arable land area was 2 286 000 hectares. Of this, 1 776 000 ha was in active production (grassland 670 000 ha, grains 934 000 ha, oil plants 76 000 ha, sugar beets 34 000 ha, potatoes 39 000 ha, other crops 17 000 ha) and 510 000 ha was fallowed.

In 1993 the value of *greenhouse production* was about FIM 1,27 billion, the share of vegetables (mainly cucumber, tomatoes, and lettuce) being about FIM 585 million and that of flowers about FIM 681 million. About 3 000 entrepreneurs were engaged in greenhouse production, and the greenhouse area was 465 hectares. Greenhouse production does not receive any actual state support. In greenhouse production the real producer prices have decreased considerably since the 1980s.



1.2 OTHER RURAL INDUSTRIES

In addition to agriculture and forestry, farmers practice many other industries, e.g. horticulture, fishing, fur farming, farm holidays, etc.

An important side-line for agriculture is *fur farming*, which is also practiced on its own. It employs about 5 000 people. There are about 2 200 fur farms mainly in Ostrobothnia.

Reindeer herding is the main source of living for about 800 households in Lapland. In addition, in about 1 500 households it is a very important secondary occupation. At reindeer round-ups in 1993/94 there were about 346 000 animals, and meat production was 3,2 million kg.

Wild berries (cloudberry, blueberry and lingonberry) are an important source of income for many people, especially in northern Finland. In 1990 this income amounted to about FIM 52,1 million. In addition, there is the value of the berries used in households. The income from picking *mushrooms* was about FIM 6,8 million in 1990. There are also a few farms specialized in mushroom production.

1.3 SEED SUPPLY SYSTEM OF AGRICULTURAL PLANTS

In Finland the seed marketing legislation was harmonized with the EU-directives in 1994. According to this legislation all the seed which is marketed should be officially certified. The certified seed can be produced from species and varieties which are included in the Finnish National List of Cultivars held by the Plant Variety Board. In 1994, however, only about 30% of the total seed volume used in Finland was officially certified. Many farmers use their home-grown seeds. Quite a few farmers also buy their seeds from the 'grey market' which developed as a result of several domestic reasons at the end of 1980's just before the implementation of UPOV-legislation in Finland.

As the northernmost field cropping country, Finland considers the persistence and origin (progeny) of plant materials very important. The cultivation of field crops is based on the utilization of Finnish cultivars of the main crop species and the national plant breeding is considered very important. National plant breeding programmes are also financially supported by the government. The winterhardy material is needed both for vegetatively propagated plants (horticulture and forest) and for grasslands. On the Finnish national list of cultivars there are several special cultivars which are adapted to the northernmost conditions only, and this



kind of cultivars are not available from other countries. Therefore Finland has had both a special legislation to support the seed production of these cultivars and a reserve stock system to secure this seed supply.

In Finland the commercial seeds of cereal plants and also most of the seeds of fodder plants (grasses) are produced on contract farms specialized in seed production. About 20 % of seeds are sorted and packed on these farms, too, and the rest is treated in various seed companies. A small amount of fodder plant seeds are imported to Finland, while almost all of the seeds of lawn grasses and horticultural plants are produced abroad and imported to Finland.

Typically, the short summer season and cool climate in Finland are unfavourable to aphids which spread many virus diseases of plants. This is why the 'high grade region' of seed potato production is located in the northwestern Finland.

Virus-free seedlings from many ornamental plant species and berries are produced at the Elite Plant Station of Finland.



CHAPTER 2

Indigenous plant genetic resources

2.1 FOREST GENETIC RESOURCES

- i) The main forest tree species, *Pinus sylvestris*, *Picea abies*, *Betula pendula* and *B. pubescens*, are all indigenous and commercially important. In terms of growing stock the proportions of tree species were 1983-1993 as follows (Year-book of Forest Statistics, 1994):

<i>Pinus sylvestris</i>	45,6 per cent
<i>Picea abies</i>	36,8 per cent
<i>Betula spp.</i>	14,5 per cent
Other broad leaved	3,1 per cent.

Out of the total forest area of 20 million hectares *circa* 25 per cent has been artificially regenerated. In other words 75 per cent of forest area is of natural origin. In addition, spontaneously born “wild” seedlings make up a large proportion of the growing stock on artificially regenerated areas. Natural regeneration has been and is common also in a long run - not only as a boom of environmental enthusiasm. However, though 75 per cent of forest area is naturally regenerated, the regular thinnings of managed forest areas have little by little narrowed the genetic diversity of trees by harvesting all the ‘deformed’ trees. Thinnings also change the ratio of forest tree species in forests.

- ii) The Ministry of Agriculture and Forestry, The Finnish Park and Forest Service, and Forestry Centre Tapio have recently reviewed and amended the guidelines of forestry practice. The ecological aspects and the maintenance of biodiversity are underlined in forest management. Even though various types of nature reserves, protected by law, are mainly devoted to ecosystem conservation, they simultaneously are gene reserves of forest trees. Nature protection areas include *circa* 480 000 ha (2.4 per cent) of forest land, which is mostly in North Finland. Due to the restrictions of nature parks and other protected areas, such as their distribution and limited access, a special programme of networks of gene reserve forests is being carried through.



- iii) Several tree species of the temperate zone have their natural tree limit in Finland. Because of the out of range occurrence they can survive only on special small sized sites. The original scattered population structure has become more pronounced because of changes in land use and heavy exploitation of valuable rare species. Natural populations of *Taxus baccata*, *Tilia cordata*, *Fraxinus excelsior*, *Ulmus glabra* and *U. laevis*, *Quercus robur*, and *Acer platanoides* are at least locally threatened by road or house construction, and even by the dominance of spruce. These populations at the boreal margin of the range of respective species must have unique genetic features. They represent the utmost adaptability of each species.

2.2 OTHER WILD SPECIES AND WILD RELATIVES OF CROP PLANTS

The fact that Finland is located between the 60th and 70th latitudes on the boreal /arctic vegetation zone brings about some very special adaptations in our native plant species. The number of species is low if compared to subtropical or tropical regions, and most species reach their northern limit of distribution in the area of Finland. Because of the great seasonal changes in temperature and in the amount of light as well as in the day length, plant species have developed many unique genetic adaptation and resistance mechanisms for these changing conditions, especially for long day conditions and for various winter stresses, and this genetic variability is a very valuable part of the plant genetic diversity of the world.

The modern intensive forestry and agriculture have, however, strongly influenced the nature of Finland. The amount of various biotypes and the biodiversity of plant and animal species has decreased along the intensification of forestry and agriculture. In Finland the first 'red book' of plant and animal species threatened by extinction was published in 1985 and a new issue in 1992. At the moment about 10% of all the Finnish plant and animal species are considered as threatened. In Finland 10 vascular plant species and 60 sporophyte species are extinct, 34 and 104 (respectively) are classified as very threatened and 54 and 143 species (respectively) are classified as threatened. Especially the diversity of species native to grove habitats has decreased since fertile grove areas have to a great extent been turned into agricultural or forestry areas.

The importance and uniqueness of wild gene resources has been lately noticed in all the Nordic countries, and within the framework of the Nordic Gene Bank (NGB) a temporary working group was established in 1993 to prepare a list of wild plant species that should be included in the mandate of NGB and examine the need for specific preservation measures. In this connection the special



emphasis is put in wild fruits and berries, ornamental trees and shrubs and pastoral species, medicinal species and herbs. The preliminary list of species, which are of interest for the group is included in the report. (Annex 1.).

The group will submit a short list of species that should be given priority in the inventory of useful genetic variation in the Nordic countries. The group will also be NGB's co-ordinating body for the follow-up of the Convention on Biological Diversity.

NGB has also published a catalogue (in Swedish) in 1994 of medicinal plant species (95 ones) which are either indigenous to the Nordic countries, or which have been naturalized to these areas after previous cultivation. In this publication e.g. the utilization, effective substances and the need for preservation measures of these species are described.

2.3 LANDRACES ("FARMERS' VARIETIES") AND OLD CULTIVARS

The gene resources of most old Finnish cereal and forage plant cultivars as well as landraces are mainly collected and preserved in the Nordic Gene Bank (NGB). These collections are stored, documented and regenerated according to the procedure of NGB. There are some smaller collections in Finland kept by the breeders, but these collections are mainly composed of breeders lines and other breeding materials.

Seed Testing Department of PPIC (Plant Production Inspection Centre of Finland) has a collection of seed samples of many of the landraces as well as of the bred varieties of cereals, fodder plants, pulses etc. since 1920's for teaching purposes, but there has not been any programme for regeneration or maintenance of these seeds. Probably most of the seeds in this 'seed testing models' collection germinate only very poorly.

There are, however, only a very few landraces and old cultivars, which have economic interest. Most farmers have old cultivars mostly as a 'hobby'. Only some rye, potato and fodder grasses' old cultivars are still used in commercial farming.

In the field of horticulture some landraces and old cultivars of berries (e.g. *Ribes nigrum*, *R. uva-crispa*), fruit trees (*Malus x domestica*) and also some other horticultural and ornamental plant species are still cultivated. At the moment we have, however, inadequate information about this sector, and more collecting work should be done especially in central and northern parts of Finland.



At the moment, there is no special governmental policy on action of encouraging the cultivation of landraces. Even though there is a strong tendency towards organic farming it doesn't mean that these mostly young and active farmers would be really interested in using the old landraces in practice. There are, however, indications that some new special organic cultivars may be required in the future.

As a whole, the government land use policies in Finland does not especially protect wild genetic resources. The communal infrastructure as well as modern intensive agriculture based on monocultures of plant species and varieties is in most cases in contradiction to the principles of saving plant genetic diversity.

Finland is, however, rather sparsely populated country, and we still have large forest areas and various types of nature reserves (Chapter 1), protected by law in which part of the Finnish plant genetic diversity is saved. There are also some plans in which attempts have been made to create e.g. pasture ecotypes by introducing typical plant and animal species to these areas and by managing them according to the traditional practices.



CHAPTER 3

Conservation Activities

The preservation of agricultural plant genetic resources is in our country predominantly arranged within the framework of the Nordic Gene Bank (NGB), officially established January 1, 1979, as a joint Nordic undertaking. The structure, mandate and various activities (storage, documentation, evaluation, characterization and regeneration of the accessions) as well as the categories of collections are explained in detail in the Country Report of Sweden. Besides the NGB collections, there are some minor holdings of *ex situ* materials, mainly as working collections of plant breeders and other scientists.

There are no specific activities in the field of plant genetic resources carried out by the NGOs in Finland. However, many national and international organizations, such as Finnish Association for Nature Conservation, Nature League and Finnish Society for Nature and Environment (Members of International Union for the Conservation of Nature, IUCN), Central Union of Agricultural Producers and Forest Owners, Finnish 4-H Federation, WWF, Greenpeace and Friends of the World (just starting in Finland) are involved in conservation of nature and environment as a whole. Finland has no national programme organizing the plant genetic resources activities, and we see the NGB activities very important for us.

3.1 *IN SITU* CONSERVATION ACTIVITIES

While the genetic resources of agricultural plants are preserved in NGB collections, the forest trees and other wild plants are at the moment mainly preserved in national collections. There are some collections in the botanical gardens connected to Finnish universities and part of the resources are preserved in national parks, or they are protected by law.

There are some special collections of *Rhododendron*, *Hippophae* and *Rubus*-species (University of Helsinki) representing the global germplasm for extreme hardiness, and of *Ribes uva-crispa*, *Rubus chamaemorus*, *Vaccinium myrtillus*, *Vaccinium vitis-idaea*, *Empetrum nigrum* and *Prunus padus* (University of Oulu) representing world wide collections of garden plants. There are also breeders *in situ* collections of berries and fruit trees (*Fragaria x ananassa*, *Ribes* sp., *Rubus*



idaeus, *Malus domestica*, *Prunus* sp. *Pyrus communis*) and native ornamental plants at the Institute of Horticulture (Agricultural Research Centre of Finland) in Piikkiš.

The national long term breeding programme for forest tree breeding (1989) contains a concrete plan of both *in situ* and *ex situ* conservation of genetic resources. The establishment of *in situ* gene reserve forests was started in 1992. By March 1995 altogether 29 forests, with a total area of 5 189 ha, have been registered. They are registered according to a dominant species: 17 Scots pine, 6 Norway spruce, 3 silver and downy birch, and 3 lime+maple. The original target was to have 40 units, but due to the uneven distribution of the existing forests we are likely to select up to 15 forests in order to obtain covering networks to all main species. The attached map shows the present state of art (Annex 2.).

A network of gene reserve forests will be the basic *in situ* method for main species. Gene reserve forests are managed, which ascertains the regeneration. Nature conservation areas complement to the managed network. Bulk of the stands of the so called noble hardwoods, are included in the Grove Stand Protection Programme. The few communities of *Taxus baccata* are protected by law. Gene reserve forests and nature protection areas are rather large areal units, and they are to stay in the special use for a long time. Therefore, they must be in state forests or belong to big companies and they are managed by professional foresters. Small groves of minor species are mostly private owned, and the management and the tending varies from careless to intensive.

3.2 *EX SITU* COLLECTIONS

The *ex situ* collections of cereal and grasses species seeds are centered around the Nordic Gene Bank. The list of accessions (1 152 in total) of Finnish origin in NGB's seed store is presented as an Annex 3. in the report. As a whole, there is no complete picture about the collections in Finland outside NGB. There are some seed collections in plant breeding institutes and in universities, but in most cases the collections are not properly stored, documented or regenerated. Thus there exists an urgent need for an inventory of these materials in the next future to prevent the losses of valuable genetic diversity.

The exchange of plant gene materials is an important part of all plant breeding programmes. In Finland the breeders collections are in most cases rather small and only restricted amounts of genetic diversity is included into collections. That's why important genes must frequently be 'imported' to the breeding programmes. Besides seed exchange between other breeders, also the collections of NGB are used each year by Finnish plant breeders and quite frequently also by other



scientists. In most cases cereal or grasses accessions as well as horticultural plants with some known disease or pest resistance genes, winterhardiness genes or quality genes (bread wheat, malting barley) has been ordered.

The increased overproduction of many agricultural products and the difficulty to export these products has led to increasing areas of fields set aside from food production. This tendency has raised interest to develop new non food-uses for existing crop species and also to develop new plant species for non food-production. It is probable that also NGB's collections will be needed in new breeding programmes aiming to develop new 'industrial crops'.

Most of the collecting activities are arranged by NGB according to their standards. There are also some minor activities carried out by individual breeders or other scientists. Generally these activities are poorly documented. There is a need for better documentation of the collections and also for some collecting activities of many native horticultural plants in Finland.

For forest trees *ex situ* method is predominantly applied in the form of living gene banks, such as clonal archives and conservation populations. Even though seed of most species is durable, seed banks are rather a transitional means of preservation. Cryopreservation is studied, because it may be used in rescuing of genotypes of small endangered populations.

There is no centralized national collection. Forest Research Institute, Foundation for Forest Tree Breeding, and Forest and Park Service have their own collections. The forest genetic register of the Finnish Forest Research Institute (FFRI) has complete information of all collections. The establishment and maintenance have been funded by the government, as a part of the national tree breeding programme. The clonal archives comprise mainly indigenous material, ramets of phenotypically selected plus trees.

There is also some foreign material of indigenous species. Provenance trials with domestic and foreign origins may sometimes save genetic variation of populations that have been destroyed on their original habitats. Seed sources of *Picea abies* from heavily polluted areas and those of *Picea omorika* from the former Yugoslavia are examples. Provenance and species trials are almost exclusively in the research areas of the Forest research institute. The *ex situ* gene reserves are mainly used for research purposes.

There is a plan to establish new long term breeding populations by breeding zones. The present collection will provide basic material. The exchange of materials has been rather small during the last few years. Export and import are in balance in 5 years' period.



The collections are fairly large and representative. The time perspective is very long. The generation time is around 50 years, after which regeneration ought to be done.

3.3 DOCUMENTATION OF FOREST COLLECTIONS

All kinds of gene reserves have been properly documented. The forest genetic register keeps record of all information. A European data base is being made in co-operation with EUFORGEN/IPGRI.

The core information is duplicated as files in the computer center of FFRI in Helsinki. Manual basic documents and paper prints concerning local items have been copied to respective district offices.

Forest Genetic Resources

- (i) The natural distribution of the main native forest species including the post glacial history has been thoroughly investigated and reported. For the time being no new large scale activities are underway.
- (ii) The national long term programme for forest tree breeding (1989) contains a definition of breeding zones. Breeding zones are aimed to match with ecogeographic zones. The same program me also contains needs and possibilities of *in situ* and *ex situ* conservation.
- (iii) Parallel maintenance of networks of *in situ* gene reserve forests and *ex situ* breeding populations and other collections is the main idea of gene conservation. Gene reserve forests are inexpensive to establish and maintain. They are in good progress. The velocity and volume of actions to *ex situ* populations depend on contemporary economic resources.
- (iv) Research projects on population structure and intraspecific diversity have been carried out, but there is no national programme for systematic surveys. Progeny tests and provenance trials are available, and genetic markers are used besides other characters. The forest genetic register keeps lists of national forest genetic resources. In the near future the common descriptors will be introduced into an European data base (EUFORGEN).



CHAPTER 4

In-Country Uses of Plant Genetic Resources

All breeding programmes of agricultural crop species are based on frequent use of gene bank (own collections, NGB, other international gene banks like CIMMYT, ICARDA, VIR) collections. Depending on the species, approximately 40% of the genetic background of developed new cultivars comes from external sources and about 60% is of native origin. Because of the small size of national breeders' collections, they are mostly used very effectively and only a minor part of collections have not been used in breeding programmes during the last 3 years.

Only a minor part of horticultural plant species are bred in Finland. There are breeding programmes mainly for berries, fruit trees and for some ornamental plants. The collections of these plant species are very seldom used in active breeding programmes, but as they represent origins collected from different parts of Finland, they are preserved mainly for the possible future importance of the genetic resources of these plant species. Most of the accessions of these collections are preserved also in the collections of NGB.

In forest tree breeding programmes most frequently used are the collections of *Pinus sylvestris* and *Picea abies*. The exchange of materials takes place between partners of the national tree breeding programme. Collections of non-coniferous species and introduced species have been only occasionally utilized, but biodiversity issues and the expected climate change have increased their potential value.

4.1 CROP IMPROVEMENT PROGRAMMES AND SEED DISTRIBUTION

The main goals of national breeding programmes is to develop new, better cultivars of agricultural and horticultural crops for Finland, or other areas with similar climatic conditions. This is mainly done by introducing specific characteristics (disease resistance, quality genes etc.) to germplasm well adapted to climatic conditions prevailing in Finland. The procedure for variety release is presented in Annex 4.



The ultimate objective of these programmes is to increase the quantity and quality of the yield, but within these programmes more and more attention is also put to the diversity of production systems (organic farming) and to the need of wider genetic basis of crop plants instead of large monocultures on the fields.

Finnish plant breeding activities with field crops are equally focused on the national needs of food production and on the export opportunities to similar climatic conditions, while at the moment the horticultural crops are mainly bred for Finnish conditions. There are, however, some plans for breeding e.g. berries, fruit trees and some ornamental plant species also for export.

In Finland agricultural crops breeding programmes are mainly carried out in one company: Boreal Plant Breeding, which is partly financed by the Finnish government. The breeding of horticultural plants is based on governmental funded programmes and the work is carried out at the State owned Institute of Horticulture (Agricultural Research Centre of Finland) in Piikkiö.

The plant breeding programmes aim to develop new cultivars mainly for the use of commercial farmers. New cultivars are readily available to farmers after they have been approved to the Plant Variety Register held by the Plant Variety Board. Farmers in Finland are not directly involved in plant breeding.

The Finnish Farmers Association have one representative in the management board of Boreal Plant Breeding organization, and farmers contribute indirectly to the development of better cultivars with their cultivar selections and royalty payments.

Better seed production and distribution is controlled by the Seed Trade Act, which allows the marketing of only certified seeds of the cultivars approved to the Plant Variety Register.

4.2 USE OF FOREST GENETIC RESOURCES

The national tree breeding programme is based on local, autochthonous populations. The goal is to improve growth and quality without sacrificing adaptability and genetic diversity. The aims are to improve profitability of planting forestry, and furthermore to increase export opportunities. The national tree breeding programme is funded by the government.

The Finnish Forest Research Institute, Foundation for Forest Tree Breeding, and Forest and Park Service share the work. Big forest companies contribute to a small extent, whereas the role of farmers is negligible. Genetically improved



reforestation material is available to anybody for the southern part of Finland. Unexpectedly high rate of pollen contamination in respective seed orchards restricts the use in North Finland.

4.3 BENEFITS DERIVED FROM THE USE OF PLANT GENETIC RESOURCES

Because of the severe climatic conditions, Finnish plant species have developed very special genetic adaptation mechanisms, which form the basis of the Finnish plant breeding programmes. These characteristics are often beneficial also when cultivars are developed for export purposes.

Some poplars (*Populus*) and willow (*Salix*) species and clones of foreign origin have turned out to be interesting in connection of short rotation biomass production studies. Exchange of material has taken place within IEA-projects and Nordic co-operation. Actual benefits to Finland are, however, rather small.

4.4 IMPROVING PGR UTILIZATION

Most of the preservation and documentation of Finnish agricultural and horticultural plant genetic resources has been carried out by the Nordic Gene Bank. As a whole, Finland has been very satisfied with the co-operation between the Nordic countries on the regional saving of genetic resources. The main achievements of this co-operation have been: improved collection and documentation of the plant genetic resources and easy accessibility of the collections for plant breeders. The activities around NGB also promote internordic collaboration in the field of all plant sciences.

The greatest value of the Nordic plant genetic resources is that plants in our conditions have developed many unique adaptive mechanisms, the basis of which is on the very special evolutionary adaptation of these species to our boreal/arctic climatic conditions. A large part of this genetic variation has not yet been employed, and it is probable that the changing demands of agricultural policy (organic farming, non food-production, environmental pollution) and also varying biological stresses (pests, diseases) will make these gene resources, if possible, even more important in the future than what they are at the time being.



Within the Nordic Gene Bank it is found important to develop international co-operation and co-ordination of documentation and finance in the field of preservation of plant genetic resources. In Finland, some extra financing is needed to get the small national collections documented and treated in a proper way. One person would be needed to become responsible for planning and monitoring the NGB conservation work of plant genetic resources (mainly co-ordination of collections, documentation etc.) in Finland.

Forest tree breeding has been based on a broad genetic basis since 1960's. The total number of phenotypically selected plus trees is over 12 000, out of which 7 268 are used in seed orchards.

The number of clones in each seed orchard is on an average over 100, and consequently the seed produced has large genetic variation. Taking into account the demand for diversity and adaptability to expected climate change broad variation is maintained both in breeding populations and in reforestation materials. The network of gene reserve forests provides an insurance.

We are mostly satisfied with the integration of gene conservation and breeding. A trouble with marketing has arisen from the strong protest against artificial regeneration. It takes time to correct the wrong image that genetically improved material contains no variation.

The greatest value is in the potential to evolve and adapt to the unpredictable changes in the future. Not only the environment will change, but also the requirements of forest owners and wood processing industry are likely to change. In forestry many issues are long lasting. Short term profitability requirements and cut-downs because of contemporary economic recession may lead to irreversible losses in the future.



CHAPTER 5

National Goals, Policies, Programmes and Legislation

Finland does not have any special 'National Programme' for plant genetic resources activities. There are, however, some programmes and legislation which guides the conservation and use of genetic resources in our country. Such laws and programmes are for instance:

- Nature Conservation Act
- National Biodiversity Research Programme
- National Action Plan for Biodiversity
- Environmental Programme for Forestry in Finland (1994)
- Agro-Environmental Programme in Finland (1994)
- Plant Protection Law
- Law on Regenerating Plant Materials

The preservation of plant genetic resources have been mainly organized in co-operation with all Nordic countries: Denmark, Finland, Iceland, Norway and Sweden. Within the NGB, there are six permanent working groups for:

- 1) cereals,
- 2) fruits and berries,
- 3) potatoes,
- 4) forage crops,
- 5) vegetables, and
- 6) root crops, oil plants and pulses.

Each group is responsible for planning and monitoring conservation work for both domesticated plants and their wild relatives. The groups also initiate Nordic projects to promote the utilization of PGR. When required, the board of NGB establishes temporary working groups for specific purposes. In 1993 a temporary working group for wild plants not covered by the permanent groups was established. The group will suggest to the board a list of species that should be



included to the mandate of NGB and examine the need for specific preservation measures. The group will also be NGB's co-ordinating body for the follow-up of the Convention on Biological Diversity.

At the moment the only legislation which protects the plant genetic resources in Finland is composed of laws on protecting plant species or plant communities. We have also laws concerning the nature reserves and the kinds of activities which are allowed on these areas.

For forest trees gene conservation is a part of the national tree breeding programme which is government-funded. Commercial firms (forest industry) are involved, but not individual farmers. So far, we have not been criticized by NGOs. The goal of the programme is to maintain genetic diversity as a component of biodiversity, and to ensure the adaptability of forest trees. The closest linkage to international programmes is through EUFORGEN/IPGRI.

Gene conservation activities of forest trees have not been organized as a specific project. The Department of Forest Policy in the Ministry of Agriculture and Forestry is the topmost co-ordinator. In the Finnish Forest Research Institute the main species and minor species are under separate projects. The annual budget is approved partly by the ministry and partly by FFRI. Gene conservation does not have a budget of its own. Neither is there a formal commitment to long term breeding programme, even though it is fairly well followed.

5.1 TRAINING

There is no full-time personnel for gene conservation activities in Finland. However, the scientific level of plant (field and horticultural crops, forest trees) breeders and other scientists working with plant genetic resources is high in Finland, and we are able to give education in the field of botany at universities and in the botanical gardens.

Within the framework of the Nordic Gene Bank special training in plant genetic resources is arranged in Denmark, and this education is directed not only to the students from the Nordic Countries, but also to people from developing countries.

There is a good competence in forest genetics and tree breeding in Finland. This back-ground covers the various aspects of biological and operational activities. Socioeconomic knowledge would be useful when carrying through the plans.



Short training courses for the involved persons in field organizations would be beneficial. The courses could perhaps be arranged together with people working with agricultural and horticultural plants.

At the moment the awareness of the importance of the national plant genetic resources is awaking, and in the near future more effort will be made at the development of national plant genetic programme. This work will be co-ordinated mainly by the group of Finnish specialists from various sectors of plant genetic resources. The group has been already established to prepare this country report.

5.2 NATIONAL LEGISLATION

The export and import of plant genetic resources (both *in vitro* materials and seeds) is directed by the Law on Plant Production, the Law on Plant Material, and the Forest Tree Reproductive Material Trade Act, which came in force in the beginning of 1995. These laws are consistent with the similar legislation of European Union. Generally the delays caused by the quarantine controls have not resulted in losses of plant materials. On the contrary, in most cases even more stringent quarantine controls are needed to test e.g. plant pathogens and find out proper host plants and test conditions for various plant pathogens.

Because of the isolated location and cold winters, Finland has been, till now, quite free from many plant pathogens and pests. To prevent introduction of hazardous pathogens, plant regeneration materials should be transferred in greater amounts in the form of sterile *in vitro* cultures. This could be encouraged also by the governments e.g. in a way, that imported/exported plant materials are taxed by the risk of introducing harmful pathogens or pests.

If the imported genetic material has passed the quarantine control (mainly pathogen tests), it is generally freely available for plantings or sowings. Sometimes there are, however, recommendations concerning e.g. the cultivation areas of some less winterhardy ornamental plants.

Because of the great economic importance of forests, the use of imported seeds or other regeneration materials in forest regeneration is more stringently controlled by the Forest Tree Reproductive Material Trade Act. According to this law, the import of forest reproductive materials from countries outside EU and from Sweden can be prevented if the origin of the material is not suitable for Finnish conditions, or if the quality of seedlings doesn't meet the requirements. From EU-countries the import is allowed, if the material passes the quarantine and quality controls. However, the import of reproductive materials from abroad has been negligible because of the stringent requirements of the origin of the materi-



als and because of the sufficient seedling production in Finland. In the future, it is expected that the import of reproductive material for some broad-leaved trees will increase, while the afforestation of set aside fields increases.

5.3 SEED REGULATORY FRAMEWORK

In Finland the seed trade is regulated by Seed Trade Act (233/93). According to this law, all the commercial seed (also farmer's varieties) must be certified and certified seed can be produced only from species and varieties which are approved on the Finnish National List of Cultivars held by the Plant Variety Board (Finnish National List of Cultivars is included in Annex 5).

All cultivars, which are on the register are available for sale to farmers. The scheme of the Finnish seed certification procedure is presented in Annex 6. According to seed trade act, the sowing seed of certain plant species may be marketed only as batches of sowing seed, the origin, varietal identity and technical quality (germination, purity and health) of which have been certified by an authority in Finland or in another state belonging to the European Economic Area (certified sowing seed). Sowing seed shall mean seeds, potatoes and union sets intended for sowing.

Sowing seed certified in Finland must be a variety entered on the catalogue of varieties of cultivated plants referred to in Act on the right of a plant breeders (789/92).

Sowing seed to be marketed to a final user shall be enclosed in packaging. The packaging of certified sowing seed shall be sealed under the supervision of a supervisory authority. The plant production inspection centre may in individual cases allow the delivery of unpacked sowing seed to the final user.

Only sowing seed that has been packaged on the basis of a special license may be marketed as sowing seed. The license can be granted if the necessary equipment and qualified personnel are available to the applicant and if the applicant meets also other requirements for carrying out packaging properly.

The Law on Plant Breeder's Rights (PBR) came into force in Finland on October 15, 1992, and Finland joined UPOV Convention from 1978 (International Union for the Protection of New Varieties of Plants) on April 16, 1994.

The Law on Breeder's Rights also allows the production of seeds for farmers own use (Farmer's Privilege) and for selling them for other purposes than reproduction (e.g. bread wheat, malting barley). At the moment 68 plant genera or species are covered by the Law on Breeder's rights in Finland.



The PBR legislation is controlled, and the possible changes in it are made by the Ministry of Agriculture and Forestry. Thus the effects of the PBR legislation on the genetic resources are fully understood by the Finnish authorities who are responsible for these programmes.

5.4 OTHER POLICIES

The national incentives for production and marketing of improved cereal cultivars are at the moment under consideration. Besides the EU-incentives for forage grasses, there are some plans for national incentives for these crops, as well. There is no direct provision of agricultural inputs available for farmers. However, these inputs are deductible expenses in farmer's taxation. Thus, these provisions do not influence much the farmers' choices of planting materials. On the contrary, in respond to the demands for more extensive and environmentally sound agriculture, the cultivation of varieties, which need plenty of fertilizers and chemical plant protection is decreasing.

5.5 TRADE, COMMERCIAL, AND OTHER INTERNATIONAL AGREEMENTS

Finland became a member of the European Union on January 1, 1995. Agriculture faces a new situation because of the membership, and it will have an enormous impact on the whole food sector of the country. It is probable, that these changes will have many impacts also on the plant genetic resources programmes and legislations which control these areas.

The membership will have the impact that Finland has to harmonize its seeds legislation according to the Community directives. A considerable change in its legislation has been called for. Marketing rules in Finland have been less stringent, i.e. in Finland it has been allowed to multiply seeds from basic seed in several generations. According to the EU-rules the production of only few generations is allowed. Also commercial seed, not certified seeds has been allowed. Seed production and marketing has been rather decentralized in Finland, resulting probably in situation where the cultivars stay in production for a longer time.

The approval of GATT/TRIP-agreement will also influence the plant genetic resources legislation in Finland.



CHAPTER 6

International Collaboration

6.1 UNITED NATIONS INITIATIVES

UNCED

Finland, together with the other Nordic countries signed The Convention on Biological Diversity in Rio de Janeiro, June 3-14, 1992. In the Nordic countries the follow-up of the Convention on Biological Diversity is mainly organized through the Nordic Gene Bank. In 1993 a temporary working group in NGB was established to act as the co-ordinating body for the follow-up to the Convention.

The consequences of the Convention to the Nordic co-operation in the field of plant genetic resources has been in detail examined in the publication by Nordahl Roaldsøy: 'Biodiversi tetskonvensjonens konsekvenser for samarbeid om bevaring av genressurser' (TemaNord 1994:575, in Danish). In the summary it was stated that even though the practical consequences of the Convention are still obscure, there is no reason to fear, that it might hamper the active Internordic co-operation in the field of plant genetic resources.

In Finland, up to the present, no special measures have been taken to implement Chapter 14G and Chapter 15 of the Agenda 21. However, a Finnish working group was established to take care of this field of action in the future, as well as to prepare the ICPPGR Country Report of Plant Genetic Resources in Finland.

In Finland we see the Convention on Biological Diversity as the general framework within which also the FAO Commission actions in the field of plant genetic resources should take place. For the successful action for both the Convention on Biological Diversity and the FAO Commission, we see that they should act in close co-operation in the field of conservation and use of plant genetic resources.

In the field of forest research international connections have been frequent during the last 5 years. Forestry issues have been dealt with on the Nordic level, on the European level, and on the global level. Pan European ministerial conferences (Strasbourg, Helsinki) and UNCED resulted in general statements.



The Nordic report on forest genetic resources (1992) reveals need of “subsidiarity” of participating countries. This matter is even more clear at European level in EUFORGEN.

FAO GLOBAL SYSTEM

Finland has joined the FAO’s Intergovernmental Commission on Plant Genetic Resources and consequently the Undertaking was signed in 1984.

The signing of the Undertaking has not yet had any remarkable impacts on the commitment to conserve and use plants genetic resources. However, a Finnish working group has been established to prepare the future actions in this field. Also the legislation concerning the conservation of biological diversity as a whole is being developed in order to keep it up to date to the international agreements and legislation on this area. There is, however, a need for a comprehensive national programme, which could cover the whole area of conservation of the biological diversity in Finland. The ultimate aim of the above mentioned working group is to prepare the framework for this national programme in the field of plant genetic resources.

The role of the ‘international fund’ is very important for the effective function of the Global System. The financing of the fund should be arranged on a multilateral basis, and the fund should aim to support the activities mainly in developing countries, but also in industrial countries on the basis of mutually accepted rules.

6.2 INTERNATIONAL AGRICULTURAL RESEARCH CENTRES

The CGIAR and regional research centres

Plant breeders in Finland have had some, but no regular connections to some CGIAR commodity centres. Most of the connections have been to CIMMYT, CIP, IITA, ILRI and ICARDA and the forms of activities have been seed transfers, visits and some longer working agreements.

There has also been active co-operation between the Agricultural Research Centre of Finland and Egyptian agricultural organizations. An Egypt-Finland Agricultural Research Project started in 1989, and a Finnish-Egyptian Sheep Breeding project has continued since 1981. These projects have been financed by the Finnish International Development Agency (FINNIDA), and within the framework of these projects people have been trained also in the CGIAR centres.



Finland was active in the initiation of the gene conservation of forest trees during the preparations of the Ministerial Conferences. Finland has joined the EUFORGEN programme and has close connections to the co-ordinating institution IPGRI.

6.3 REGIONAL INTERGOVERNMENTAL INITIATIVES

Finland is taking part in the activities of ECPGR, and the activities are mainly organized through the function of the Nordic Gene Bank. Finland has also decided to participate in the ECPGR Phase V programme, because we find this kind of European collaboration very important for us.

To make the function of the Nordic Gene Bank as effective and of as high a quality as possible, a closer co-operation within the various European Gene Banks might increase the effectiveness and the value of NGB.



CHAPTER 7

National Needs and Opportunities

The plant species diversity is low in Finland, if compared to subtropical or tropical regions, and many species reach their northern limit of distribution within Finland. However, plants which are adapted to grow and reproduce in these northern conditions have developed many unique genetic adaptations, which are very valuable if the plant genetic diversity of the world is considered as a whole.

Because of the great seasonal changes in temperature and in the amount of light as well as in the day length, plant species in our boreal / arctic area have developed many unique adaptation and resistance mechanisms for these changing conditions, especially for long day conditions and for various winter stresses.

The importance and uniqueness of these Nordic gene resources has been lately noticed in all the Nordic countries, and within the framework of the Nordic Gene Bank (NGB) a specific activity has already started to preserve and reasonably utilize these gene resources. In this connection all the international co-operation in the field of plant genetic resources preservation and utilization will surely benefit all the participants.



CHAPTER 8

Proposals for the Global Plan of Action

In Finland we see that the most important goal of this FAO Global Action is the preservation and sustainable use of Plant Genetic Resources in the plant breeding processes in ways, which benefit the whole mankind.

This Global Plan of action should be developed on multilateral basis and on mutually agreed terms. The financing of the action should not effect an undue burden on any party of the world.

Care should be taken not to duplicate the work needed (e.g. in the *ex situ* collections, in the necessary documentation) and the organisations already established should as much as possible be used as the focal points in this work.



ANNEX 1

Forest Genetic Resources

- i) The natural distribution of the main native forest species including the post-glacial history has been thoroughly investigated and reported. For the time being no new large scale activities are underway.
- ii) The national long term programme for forest tree breeding (1989) contains a definition of breeding zones. Breeding zones are aimed to match with ecogeographic zones. The same programme also contains needs and possibilities of *in situ* and *ex situ* conservation.
- iii) Parallel maintenance of networks of *in situ* gene reserve forests and *ex situ* breeding populations and other collections is the main idea of gene conservation. Gene reserve forests are inexpensive to establish and maintain. They are in good progress. The velocity and volume of actions to *ex situ* populations depend on contemporary resources.
- iv) Research projects on population structure and intraspecific diversity have been carried out, but there is no national programme for systematic surveys. Progeny tests and provenance trials are available, and genetic markers are used besides other characters. The forest genetic register keeps lists of national forests genetic resources. In the near future the common descriptors will be introduced into an European database (EUFORGEN).



Acknowledgements

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FLOODING ZONES IN FINLAND

J. Niemelä / 23.5.1995, time 19.00)

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