# COUNTRY REPORT ON THE STATE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

## FINLAND

# State of Plant Genetic Resources for Food and Agriculture in Finland

# Second Finnish National Report

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# ABSTRACT

The second Finnish national report includes the description of the state of plant genetic resources concerning material under both Nordic and national management. An attempt has been made to describe the trends regarding changes in the operational environment, conservation and use since 1996. The report has been compiled under the National Plant Genetic Resources Programme of Finland in cooperation with the Nordic Genetic Resource Center. The work has been steered by the National Advisory Board for Genetic Resources.

At the Finnish national level, a major improvement since 1996 was the launching of the National Plant Genetic Resources Programme in 2003. The programme covers PGR both for agriculture and horticulture and for forestry. In fact, these two sectors naturally overlap in Finland and can in the future cooperatively enhance *in situ* conservation activities of crop wild relatives. MTT AgriFood Research Finland is responsible for the coordination and conservation of vegetatively propagated crops. The National Advisory Board for Genetic Resources, appointed by the Ministry of Agriculture and Forestry, governs and monitors the national programme. The future challenge is to secure stable funding for the programme activities.

The *ex situ* conservation of plant genetic resources of seed propagated crops, including potato and documentation, was carried out by the Nordic Gene Bank (NGB) until 2007. From the beginning of 2008 the gene resource institutes in the Nordic area were reorganized and merged. The new Nordic Genetic Resource Center now comprises plants for food and agriculture, forestry and domestic animals. It is expected that this re-reorganization leads to more effective use of resources, and benefits especially the use of the genetic resources in the Nordic countries. From PGRFA point of view, further developments are expected in the overall gene bank management and documentation systems.

*In situ* and on-farm conservation crops and crop wild relatives are of great national interest. On-farm conservation of locally adapted crops increases diversity in fields and gardens. Management of landraces and crop wild relatives in the changing environment also provides evolutionary potential for the future. Activities to enhance on-farm conservation of crops have been initiated, but great challenges remain regarding the *in situ* conservation of crop wild relatives.

The ultimate goal of the conservation activities is to lay the basis for the sustainable use of plant genetic resources. The chain, conservation–documentation–evaluation & characterization–research–plant breeding, needs to be functional to achieve this. Nordic countries have made major efforts to tighten the chain in the past. However, the future challenge is to provide plant breeding and other users with valuable germplasm that is useful in changing environmental conditions.

In the international forums Finland has supported the activities of the FAO. The International Treaty on Plant Genetic Resources for Food and Agriculture is seen as a mechanism that allows the access and benefit sharing arising from the use of PGR. Furthermore, the activities of CBD promoting national biodiversity strategies have been valuable. Regional activities within Europe (European Cooperative Programme for Plant Genetic Resources ECPGR) and in the Nordic area have benefited task sharing in the conservation of PGR.

# INTRODUCTION TO FINLAND AND ITS AGRICULTURAL SECTOR

The total area of Finland is 338 145 km$^2$ of which 23 072 km$^2$ is agricultural land, 233 665 km$^2$ forests and other wooded land, 9 390 km$^2$ is built-up and related land area, 33 552 km$^2$ is water and 33 378 km$^2$ is classified as other areas.

In 2007 the number of protected areas on state-owned land was 482, comprising 1 675 677 hectares. On private land there were 5 213 protected areas, covering 196 500 hectares. In addition, in the north of the country there are 12 wilderness reserves with a total area of 1 489 000 hectares.

In 2007 the combined share of agriculture, forestry, hunting and fishing of the gross domestic product was 3.2 %. 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 2001 – 2002 the food expenditure amounted to 1 580 euros/person, and its share in the consumer expenditure was 13 %. 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 2007 the population of Finland was 5 300 484. The employed labor force was about 2 492 000. The share of the employed labor force in agriculture in the national economy was 5.8 % in 2007, thus showing a decline from the 7.8 % in 2000. This is still considerably larger than the share of agriculture in the gross domestic product. However, the compilation of statistics on the labor force and labor 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 2001 investments in agriculture totaled 874 million euros, compared to 469 million euros on 1994, when the share of agriculture in the investments was low due to economic stagnation and accession to the EU.

## 1. The Finnish Farm

Farming in Finland is possible thanks to the Gulf Stream, which makes temperatures in Finland 3–4 C higher than usual at 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 are also large differences in the effective temperature sum: 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.

FIGURE 1

**The north of Finland is well above the Arctic Circle (blue). The south of the country is at 60 N (yellow circle)**

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 plant cultivars. Breeding of plant cultivars that are adapted for the Finnish conditions is needed.

Climatic conditions are a decisive factor in the location of crop production. Cultivation of wheat and oilseed plants is restricted to southern Finland, whereas barley, oats, grass and potato can be cultivated in most parts of the country. In many parts of Finland, livestock farming, especially dairy farming, is the only profitable production sector.

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 2007 the average yields of field crops (kg/ha) were (total yield in parenthesis, 1 000 tons): wheat 3 930 (797), rye 2 740 (87), oats 3 520 (1 222), barley 3 720 (1 984), turnip rape 1 210 (95), rape 1 670 (18), pea 2 450 (11), potato 25 730 (722) and sugar beet 42 180 (673).

Finnish agriculture is based on family farms. In 2007 private persons owned 88.4 % of farms, heirs and family companies 10.4 %, corporations, foundations and cooperatives 0.8 % and the state, municipalities and parishes 0.1 %. On average, a working farmer was 50 years of age.

In 2007 the total area under cultivation was 2.28 million ha. About 66 800 farms applied for the basic agricultural support payments (in 1995 about 95 600 farms). In 2007 the average farm size was about 33.5 ha.

Every year a good number of small farms give up production, but in other respects structural development is slow. In practice, it is possible to increase the size of a farm by leasing arable land, which has become increasingly common. In 2007 about 34 % of the arable land area was leased.

Forest is an integral part of a Finnish farm. An average farm has 48 ha of forest.

However, the regional distribution varies. In general, arable land area is larger and forest area is correspondingly smaller in the south than in the north.

About 21 % of working farms practice dairy husbandry as their main production sector. However, pork, beef and egg production are also typical on Finnish farms. Specialization in agriculture accelerated especially in the 1960s and 1970s. The number of milk suppliers has decreased steadily and in 2007 there were only 14 000 farms that supplied milk (in 1991 about 40 000 farms).

62 % of working farms specialize solely in crop production.

[Source:MTK(2008)]

## 2. Other Rural Industries

Besides agriculture and forestry, farmers engage in many other industries, e.g. horticulture, fishing, fur farming, farm holidays, etc.

An important secondary occupation practiced alongside with agriculture is fur farming, which is also practiced on its own. In 2006 the value of fur sales totaled 200 million euros. There are about 1 500 fur farms in Finland, most of them in Ostrobothnia.

In 2006 there were a total of 589 reindeer farms in Finland. During the 2000s there have been about 200 000 animals at the round-ups, and annual meat production has been around 2 million kg.

Wild berries (cloudberry, blueberry and lingonberry) are an important source of income for many people, especially in northern Finland. In 2007 this income amounted to about 200 million euros.

In addition, there is the value of the berries used in households. The income from picking mushrooms was about 100 million euros on 2007. There are also a few farms which specialize in mushroom production. The value of picking herbs and other natural products is about 20 million euros annually.

## 3. Seed Supply System of Agricultural Plants

In Finland all seed which is marketed should be officially certified. Certified seed can be produced from species and cultivars which are included in the Finnish National List of Cultivars kept by the Plant Variety Board. In 2002, however, only about 26 % of the total seed volume used in Finland was officially certified since many farmers also use homegrown seeds.

As the northernmost field cropping country, Finland considers the persistence and origin (progeny) of plant material very important. The cultivation of field crops is based on the utilization of Finnish cultivars of the main crop species, and national plant breeding is considered very important.

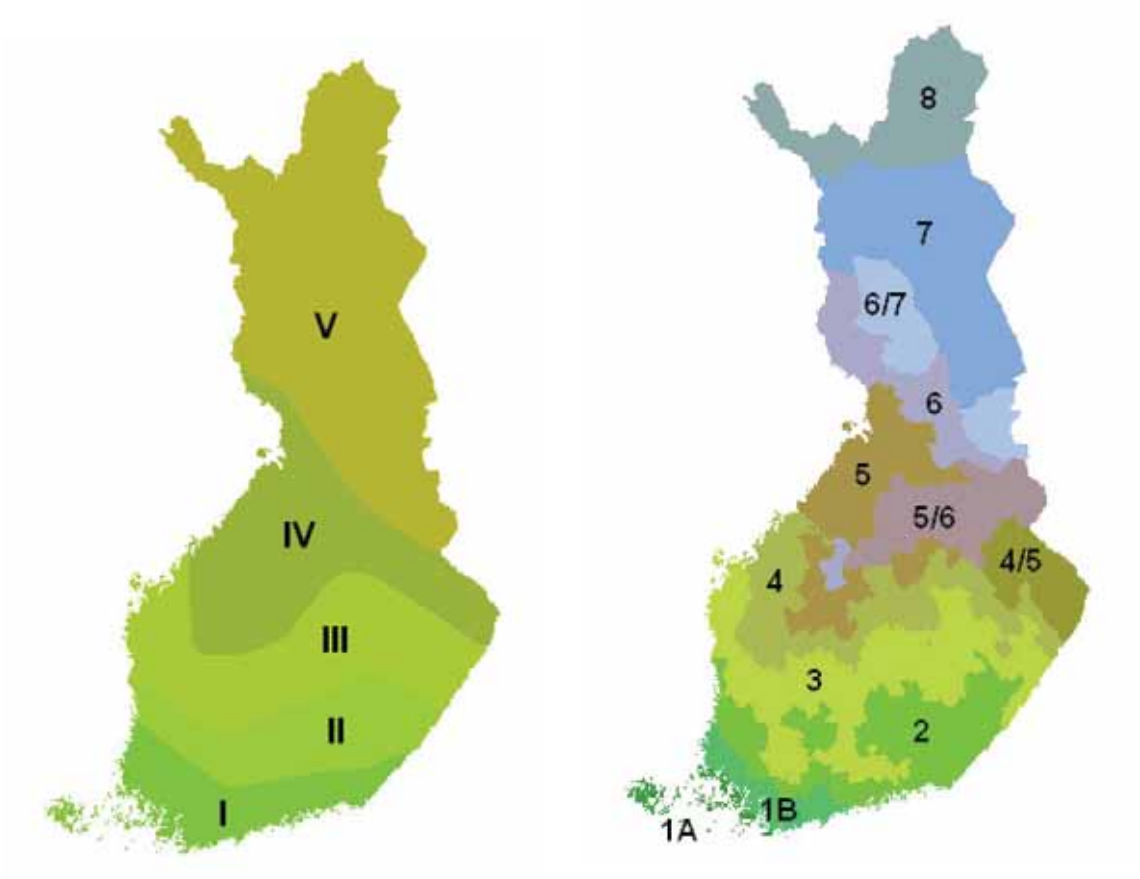
Winter-hardy material is needed both for vegetatively propagated plants (horticulture and forest) and for grasslands. On the Finnish National List of Cultivars there are several special cultivars which are adapted to the northernmost conditions only, and this kind of cultivars are not available from other countries. The legislation concerning seeds is described in section 5.3.

In Finland the commercial seeds of cereals as well as most of the seeds of fodder plants (grasses) are produced on contract farms specialized in seed production.

Typically, the short summer season and cool climate in Finland are unfavorable to aphids which spread many virus diseases of plants. This is why the "high grade region" of seed potato production is located in north-western Finland. Virus-free seedlings of many ornamental plant species and berries are produced at the MTT Laukaa Research and Elite Plant Unit.

FIGURE 2

**For agricultural crops the country is divided into five zones I–V (a) that are used as a reference in crop production and in cultivar marketing and production. In horticulture the zone pattern for perennials and ligneous plants is more complex. Figure b shows a horticultural zone pattern based on observations in the communes, worked out by the Finnish Meteorological Institute**




(a) agriculture

(b) horticulture

CHAPTER 1

# THE STATE OF DIVERSITY

Table1.1 presents the areas under annual and biennial agricultural crops in Finland in 1998 – 2007. For forage plants the statistics in Table1.1 cover only certified seed production. Statistics for sugar beet are not complete.

Barley, oats, wheat, rye, turnip rape, potato and sugar beet were all cultivated on the average of more than 10 000 hectares/year during the period. The averages for other crops were well below 10 000 hectares/year. Based on this, these seven crops can be regarded as the major crops in Finland even if, when combined, the forage crops in perennial grasslands may also be classified as such.

Forage crops and cereals together cover 80 – 90 % of the field crop area. Barley and oats are the most important cereals. The main root crops cultivated in Finland are potato and carrot. Other root crops, red beet, swede, turnip, turnip-rooted celery and parsnip, are each cultivated on less than 500 ha (in 2003). Cabbages were cultivated on some 1 300 ha and onions on 1 035 ha in 2003. The most important pulses in Finland are pea (2 355 ha) and beans (11 ha). Cucumbers and spices are also significant horticultural crops. The most important crops in greenhouse production are tomato, cucumber and sweet pepper.

A new crop used for bioenergy production is reed canary grass (Phalaris arundinacea), with a cultivation area that in Finland approached 20 000 ha in 2007.

TABLE 1.1

**Cultivation areas of annual and biennial agricultural crops 1998 – 2007**

- **AVG 10 000 OR MORE HA/YEAR**

| GRP | Crop | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | AVG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CER | *Hordeum* | 5 782 | 5 809 | 5 588 | 5 469 | 5 222 | 5 303 | 5 641 | 5 942 | 5 641 | 5 499 | 5 589 |
| CER | *Avena* | 3 866 | 4 039 | 3 995 | 4 224 | 4 507 | 4 252 | 3 715 | 3 457 | 3 534 | 3 613 | 3 920 |
| CER | *Triticum* | 1 373 | 1 177 | 1 495 | 1 445 | 1 743 | 1 915 | 2 353 | 2 149 | 1 923 | 2 038 | 1 761 |
| OIL | *Brassica* | 645 | 618 | 518 | 724 | 666 | 741 | 825 | 769 | 1 079 | 901 | 749 |
| TUB | *Solanum* | 328 | 324 | 321 | 299 | 297 | 286 | 292 | 288 | 280 | 275 | 299 |
| SUG | *Beta* | | | | 310 | 310 | 290 | 310 | | | | 300 |
| CER | *Secale* | 361 | 123 | 446 | 290 | 305 | 307 | 310 | 143 | 219 | 320 | 282 |
| CER | Cereal Mix | | | 115 | 114 | 119 | 122 | 137 | 139 | 153 | 157 | 106 |

- **AVG LESS THAN 10 000 HA/YEAR**

| GRP | Crop | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | AVG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRO | *Pisum* | 49 | 48 | 52 | 54 | 51 | 41 | 40 | 38 | 42 | 45 | 46 |
| IND | *Phalaris* | | | | | | | | 89 | 172 | 189 | 45 |
| FOR | *Phleum* | | | | | | 73 | 57 | 52 | 69 | 70 | 32 |
| FOR | Forage-Cereal Mix | | | 23 | 34 | 32 | 30 | 38 | 38 | 41 | 53 | 29 |
| IND | *Linum* | 28 | 31 | 25 | 20 | 16 | 21 | 21 | 18 | 19 | 20 | 22 |
| PRO | Protein-Cereal Mix | | | | 38 | 32 | 30 | 18 | 14 | 19 | 20 | 17 |
| FOR | *Festuca* | | | | | | 19 | 18 | 18 | 17 | 17 | 9 |
| CER | *xTriticale* | 23 | 7 | 23 | 6 | 4 | 5 | 3 | 1 | 1 | 1 | 7 |
| CER | *Fagopyrum* | 5 | 5 | 5 | 4 | 5 | 5 | 7 | 9 | 6 | 5 | 6 |
| FOR | *Trifolium* | | | | | | 6 | 6 | 6 | 8 | 9 | 3 |

| GRP | Crop | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | AVG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRO | *Vicia faba* | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 3 | 5 | 5 | 3 |
| IND | *Cannabis* | 13 | 1 | 1 | 1 | <1 | <1 | <1 | 1 | 2 | 3 | 2 |
| OIL | *Helianthus* | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 |
| CER | *Zea* | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| FOR | *Lolium* | | | | | | 1 | 1 | 1 | 1 | 1 | <1 |
| PRO | Protein-Oil Mix | | | | <1 | | | | | | <1 | <1 |
| FOR | *Dactylis* | | | | | | <1 | | | | | <1 |
| PRO | *Glycine* | <1 | | | | <1 | | | | | | <1 |

Source: TIKE t 050708, 04.08.2008

For forage plants only seed production is included, not perennial grasslands. Multiuse crops in industrial (IND) group: Linum (oil, fiber), Cannabis (oil, fiber, energy) and Phalaris (forage, energy). Numbers are in hundreds of hectares

Fruits and berries are important both in commercial production and home gardens.
The areas for commercial production are:

| | |
|---|---|
| Strawberry | 4 000 ha |
| Currants | 1 800 ha |
| Red raspberry | 280 ha |
| Apple | 450 ha |

## 1.1 Importance Of All Major Crops

The field crop diversity varies between different growing zones (mainly determined by the temperature sum). All major crops can be grown in southern Finland, while in the more northern zones IV and V only early yielding cereals, forages and potato can be grown (Table1.2). It should be noted that in northern Finland risks related to the short growing season are greater that in the southern part of the country.

TABLE 1.2
**Cultivation zones for the smajor crops**

| Crop | Zone i | Zone ii | Zone iii | Zone iv | Zone v |
|---|---|---|---|---|---|
| Winter wheat | x | x | | | |
| Spring wheat | x | x | x | | |
| Winter rye | x | x | x | | |
| Spring rye | x | x | | | |
| Barley | x | x | x | x | |
| Oat | x | x | x | x | |
| *Pisum* | x | x | x | | |
| *Brassica rapa* | x | x | x | | |
| *Brassica napus* | x | x | | | |
| Potato | x | x | x | x | x |
| Forage grasses | x | x | x | x | x |

The diversity of crops can be measured by the number of cultivars used in cultivation.

In Table1.3 the number of cultivars is presented as reported by farmers to Tike, the Information Centre of the Ministry of Agriculture and Forestry of Finland. For barley, the most important cereal, the number of cultivars used was growing steadily between 1998 and 2007. About half of the cultivars used are domestic, but foreign cultivars have also been tested quite frequently for introduction to Finnish markets. The same trend of growing numbers of cultivars applies to the other cereals, as well. For oilseed crops (*Brassicas*) the number of cultivars has stayed about the same.

TABLE 1.3
**Number of cultivars of the major crops (except sugar beet) in cultivation in 1998 – 2007**

| | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|
| Barley | 24 | 27 | 33 | 40 | 43 | 49 | 59 | 67 | 70 | 77 |
| Oats | 16 | 15 | 19 | 20 | 22 | 24 | 31 | 33 | 33 | 37 |
| Wheat | 23 | 23 | 25 | 31 | 33 | 35 | 46 | 48 | 49 | 51 |
| *Brassica rapa* | 4 | 5 | 8 | 8 | 7 | 9 | 9 | 12 | 13 | 13 |
| Potato | 38 | 38 | 41 | 48 | 51 | 53 | 52 | 58 | 59 | 64 |
| Rye | 10 | 10 | 11 | 13 | 13 | 15 | 18 | 17 | 19 | 20 |

## 1.2 Importance of Minor Crops

TABLE 1.4
**Number of cultivars of minor crops in cultivation in 1998 – 2007**

| | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|
| *Pisum sativum* | 8 | 8 | 10 | 11 | 11 | 12 | 12 | 13 | 16 | 16 |
| *Phalaris aruninacea* | | | | | | | | 3 | 4 | 4 |
| *Phleum pratense* | | | | | | 14 | 14 | 15 | 17 | 17 |
| *Brassica napus* | 4 | 4 | 3 | 2 | 3 | 4 | 4 | 4 | 6 | 8 |
| *Linum usitatissimum* | 14 | 12 | 14 | 9 | 9 | 9 | 8 | 10 | 8 | 9 |
| *Festuca pratensis* | | | | | | 8 | 7 | 7 | 7 | 6 |
| *x Triticale* | 2 | 2 | 4 | 6 | 6 | 6 | 6 | 5 | 4 | 4 |
| *Fagopyrum esculentum* | 1 | 1 | 1 | 1 | | | | | 1 | 1 |
| *Triticum spelta* | | | | | | | 9 | 7 | 6 | 6 |
| *Trifolium pratense* | | | | | | 5 | 6 | 6 | 6 | 7 |
| *Vicia faba* | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 6 |
| *Cannabis sativa* | 7 | 4 | 3 | 7 | 7 | 4 | 4 | 2 | 4 | 8 |
| *Helianthus annuus* | 7 | 5 | 4 | 64 | 5 | 5 | 5 | 4 | 7 | |
| *Festuca arundinacea* | | | | | | 1 | 1 | 1 | 1 | 1 |
| *Lolium perenne* | | | | | | 2 | 2 | 2 | 2 | 2 |
| *Trifolium hybridum* | | | | | | 1 | 1 | 1 | 1 | 1 |
| *Trifolium repens* | | | | | | 2 | 2 | 2 | 2 | 1 |
| *Dactylis glomerosa* | | | | | | 1 | | | | |
| *Lolium multiflorum* | | | | | | 1 | 1 | 1 | 2 | 1 |
| *Westerwoldicum* Group | | | | | | | | | | |

Forages cover some 700 000 ha of arable land. Taken individually, each forage crop (species) can be considered as a minor crop based on their annually sown area, but collectively the forages constitute a major crop group. The number of cultivars for forage grasses and clovers has stayed about the same, although the number of timothy cultivars has increased slightly. Timothy is the most important forage grass in Finland. Table 1.4 summarizes the number of cultivars for some of the minor agricultural crops used in Finland.

There may actually be more cultivars of some other minor crops in cultivation, like *Festuca rubra, Zea mays, Triticum durum*, but only cultivars eligible for support have been counted individually in the statistics.

One recent addition to the cultivated flora of Finland is the species *Camelina sativa*.

This new oilseed crop has been tested for a few years at least in organic cultivation. The total cultivated area of *Camelina sativa* was 5 300 hectares in 2006 and 1 900 hectares in 2007. The average yields were 1 280 kg/ha and 930 kg/ha, respectively.

The genus *Camelina* is a very interesting case of a crop wild relative with several taxa that survived in times preceding modern threshing and cleansing methods as a mimicry weed in other crops such as flax, rye and wheat.

Horticultural crops can be considered as minor crops in Finland if their importance is measures by cultivation areas. However, fresh vegetables, fruits and berries have a share of about 5 % of the total agricultural income in Finland. At the moment no statistics on cultivars for horticulture are available for Finland.

## 1.3 Wild Plants Harvested

Many wild taxa, especially berries, are commonly collected for human consumption, primarily in the *genera Vaccinium* and *Rubus*. The most important species include lingonberry (*Vaccinium vitis-idaea*), blueberry (*V. myrtillus*), cranberry (*V. oxycoccus*), raspberry (*Rubus idaeus*), cloudberry (*R. chamaemorus*), arctic bramble (*R. arcticus*), wild strawberry (*Fragaria vesca*) and sea-buckthorn (*Hippophae rhamnoides*). In addition to private households and street markets, most species are also important in the food industry.

Many wild berries are also important export products, as are premium mushrooms species like *Boletus edulis*. A new addition among exported wild plants in recent years is the genus *Drosera*, which has been collected extensively and exported to Central Europe for use in the medicinal industry.

Wild mushrooms allowed on the market are: *Boletus edulis, B. pinophilus and B. reticulatus, Suillus variegatus, Leccinum versipelle,* L. *aurantiacum* and L. *vulpinum, Suillus luteus, Lactarius trivialis* and L. *utilis, Lactarius rufus, Lactarius torminosus, Lactarius deliciosus and* L. *deterrimus, Russula paludosa, Russula decolorans, Russula claroflava, Russula vinosa, Hygrophorus camarophyllus, Rozites caperatus, Armillaria melleagroup, Cantharellus cibarius, Cantharellus tubaeformis and Cantharellus lutescens, Craterellus cornucopioides, Albatrellus ovinus, Hydnum* rep and um and *H. rufescens, Gyromitra esculenta, Morchella* spp. and *Tricholoma matsutake. Boletus edulis, Cantharellus cibarius, Lactarius trivialis* and *Lactarius utilis* and *Gyromitra esculentaare* the most important wild mushroom species in the food industry.

### Wild plants and domestic animals

The Finnish farm system, like all farming in industrialized countries, has undergone fundamental changes during the last century. Old maps of villages from the 17th century onwards, and even photographs from the late 19th century show a structure of land use where the fields, farms and the roads between them were fenced to keep the grazing livestock away. In those times cattle were confined to forests and natural grasslands. In coastal and inland lake regions sheep, goats, heifers and young horses even spent the whole summer season on islands in the archipelago or lakes.

This situation changed completely when agriculture and forestry became affected by industrialization at the end of the 19th and beginning of the 20th century. Yields increased as a result of new machinery, inorganic fertilizers and plant breeding. Field crop production and forestry became more important for the farms as means of income and the cultivation areas increased. As a result, it was the grazing areas that became restricted and fenced, and the importance and number of wild forage plants declined. Since then the situation has gone even further, even to extremes – now dairy cows may even spend their entire lives inside farm buildings, being fed on silage and other purchased fodder produced solely from cultivation of bred cultivars.

But there is one important exception to this change: reindeer herding in the north. Agricultural zone V (Fig.2 (a), page 8) actually defines the Finnish reindeer herding area as well. In this area reindeer husbandry is still practiced and managed, mainly by the Sami people, according to the traditional free-grazing model and nomadic moving between winter and summer grazing areas.

Many matters regarding reindeer herding are not dealt with by the Nordic governments and parliaments directly but by the Sami Parliaments (Sámediggi). There is no single, unified Sami Parliament, but Finland, Norway and Sweden have set up their own separate legislation for Sami people, even though the three Sami Parliaments often work together on cross-border issues.

In the three aforementioned countries there are altogether around 800 000 reindeer (domesticated *Rangifer tarandus tarandus*). The herds depend on wild plants and lichens, and during winter grazing almost entirely on lichens. Warenberg (1997) describe 60 wild plants, lichens and fungi that are important for the reindeer herds during the different seasons, as well as their habitats.

## 1.4 Cultivars and Landraces

In Finland agriculture and horticulture are today mainly based on the use of bred cultivars. However, for reasons such as independence from commercial seed, local adaptation,cultural or culinary values – landraces and local strains of cereals, forages, fruits andberries have been cultivated to some extent. There are no statistics on landrace cultivation from the period 1996 – 2006 available. However, for cereals a so-called "seed-call" was carried out in 2006. Table 1.4 presents the number of farmers growing landraces or oldcultivars on their farm (Heinonen & Veteläinen, 2007). It can be concluded that of themain cereals only rye landraces are still cultivated to a certain extent, probably due to theimportance of traditional rye bred in the Finnish diet.

TABLE 1.4
**Number of farmers growing landraces or oldcultivars on their farm**

| | Winter rye | Spring wheat | Oats | Barley 4/6 rowed | Barley 2-rowed | Winter wheat | Spring wheat | Tot | No answer |
|---|---|---|---|---|---|---|---|---|---|
| Landrace | 13 | 1 | 3[a] | – | 1 | 1 | 1 | 20 | 1 |
| Old cultivar | 2 | – | 4 | 2 | 2 | 1 | – | 11 | |

[a]Only one of 3 oat landraces are still in active cultivation

The AgriFood Research Finland has a trademark FinE, Finnish Elite, that distinguishes plant material which meets certain quality specifications. A few plants have been selected based on long-standing experience. Some of the FinE plants, which have proved to be valuable in cultivation, originate from the old local varieties. Currently, one local strain of plum (*Prunus domestica*) and three of sour cherry (*Prunus cerasus*) are sold under the FinE trademark. In addition, two local strains of sour cherry and five of plum are in the elite plant production. There are also local nurseries that may have local strains of fruits and berries in their assortments.

## 1.5 Factors of Diversity

Looking back to 1996 and Finland's first Country Report on Genetic Resources for Food and Agriculture to the Commission, there have been two major political and economic changes which have affected the state of plant genetic resources in Finland.

Firstly, Finland became a member of the European Union, whose agricultural policy reforms have shaped the structure of agricultural production. However, there are no statistics available that would clearly demonstrate the effects of political changes on the state of plant genetic diversity in Finland. Nevertheless, some assumptions can be made. For example, the EU's crop-specific seed directives have now been implemented in Finland (see chapter 5.3). Naturally these have consequences on the types of material which receive subsidies and can be marketed.

Secondly, both Finnish agriculture and horticulture and the related research have been more market-driven since 1996. Both within plant production and in research most of the investments are made in the major crops. Consequently, minor crops are becoming even more marginalized, if the society does not apply any means to support more diversified plant production. Non-profit-oriented plant breeding of many horticultural crops has disappeared or is being terminated in Finland. Still, plant breeding of some nationally important crops, such as rye and potato, is supported by the National Emergency Supply Agency.

All environmental changes affect the plant genetic resources found *in situ*. In the northern conditions of Finland, the climate change is predicted to have major effects on both the temperature and precipitation. One scenario hypothesizes that more southerly species and populations will replace the vulnerable northern populations due to the increase in the average temperature, which based on estimates of future climatic change in Finland is predicted to be 4 – 6 C higher by year 2080. We believe that changes in biodiversity and its utilization will be significant and extensive. For example, mosses and twigs may replace lichens grazed by the reindeer. Wild berry production may be threatened by flowering earlier when there is still a risk of frost. Therefore, it is essential for Finland that the conservation of agrobiodiversity combines *ex situ* and *in situ* conservation in an effective manner. This will ensure that our plant production can be developed in the future in changing environmental conditions.

CHAPTER 2

# THE STATE OF *IN SITU* MANAGEMENT

## 2.1 Inventories and Surveys

### 2.1.1 Crop Wild Relatives in Finnish Flora

TABLE 2.1
**Estimated CWR percentages in Finnish vascular flora and in classes of threatened plants**

| | Number | Percentage of vascular flora | Percentage of CWR |
|---|---|---|---|
| **The whole vascular flora** | ≈ 3 200 | 100 | – |
| **CWR TAXA** | 1 905 | 60 | 100 |
| CWR with no known use | 1 177 | 37 | 62 |
| CWR with some known use | 728 | 23 | 38 |
| **IUNC category of CWR** | | | |
| Near threatened (NT) | 70 | 2.2 | 3.7 |
| Vulnerable (VU) | 69 | 2.2 | 3.6 |
| Endangered (EN) | 37 | 1.2 | 1.9 |
| Critically endangered (CR) | 28 | 0.9 | 1.5 |
| Regionally extinct (RE) | 5 | 0.2 | 0.3 |

Source: Korpelainen *et al.* (2007)

Crop wild relatives in Finnish flora were compiled in respect to their conservation situation (Takaluoma, 2005). The survey was carried out within the framework of the EC-funded PGR Forum project without a formal link to the National Plant Genetic Resources Programme of Finland or to the National Action Programme on Biological Diversity.

However, the valuable compilation work was conducted using (partly) the existing lists of wild vascular plants (Hämet-Ahti *et al.*,1998) and crop plants (Räty & Alanko,2004) as the main sources. Table2.1 summarizes the results and shows that an estimated 60 % of the wild vascular flora of Finland can be classified as crop wild relatives, of which more than one third already have some known use.

Information on the conservation status, habitats and risk factors of the Finnish crop wild relatives is available in the publications of the Finnish Environment Institute (Rassi et al., 2001; Internet publications, 2004-2005). It was discovered that 11.0 % of the CWR taxa (6.5 % of the whole vascular flora) belonged to some IUCN Category of Threat (near threatened, vulnerable, endangered, critically endangered or regionally extinct). The knowledge of the taxonomic diversity and the degree of rarity among Finnish CWRs is quite good. However, what is lacking among the majority of any kind of wild plants is detailed information on their demography, and even more so, on the genetics of their populations (Korpelainen *et al.*, 2007).

### 2.1.2 Inventories of Rural Landscapes and Farmland Ecosystems

Traditional rural biotopes are habitat types like various semi-natural grasslands, wooded pastures and grazed forests, created by traditional practices of animal husbandry. These habitats have great historical, aesthetic and biological value. Lately the area of grasslands and pastures has declined drastically all over Europe. In Finland the area of traditional rural biotopes has gone down to less than 1 % of the area covered by these biotopes one century ago. This is due to the great changes in Finnish agriculture particularly during the 20th century.

The nationwide inventory of the traditional rural biotopes was started by the environmental administration in 1992. The goal was to find out the status of these biotopes and to define their current management needs and goals. The results of the project were published in altogether 16 regional reports in 1996 – 2001. Åland was not included in the inventory.

The results of the project are alarming. Less than 19 000 ha of valuable areas were found, and the total area of traditional rural biotopes is thus estimated to be only about 20 000 ha. Of the 3 694 valuable areas found in the inventories only just over half were still managed, mostly grazed by cattle. Only part of managed areas have retained their original characteristics of traditional use. The estimated area of overgrown traditional rural biotopes with potential for restoration at reasonable cost is 40 000 ha.

Both the highest number and the largest area of traditional rural biotopes were found in the southwest region of Finland. The next largest total areas were in North Ostrobothnia and Lapland. Particularly high numbers of these sites were also found in Uusimaa and Satakunta regions. The smallest numbers of areas were found in the southeast regions of the country. Most of the traditional rural biotope types are considered threatened in Finland. The status of dry meadows, wooded meadows, dry heaths and mowed meadows is particularly critical and the percentage of these types combined is less than 3 % of the total. Almost one third of the area of valuable traditional rural biotopes were grazed forests. Mesic grasslands, coastal meadows, wooded pastures and fen meadows each cover about 10 % of the total area.

[Source:Vainio *et al.*(2001)]

## 2.2 Conservation of Wild PGRFA

### Crop Wild Relatives

Crop wild relatives (PGR for food and agriculture) are not as such covered by any *in situ* conservation programme in Finland. However, at present about 9% of the total area of the country is protected under the Nature Conservation Act (page 36) or the Act on the Protection of Wilderness Reserves (Finnish Environment Institute, Internet publications, 2004 – 2005). Most of these protected areas also belong to the Natura 2000 network. The Finnish Government has approved seven specific nature conservation programmes covering the following areas: national parks (Appendix A) and strict nature reserves (Appendix A), mires, bird wetlands, eskers, herb-rich woodland, shores and old-growth forests. Altogether 137 taxa of vascular plants are included among the organisms protected under the Nature Conservation Act. Despite quite prominent conservation actions targeted to the Finnish flora, especially plants dependent on cultural landscapes are rather poorly considered in the present programmes (Korpelainen *et al.*, 2007).

According to Korpelainen *et al.*(2007), the main points to be considered in the conservation of crop wild relatives in Finland are, firstly, the selection of target taxa (i.e., prioritization) and, secondly, the understanding of their demography, ecology and population genetics, including the estimation of genetic diversity by means of available molecular marker analyses.

Plant taxa may be prioritized for conservation according to different criteria, e.g. socio-economic use, current conservation status, eco-geographic distribution, threat of genetic erosion, and biological and cultural importance (Maxted *et al.*,1997). In the case of the Finnish CWRs, a prioritization is suggested which combines the conservation status (threatened, vulnerable, endangered or critically endangered) and the socio-economic importance (i.e. use for food, fodder or medicinal purposes). Based on such criteria, the family *Rosaceae* and its *genera Fragaria,Rubus, Malusand Sorbus*, with threatened but potentially important crop wild relatives for berry or fruit production, and the genus *Rosa*, with a high exploitation potential among ornamental plants, emerge as CWRs which can be considered especially important genera for *in situ* conservation of crop wild relatives in Finland.

Further evaluation of other important Finnish CWRs is needed. For example, very rare native plants that are also CWRs, e.g. *Elymus farctus, E. alascanus* and *E. fibrosus*, already enjoy some protection under the wild plant protection programmes. However, their utilization, and even research, would require method development for *ex situ* cultivation, which is countered by their rareness and narrow ecological niche. In addition, even seed collection from protected plants requires special permission, and benefit sharing schemes and rights to such germplasm are completely open issues.

On the other hand, alien CWRs, garden escapees and other introductions do not enjoy protection under wild plants programmes, since they are neither native nor archeophytes. The germplasm of such alien CWR populations may, however, be important PGRFA because they are already adapted to the climate.

## 2.3 Ecosystem Management

A summary of protected areas and wilderness reserves in Finland is presented in Table 2.2. In addition to the types of areas listed in the table, the Act on the Protection of Rapids protects a total of 53 individual rapids, river portions or catchment areas against power station construction. Corresponding acts have been passed on the protection of the Ounasjoki and Kyrönjoki rivers.

TABLE 2.2
**Protected areas and wilderness reserves in Finland**

| AREA TYPE | NUMBER | AREA,HA | WATER, % |
|---|---|---|---|
| National parks | 35 | 885 253 | 9.7 |
| Strict nature reserves | 19 | 153 584 | 1.7 |
| Protected peatland areas | 171 | 460 362 | 2.5 |
| Herb-rich forest areas | 52 | 1 236 | 1.0 |
| Old-growth forests | 91 | 93 891 | 0.2 |
| Seal protection areas | 7 | 18 817 | 100.0 |
| Protected areas established by Metsähallitus | 24 | 807 | 5.3 |
| Nature conservation areas on private land | 5 213 | 196 500 | 56.0 |
| Protected areas in Aland | 44 | 12 600 | 84.8 |
| Other protected areas | 39 | 49 127 | 14.4 |
| **TOTAL PROTECTED AREAS** | **5 695** | **1 872 177** | **13.2** |
| Wilderness reserves | 12 | 1 489 000 | 7.4 |

### Protected Areas

National parks and strict nature reserves are protected areas established on state-owned land under the Nature Conservation Act (page 36).

In addition, other protected areas based on the Nature Conservation Act have been established on both state-owned and private land. Some of the state-owned, other protection areas have been classified as "protected herb-rich forests" and "protected old-growth forests", and some are called "special protection areas".

Privately owned protection areas are mainly established on the owner's request, or with the owner's consent. The Nature Conservation Act now also allows the Regional Environment Centres to decide on the establishment of protected areas on private land without special application. The rules for land use are laid out in cooperation between the owner and the Regional Environment Centre.

There are many protected areas on private land, but they are usually small in size. Common types are eutrophic bogs, herb-rich forests, bird areas, beaches, eskers and traditional rural landscapes. They also tend to concentrate to the southern part of the country where there is less state-owned land, but where they complement well the state-owned protected area network.

### 2.3.1 Natural Ecosystems

In addition to national parks and strict nature parks, Finland also has conservation programmes for ecological vegetation types like mires, bird wetlands, eskers, herb-rich woodland, shores and old-growth forests. Their number and areas are presented in Table 2.2.

### 2.3.2 Rural Landscapes and Farmland Ecosystems

Farmland biodiversity has largely been maintained and managed through the agri-environmental support scheme within the Horizontal Rural Development Programme. The EU Commission adopted a new Rural Development Programme for the programming period 2007 – 2013 in August 2007. The biodiversity support measures are implemented mainly through the axis 2 measures, which include the environmental payments and non-productive investments.

## 2.4 On-Farm Management

Landraces of crop plants adapted to northern conditions are a globally unique genetic resource. In Finland they represent the national cultural heritage, and are a part of our agricultural history. Following the obligations of CBD and FAO Global Plan of Action, a "landrace project" financed by the Government and implemented by the Finnish Plant Production Inspection Centre was initiated in 1997. The aim was to draw up a proposal on how varietal research, registration and on-farm maintenance of cereal, forage grass and legume landraces and old commercial cultivars could be organized in Finland (Onnela, 1999).

As a result of this project and a survey on the extent of cultivation of crop landraces and old cultivars in Finland, a new Decree on seed production, approval and marketing was adopted. This Decree, which applied to cereals and forage landraces, came into force in 2000. The Decree was revised in 2007 and it now also includes pulses (pea and broad bean). The present incentive to produce seed of these landraces is a subsidy on 600 euros/ha for cereals and pulses and 450 euros for forages. The conditions for seed production require the registration of the landrace or old cultivar in question. Registration costs are covered by the seed grower.

Even though the two separate surveys on the extent of landrace cultivation (Onnela, 1999; Heinonen & Veteläinen,2007) showed that they are still maintained to some extent in Finland, the Decree has not worked well as an incentive. Only some 10 growers have registered landraces or old cultivars prior to seed production. One reason for this is the registration fee that equals the subsidy, but also the idea of registration itself is often felt to be strange or not necessary among farmers who mainly cultivate a landrace for household use. However, an ongoing project 2006 – 2008 "ONFARMSUOMI: Social and cultural value, diversity and utilization of Finnish landraces" aims to find new means to encourage on-farm management of crops. This project has developed e.g. a web-based "landrace information bank" in order to encourage and support the cultivation of landraces among farmers, as well as to enhance the awareness of genetic resources among the general public.

It remains to be seen how Commission Directive 2008/62/EC on the marketing of "conservation varieties" affects the national legislation and on-farm management of crops in Finland.

## 2.5 Assessment of Needs

**On-farm conservation**

- A comprehensive survey of the extent of on-farm and on-garden management and conservation of landraces and local strains of all PGR for food and agriculture in Finland
- Continued research on the value of landraces and their use and indigenous knowledge
- Improvement of a landrace cultivation support system
- Awareness improvement of the value of the landraces on-farms in contributing to crop diversity and cultural values
- Development of market opportunities for landrace-based products

*In situ* conservation of crop wild relatives (CWR)

- Development of a national crop wild relative conservation strategy within and outside protected areas, including an extended national inventory on CWRs, prioritizing of CWR taxa/diversity, eco-geographic and genetic analysis of priority CWRs and establishment of a conservation and monitoring programme.

CHAPTER 3

# THE STATE OF *EX SITU* MANAGEMENT

## 3.1 State of Collections

Regarding the conservation of cultivars, one way of estimating the completeness of a collection is to compare the number of cultivars known from literature with the number of cultivar accessions actually stored.

Table 3.1 shows the number of the stored and known cultivars produced by Finnish field crop breeders during the decades 1910 – 1990. The reference database is not complete, especially not for cultivars that are still on the market. The a:c ratio can be seen as an indicator of efficiency in the conservation of old cultivars.

TABLE 3.1

**Number of the stored and known cultivars produced by Finnish field crop breeders during the decades 1910 – 1990**

| | 1910 | 1920 | 1930 | 1940 | 1950 | 1960 | 1970 | 1980 | 1990 | UNK | TOT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Agrostis capillaris* | | | | | | | 1 : 1 | | | | 1 : 1 |
| *Avena sativa* | | | 1 : 1 | | 1 : 1 | | 3 : 3 | 4 : 4 | 2 : 6 | 19 : 20 | 30 : 35 |
| *Brassica juncea* | | | | | | | | | 1 : 1 | | 1 : 1 |
| *Brassica napus* ssp. *oleifera* | | | | | | | 2 : 3 | 1 : 1 | 1 : 1 | | 4 : 5 |
| *Brassica napus* var. *napo brassica* | | | | | | | | | 1 : 1 | | 1 : 1 |
| *Brassica rapa* ssp.*oleifera* | | | | | | | 1 : 2 | 3 : 4 | 2 : 2 | : 2 | 6 : 10 |
| *Bromus inermis* | | | | | | | 1 : 1 | | | | 1 : 1 |
| *Dactylis glomerata* | | 1 : 1 | | | | | | | 1 : 1 | | 2 : 2 |
| *Festuca pratensis* | | 1 : 1 | | 1 : 1 | | | 2 : 2 | | 1 : 1 | | 5 : 5 |
| *Festuca rubra* | | | | | | | | 3 : 3 | | | 3 : 3 |
| *Hordeum vulgare* ssp. *vulgare* | | 7 : 7 | 3 : 3 | 2 : 2 | 2 : 2 | 5 : 5 | 7 : 7 | 7 : 8 | : 6 | 1 : 1 | 34 : 41 |
| *Linum usitatissimum* | | | 2:2 | | | | | | :1 | | 2:3 |
| *Lolium perenne* | | | | | | | | 1 : 1 | | | 1 : 1 |
| *Medicago sativa* | | | | | 1 : 1 | | | | | | 1 : 1 |
| *Phleum pratense* ssp. *pratense* | | | | 2 : 2 | | | 2 : 2 | 2 : 2 | | | 6 : 6 |
| *Pisum sativum* ssp. *sativum* | | : 3 | | | | | | | | | : 3 |
| *Pisum sativum* var. *arvense* | | : 4 | 1 : 5 | 1 : 3 | 1 : 1 | : 1 | : 3 | 6 : 6 | 3 : 6 | | 12 : 29 |
| *Poa pratensis* | | | | | | | | 1 : 1 | | | 1 : 1 |
| *Secale cereale* | | : 2 | 3 : 3 | 1 : 2 | : 1 | 1 : 1 | 5 : 5 | | : 1 | 1 : 1 | 11 : 16 |
| *Trifolium hybridum* | | | | | | 1 : 1 | | | | | 1 : 1 |

| | 1910 | 1920 | 1930 | 1940 | 1950 | 1960 | 1970 | 1980 | 1990 | UNK | TOT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Trifolium pratense* ssp. *pratense* | | | 1 : 1 | | | 2 : 2 | 1 : 1 | | | | 4 : 4 |
| *Trifolium repens* var. *repens* | | | | | | 1 : 1 | | | | | 1 : 1 |
| *Triticum aestivum* ssp. *aestivum* | 1 : 1 | 2 : 5 | 3 : 4 | 2 : 2 | 5 : 5 | 4 : 5 | 4 : 5 | 3 : 6 | 1 : 2 | 4 : 5 | 29 : 40 |
| *Vicia faba* | | | | | | | 1 : 1 | : 1 | 1 : 1 | | 2 : 3 |
| **TOTAL** | **1 : 1** | **11 : 23** | **14 : 19** | **9 : 12** | **10 : 11** | **14 : 16** | **29 : 35** | **33 : 39** | **13 : 29** | **25 : 40** | **159 : 225** |

## 3.2 Collecting

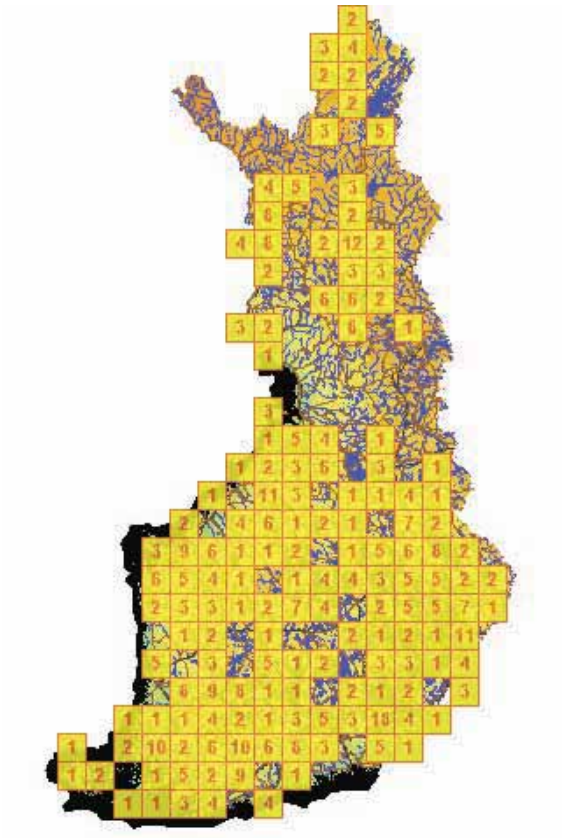
Planned and targeted collecting missions have played an important role in the conservation of plant genetic resources dur-ing the past forty years. Particularly since 1979, when the Nordic countries started their joint gene bank activities, collection missions have been the main means to try to find valuable locally cultivated plant material that could otherwise soon be lost forever.

One of the first joint Nordic activities on the conservation of PGRFA was an inaugural collection mission to northern Finland, Norway and Sweden in 1979. Since then, collection missions under the auspices of the NGB and its working groups have added much value to *ex situ* seed collections as well as to the national field collections.

The frequency of collections has varied over the years, however. At times, working groups have focused on characterizations, evaluations and other activities. More recently, however, new areas and crops of interest have again received the attention they deserve.

Figure 3.1 shows the collection sites of seed material stored at NordGen. The numbers in the squares represent the number of accessions collected in that area. Note that not all collected accessions have been georeferenced and that the map only shows accessions stored with long-term conservation responsibility.

FIGURE 3.1
**Distribution of collection sites**



In addition to the collected seed accessions that are part of the NordGen collection projects, there is also a number of accessions that have been collected through national activities, sometimes even before the NGB was established, and that have become part of some the NGB *ex situ* seed collections through donations. Part of the accessions, e.g. clonal material, is stored in field collections in the country of origin.

The following list presents the targets and results of the collection missions to Finland. The peaks in the acquisition of new seed material in Table3.2 also correspond to the time of collection missions.

**1979** Collection in northern Sweden and Finland 1979. Inaugural collection mission. 94 accessions, mostly wild or semi-wild forages but also some cereals, are in long-term storage at NordGen.

**1980** Collections in Finland 1980. Mostly locally cultivated rye accessions from Finnish farms, but also barley, forages, turnip and broad beans. 156 accessions are in long-term storage.

**1981** Collection in Ostrobothnia, Finland 1981. Mostly locally cultivated rye, but also barley, forages, swede, turnip, broad bean. 125 accessions are in long-term storage.

**1982** Collection in Finland 1982. Locally cultivated forages *Phleum,Trifolium* and rye, but also barley. 83 accessions in long-term storage.

**1983** Collection in Finland 1983. Locally cultivated rye and forages but also barley, swede, broad bean and buckwheat. 50 accessions in long term storage.

**1994** Conservation of potato onions in Finland. Collected before NordGen times. 27 accessions are maintained at MTT PIIKKIÖ and MTT ROVANIEMI (page 27). 22 of them are also in *in vitro* culture at NordGen.

**1994** Conservation of rhubarbs in Finland. Collected before NordGen times. 34 accessions are now maintained in a field collection at MTT PIIKKIÖ (page 27).

**1998** Inventory of Prunus padusin Scandinavia. The project resulted in a small field collection of about 40 accessions of *Prunus padus* ssp. *borealis* and close relatives or hybrids at METLA MUHOS) (page 27).

**2000** Collection mission of natural populations of reed canary grass in Finland. 96 accessions of *Phalaris arundinacea*in long-term storage at NordGen.

**2001** VIR-NGB plant collecting mission in Karelia. Cooperation in collecting material from former Finnish villages in Karelia. Material is at VIR.

**2007** Collection of grasses and clovers in northern part of Finland. Not in storage yet.

The analysis of the potential gaps in the Finnish collections of vegetatively propagated crops has not yet been fully implemented. However, the crop-specific national working group experts handle questions concerning the most obvious gaps in the national collections as part of their routines.

Target collections are planned for herbs and medicinal plants, as well as for some historically important vegetables.

## 3.3 Types of Collections

### 3.3.1 *Ex Situ* Seed Collections

The Nordic Genetic Resource Center (NordGen), formerly the Nordic Gene Bank (NGB), situated in Alnarp, Sweden, is responsible for maintaining the seed collections for all five Nordic countries. According to the agreement, the countries have a joint ownership to the stored material. Therefore, the information in Tables 1 and 2 will be included in the reports of all Nordic countries.

The storage conditions for material for which the countries take long- and medium-term responsibility are identical (see section 3.4). Medium-term material is not monitored for viability and not regenerated. The main criterion for accepting long-term storage responsibility is that the material should be Nordic in origin. Duplicates of Nordic material are also stored under medium-term responsibility, as is some Nordic material that cannot be regenerated without losing its characteristics. On the other hand, long-term responsibility has been accepted for some non-Nordic material that cannot be repatriated to genebanks in the regions of origin. Most of the material is stored as part of the "Ordinary Collection", but some is part of "Special Collections". The Ordinary Collection contains material gathered as a result of the normal activities of the NordGen staff and the Nordic crop working groups. The special collections are larger sets of material donated to NordGen by other institutions, which normally comprise genetic stock collections or other breeding and research material. The most notable special collection is the Barley Mutant collection. The number of accessions stored (long- and medium-term) in the various seed collections is presented in Table 3.2 (long-term) and Table 3.3 (medium-term). The section for medium-term collections also includes accessions that are pending for a decision for becoming accepted for long-term storage. The numbers reflect the situation at the end of 2007.

TABLE 3.2

**Nordic *ex situ* seed collections with number of accessions in long term storage, grouped by Nordic country of origin**

| Long term | DNK | FIN | ISL | NOR | SWE | OTH* | TOT |
|---|---|---|---|---|---|---|---|
| Ordinary Seed Collection | 1 520 | 1 152 | 300 | 1 512 | 2 465 | 447 | 7 396 |
| Barley Mutant Collection | 24 | | | | 1 684 | | 1 708 |
| Barley Translocation Lines | | | | | | 685 | 685 |
| Barley Duplication Lines | | | | | | 58 | 58 |
| Collection of Wild *Triticeae* | 5 | 14 | 8 | 6 | 12 | 1 174 | 1 219 |
| The Aberg collection (rye) | | | | | | 53 | 53 |
| Inbred Rye Collection | | | | | | 126 | 126 |
| Collection of Near-Isogenic Lines | 5 | | | | 390 | 135 | 530 |
| Pisum Genetic Stock | 25 | 45 | | | 831 | 748 | 1 649 |
| The Haslund-Christensen Expedition to Central Asia | | | | | | 111 | 111 |
| **TOTAL** | **1 579** | **1 211** | **308** | **1 518** | **5 382** | **3 537** | **13 535** |

* The OTH column contains accessions from Non-Nordic countries as well as accessions of unknown origin

TABLE 3.3

**Nordic *ex situ* seed collections with number of accessions in medium term storage, grouped by Nordic country of origin**

| MEDIUM TERM | DNK | FIN | ISL | NOR | SWE | OTH* | TOT |
|---|---|---|---|---|---|---|---|
| Ordinary Seed Collection | 1 740 | 354 | 22 | 93 | 1 062 | 1 782 | 5 053 |
| Barley Mutant Collection | 370 | | | | 7 880 | | 8 250 |
| Collection of Wild *Triticeae* | | | | | 1 | | 1 |
| Pisum Genetic Stock | | | | | 84 | 820 | 904 |
| The Haslund-Christensen Expedition to Central Asia | | | | | | 4 | 4 |
| **Totals** | **2 110** | **354** | **22** | **93** | **9 026** | **2 607** | **14 212** |

* The OTH column contains accessions from non-nordic countries as well as accessions of unknown origin

TABLE 3.4

**Accessions in long term seed storage, grouped by taxa and culta**
**Finnish long term *ex situ* seed material by taxa**

| TAXON | CUL | BRE | LAN | WIL | OTH | TOT | SAF* |
|---|---|---|---|---|---|---|---|
| *Agrostis capillaris* | 1 | 2 | 7 | 32 | | 42 | 15 |
| *Agrostis gigantea* | | 1 | | | | 1 | 1 |
| *Agrostis stolonifera* | | | 2 | 2 | | 4 | 1 |
| *Allium schoenoprasum* var. *schoenoprasum* | | | | 14 | | 14 | 12 |
| *Alopecurus pratensis* | | 1 | 13 | 24 | | 38 | 21 |
| *Anthoxanthum odoratum* ssp. *odoratum* | | | 2 | 7 | | 9 | 2 |
| *Avena sativa* | 26 | 5 | 13 | | | 44 | 43 |
| *Avena strigosa* | | | 1 | | | 1 | 1 |
| *Beta vulgaris* var. *altissima* | 1 | | | | | 1 | 1 |
| *Brassica napus* ssp. *oleifera* | 4 | 4 | | | | 8 | 8 |
| *Brassica napus* var. *napobrassica* | 1 | | 5 | | 4 | 10 | 5 |
| *Brassica rapa* ssp. *oleifera* | 6 | 1 | | | | 7 | 6 |
| *Brassica rapa* ssp. *rapa* | | | 7 | | 1 | 8 | 7 |
| *Bromus inermis* | 1 | | | | | 1 | 1 |
| *Dactylis glomerata* | 2 | 1 | 8 | 11 | 1 | 23 | 18 |
| *Deschampsia cespitosa* ssp. *cespitosa* | | | 14 | 14 | | | 28 |
| *Deschampsia flexuosa* | | | 4 | 11 | | 15 | 1 |
| *Elymus caninus* | | | | 7 | | 7 | |
| *Elymus fibrosus* | | | | | 4 | 4 | |
| *Elymus mutabilis* | | | | | 3 | 3 | |
| *Fagopyrum esculentum* | | | 7 | | | 7 | 4 |
| *Festuca* | | | | 1 | | 1 | |
| *Festuca ovina* | | | 3 | 10 | | 13 | 3 |
| *Festuca pratensis* | 6 | 1 | 6 | 5 | 3 | 21 | 11 |
| *Festuca rubra* | 3 | 2 | 8 | 37 | | 50 | 35 |
| *Hordeum vulgare* ssp. *spontaneum* | | 2 | | | | 2 | 1 |
| *Hordeum vulgare* ssp. *vulgare* | 39 | 38 | 51 | | 1 | 129 | 120 |
| *Linum usitatissimum* | 2 | | | | | 2 | 2 |
| *Lolium perenne* | 1 | 2 | | | | 3 | 3 |
| *Medicago sativa* | 1 | | | | | 1 | 1 |
| *Phalaris arundinacea* | | 1 | 3 | 68 | | 72 | 38 |
| *Phleum alpinum* | | | 1 | 2 | | 3 | |

| TAXON | CUL | BRE | LAN | WIL | OTH | TOT | SAF* |
|---|---|---|---|---|---|---|---|
| *Phleum pratense* ssp. *bertolonii* | | | | 1 | | 1 | 1 |
| *Phleum pratense* ssp. *pratense* | 7 | 1 | 132 | 48 | 3 | 191 | 161 |
| *Pisum sativum* | 16 | 20 | 2 | | 1 | 39 | 14 |
| *Pisum sativum* ssp. *sativum* | 9 | 2 | | | | 11 | 5 |
| *Pisum sativum* var.*arvense* | 9 | | 3 | | | 12 | 12 |
| *Poa alpigena* | | | | 6 | | 6 | 6 |
| *Poa pratensis* | 1 | | 18 | 17 | | 36 | 13 |
| *Poa trivialis* | | | 5 | 4 | | 9 | |
| *Rubus arcticus* ssp. *arcticus* | | | | 1 | | 1 | 1 |
| *Secale cereale* | 29 | | 82 | | | 111 | 98 |
| *Trifolium hybridum* | 1 | | 5 | 3 | 1 | 10 | 4 |
| *Trifolium pratense* ssp. *pratense* | 4 | | 85 | 17 | 3 | 109 | 79 |
| *Trifolium repens* var. *repens* | 1 | | 6 | 5 | | 12 | 6 |
| *Triticum aestivum* ssp. *aestivum* | 33 | 6 | 7 | | | 46 | 42 |
| *Triticum aestivum* ssp. *spelta* | | | 2 | | | 2 | 2 |
| *Vicia cracca* | | | 4 | 1 | | 5 | 1 |
| *Vicia faba* | 2 | 2 | 24 | | 1 | 29 | 27 |
| *Vicia faba* var. *equina* | | | 2 | | | 2 | 2 |
| *Vicia sepium* | | | 5 | 2 | | 7 | |
| **TOTAL** | **206** | **92** | **537** | **357** | **19** | **1 211** | **835** |

* The last column SAF shows the number of accessions safety duplicated in the Svalbard Global Seed Vault

The dates of acquisition of the seed samples (Figure 3.2) show that most of the Finnish landraces have been acquired during the targeted collection missions in 1979 – 1983. Most of the old Finnish cultivars that were still available were also acquired from the Finnish breeders' own storages shortly after the NGB was established. After a period with few collection projects in the latter part of the 1990s, the focus of activity again returned to targeted collections. The last collection mission in Finland was in 2007, but the material does not yet show in the statistics used for this report.

### 3.3.2 *In Vitro* Collections

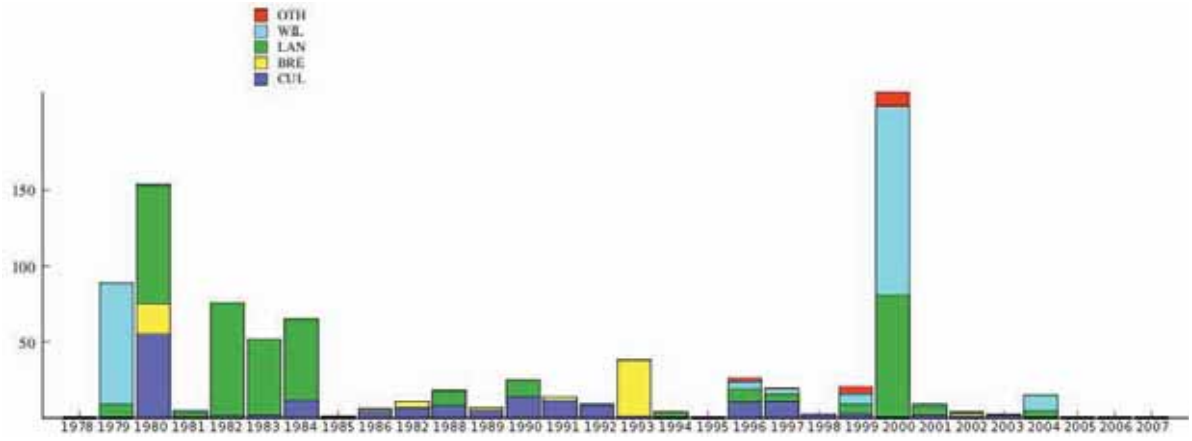
Potato and onions are maintained as *in vitro* collections. The collections are managed by NordGen.

TABLE 3.5

**Nordic potato and onion accessions in *in vitro* storage. All Finnish onion accessions are Potato Onions.**

| *In vitro* collection | DNK | FIN | ISL | NOR | SWE | TOT |
|---|---|---|---|---|---|---|
| Potato *in vitro* collection | 9 | 9 | 3 | 16 | 27 | 64 |
| Onion *in vitro* collection | 15 | 24 | | 8 | 18 | 65 |
| **Totals** | **24** | **33** | **3** | **24** | **45** | **109** |

FIGURE 3.2
**Acquisition years for Finnish long term seed material at NordGen storage, with number of accessions on the y-axis. The bars also show the proportions between the aquired culta (cultivars, landraces, breeding material, wild). There are no long term accessions acquired during 2005 – 2007, partly due to the fact that decisions on long term storage responsibility has not yet been taked for recently acquired material.**




### 3.3.3 *Ex Situ* Field Collections

There are about 2 200 accessions stored in field genebanks at the MTT research stations around the country (page 27). The material has been grouped into ligneous ornamentals, perennial ornamentals, herbs & spices, fruits & berries and vegetables. Decisions on long-term storage responsibility have so far been taken for 406 accessions of vegetables and fruits & berries.

In addition, a number of herbs, spices and medicinal plants will soon be accepted for long-term conservation. The belong to the following genera (number of accessions in parentheses): *Acorus* (11), *Arnica* (15), *Artemisia* (2), *Carum* (1), *Chenopodium* (10), *Hypericum* (40), *Hyssopus* (1), *Inula* (1), *Leonurus* (12), *Levisticum* (1), *Mentha* (32), *Myrrhis* (1), *Nicotiana* (1), *Rhodiola* (18), *Salvia* (1), *Solidago* (39), *Symphytum* (1) and *Tanacetum* (21).

## 3.4 Storage Facilities

The storage facilities for seed material are managed by NordGen in Alnarp, Sweden.

NordGen also manages a laboratory for *in vitro* cultivation. The Nordic *in vitro* potato collection is also administered by NordGen, but is cultures are held by IVK in Umeûa. The *ex situ* field collections are held nationally within the country.

### 3.4.1 Storage of Seed Material

#### 3.4.1.1 Conditions

Seed material for which medium- and long-term storage responsibility has been taken is stored under identical conditions in the NordGen seed store. The seed store fulfils the gene bank standard for long-term storage. Seeds are preprocessed in similar ways, i.e. dried to moisture content of 6 – 8 %. Thus the terms of medium-term and long-term storage refer to the responsibility to monitor and regenerate the accessions rather than to the actual storage conditions. The terms accepted (ACC) and temporary (TEM) are more commonly used in reports and in communication between Nordic work group members and staff to denote material with long-term and medium-term responsibility.

TABLE 3.6
**Accessions of PGRFA with long term storage mandate in Finnish field genebanks**

| Taxon | Common name | Accessions |
|---|---|---|
| *Allium cepa Ascalonicum* Group | Shallot | 6 |
| *Allium cepa Aggregatum* Group | Potato Onion | 27 |
| *Allium schoenoprasum* var. *s choenoprasum* | Chives | 8 |
| *Armoracia rusticana* | Horse Radish | 26 |
| *Chaenomeles japonica* | Japanese Quince | 18 |
| *Fragariaÿananassa* | Strawberry | 12 |
| *Fragaria vesca* | Wild Strawberry | 1 |
| *Hippophae rhamnoides* | Sea-Buckthorn | 5 |
| *Humulus lupulus* | Hop | 11 |
| *Malus domestica* | Apple | 129 |
| *Prunus cerasus* | Sour Cherry | 32 |
| *Prunus domestica* ssp. *domestica* | Plum | 13 |
| *Prunus domesticas* sp. *insititia* | Bullace | 7 |
| *Pyrus communis* | Pear | 6 |
| *Rheum rhabarbarum* | Rhubarb | 34 |
| *Ribes nigrum* | Black Currant | 24 |
| *Ribes Rubrum* Group | Red Currant | 11 |
| *Ribes Grossularia* Group | Gooseberry | 9 |
| *Rubus arcticus* | Arctic Bramble | 6 |
| *Rubus arcticus notho* ssp. *stellarcticus* | | 2 |
| *Rubus x binatus* | Nectar Bramble | 3 |
| *Rubus chamaemorus* | Cloudberry | 1 |
| *Rubus idaeus* | Raspberry | 12 |
| *Rubus idaeus x allegheniensis* | | 2 |
| *Rubus nessensis* | | 1 |
| **TOTAL** | | **406** |

Another difference between accepted and temporary material is that the accepted material is also stored in the base collection, while the temporary material is only stored in the active collection. The active collection is used for distribution, characterization/evaluation and regeneration. The base collection is assumed to contain at least a certain minimum amount of the most original (viable) samples. This material is set aside for the future and should only be used for rejuvenation in case of low seed viability. Regeneration due to insufficient amount of seed should be done from seeds in the active collection.

Up to 2005 both the active and base collections were stored in deep freezers in the same seed store at NordGen in Alnarp. To further improve the security of the stored material, the base collection has been moved to Arslev in Denmark.

Since 1984 NGB has used an old cold mine in the Svalbard Islands, Norway, for storing safety duplicates of the accepted seed material. Due to the permafrost, the temperature in this safety storage stays at -4 C around the year without any need for energy input. After the inauguration of the Global Seed Vault (2008) nearby, the Nordic material from "Gruve 3" will also be moved to the new global safety storage. The temperature in the Global Seed Vault is kept at -18 C by means of external electric power.

### Containers

The seed material in the active collection is stored in hermetically sealed aluminum bags with plastic lining. Smaller bags are used as prepacked distribution units while larger bulk bags are used for the main part of the material.

The material in the base collection was stored in sealed glass bottles up to 1998. Due to the observation that the caps of the bottles in the base collection did not stay reliably air-tight over time, it was decided that the base collection, too, should be stored in aluminum bags. The containers of the material in base collection have been changed and now the same type of bags as those for the active collection is being used.

At first sealed glass ampoules were used for the safety duplicates. Here, too, the type of containers (for new deposits) was changed to aluminum bags since thin glass ampoules are fragile and even larger vessels may easily break at the sealing joints, especially during transportation.

It is also much more difficult to remove excessive air from rigid containers than from flexible bags during packing, which is another reason why NordGen now stores all seed material in bags rather than glass containers.

TABLE 3.7
***Ex situ* storages (NordGen)**

| Storage type | Temperature | | Moisture % | | Vol/area |
|---|---|---|---|---|---|
| | Min | Max | Min | Max | |
| Medium term (active) | -20 | -20 | 6 | 8 | 49 |
| Long term (base) | | | 6 | 8 | |
| Long term (safety) | -18 | -18 | 6 | 8 | 768 |
| *In vitro* | 8 | 8 | | | 1 |

## 3.4.2 *Ex Situ* Field Collections

According to the national strategy for conservation of plant genetic resources, MTT AgriFood Research Finland is the main responsible organization for the conservation of *ex situ* field collections of vegetatively propagated crops in Finland. MTT has a network of research stations located in different parts of the country. When the inventory of national plant collections was initiated on 2003, it was recognized that most of the stations had collections of horticultural crops which included material that fulfilled the criteria for long-term conservation set out by the National Plant Genetic Resources Programme.

FIGURE 3.3
**Piikkiö, Jokioinen, Mikkeli, Laukaa, Muhos and Rovaniemi (Sto N)**

Due to the rationalization of the MTT research station network, the possibilities to utilize all the stations for *ex situ* field conservation have diminished since 2003. Therefore, MTT units with the best expertise and facilities for the purpose were selected as principal conservation sites as follows:

**MTT PIIKKIÖ** Field collections of horticultural crops and landscape gardening plants (also managing collections at Countryside College of Southwest Finland in Tuorla and arboretum Yltiöinen).

**MTT LAUKAA** Field collections of horticultural crops and landscape gardening plants.
MTT laukaa also carries out production of nuclear stock plants by disease and pest elimination and testing, micro-propagation and cryo-preservation.

**MTT MIKKELI** Field collections of herbs and medicinal plants.

**MTT ROVANIEMI** Field collections of *Allium* spp. and landscape gardening plants.

**MTT JOKIOINEN** Temporary field collections and demonstration plantations.

**METLA MUHOS** Finnish Forest Research Institute METLA maintains a field collection of *Prunus padus* ssp. *borealis* and other related *Prunus padus* accessions of northern origin.

MTT units managing field collections have access to fields and glasshouses, qualified technical staff and equipment. Facilities for disease and pest elimination and testing are also available.
In the long run the National Programme aims to expand the conservation network to agricultural colleges, botanical gardens and other relevant partners. So far, only the national field collection of hop is hosted entirely outside the MTT, at HAMK University of Applied Sciences in Mustiala.
The main constraints for the *ex situ* field conservation and expanding the collections at MTT are the limited funds for staffing and improvement of the health status of the conserved material. This probably also applies to other public institutions to be included in the conservation network in the next ten years due to on-going Government savings programme.

## 3.5 Security of Stored material

### 3.5.1 *Ex Situ* Seed Collections

Seed accessions accepted for long-term conservation are regularly tested for viability and regenerated if necessary. This form of regeneration is called rejuvenation. In the rejuvenation process it is ensured that the seeds used are taken from the most original (viable) sample, i.e. from the base collection.
Regeneration due to insufficient amount of material is somewhat different as the seeds used can be taken from the active collection, i.e. the source does not necessarily have to be the most original sample.
For newly collected material there is no choice, since there is only one sample. Especially for wild or semi-wild accessions the amount of collected seed is often minimal and all of the original sample has to be used for regeneration before anything else, including viability tests, initial characterization and decisions on long-term conservation, can be made.
Once sufficient amounts of seed are available, the samples will be stored in the active collection and made available for distribution. If a decision on long-term conservation responsibility is made, a sample will also be stored in the base collection.
The Nordic countries are storing a duplicate safety base collection in the Svalbard Islands. Samples of all accessions accepted for long-term conservation will also be sent to Svalbard.
The number of accessions actually stored in the safety base collection is given for each species in the last column of Table3.4 (page 22). 69 % of the Finnish *ex situ* seed accessions accepted for long-term conservation are also stored at the Svalbard safety storage.

### 3.5.2 *Ex Situ* Field Collections

The National Plant Genetic Resources Programme has set a principle that each accession approved for long-term conservation in field collections should have a safety duplicate. The safety duplicate should be preserved in a different location for security reasons. In addition, a sample should be stored in the cryopreservation security storage.

Less than 35 % of vegetatively propagated material has a duplicate in another site, or is stored using different methods.

TABLE 3.8

**Number of accessions in field collections accepted for long term storage, with number of accessions stored at at least one other site (SAF) and accessions stored using at least two different methods (MUL). The total safety percentage is less than 35% (some accessions are counted both in column SAF and MUL)**

| CROP GROUP | ACC | SAF | MUL |
|---|---|---|---|
| VEGETABLES | 112 | 19 | 9 |
| FRUITS&BERRIES | 294 | 96 | 31 |
| **TOTAL** | **406** | **115** | **40** |

Cryo preservation techniques were introduced at MTT in 2004, as the only unit in the Nordic countries exploiting this method for plant material. The practical preservation, as well as research, is mainly located at MTT Laukaa Research and Elite Plant Station. Long-term preservation was first started with *Humulus, Prunus* and *Rubus* materials. In addition to optimizing the methods for particular species and genotypes, research is conducted on various types of preserved plant material (buds, shoot tips, somatic embryos). Additional beneficial effects like virus elimination and enhancement of plant regeneration capacity are monitored continuously.

## 3.6 Documentation and Characterization

### 3.6.1 Nordic Collections

For the Nordic seed collections in Alnarp, NordGen has developed a relational information system, Sesto. Though originally intended for Seed Store management, Sesto includes many other utilities related to gene bank management. The data sets include accession passport data, seed store data (including germination tests), taxonomic references and checklists, cultivar information, material requests, distribution, characterization and evaluation results, simple GIS and data analysis utilities, photo archive, project and activity information, person and organization details, correspondence and library references.

The main client interface is based on a browser. The database server can be local or remote. Currently the National Programmes of the Nordic countries and gene banks in the Baltic countries are using Sesto remotely against the NordGen server in Alnarp. In other cooperation projects test versions of Sesto have been installed in other PGR centers.

### 3.6.2 Evaluation and characterization

Over the years since the establishment of NordGen, accessions in the *ex situ* seed collections have been subject to characterization and evaluation in projects administered by the crop working groups. These projects have targeted characters that can roughly be grouped as botanical, agronomic, resistance, tolerance, chemical and utilization features.

The results of the characterizations and evaluations, however, have not always been easily accessible for comparison. Though results were regularly published in reports, they were not easily found when they were needed. It was not until the integrated documentation system Sesto was developed in the mid-1990s that results started to become available for the general public. Results are now regularly registered in the NordGen database when new evaluations are made. Sesto also contains a Dynamic Data Analyzer application that allows users to study and compare evaluation results online.

The figures in Table 3.9 are taken from the Sesto database. There are certainly more evaluation results published in older publications, but they are not easy to count. Indeed, even the totals from later projects may be hard to count properly and relate to how much is known about the accessions, for several reasons.

First, characterization and evaluation is not performed only on material already destined for long-term conservation, since information on the characteristics of new material is also important in order to decide on the conservation mandate. Conversely, some evaluated material may no longer be considered important enough to justify long-term conservation, i.e. the mandate status may have changed afterwards.

Second, just counting the number of accessions that have been part of at least one evaluation does not show how much is known about the whole collection. Classifying the evaluated characters and counting accessions in each class separately, as is done in Table 3.9, is one way of trying to circumvent this restriction.

TABLE 3.9

**Number of accessions of Finnish origin evaluated for botanical (BOT), agronomical (AGR), resistance (RES), tolerance (TOL), chemical (CHE), utilization (UTI) and other (OTH) characters**

| | BOT | | AGR | | RES | | TOL | | CHE | | UTI | | OTH | | TOT** | | EVA** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Crop*** | **ACC** | **!ACC** | **ACC** | **!ACC** | **ACC** | **!ACC** | **ACC** | **!ACC** | **ACC** | **!ACC** | **ACC** | **!ACC** | **ACC** | **!ACC** | **ACC** | **!ACC** | **ACC** | **!ACC** |
| Cereals | 42 | 33 | 69 | 44 | 23 | 4 | | | 47 | 28 | | | 56 | 56 | 349 | 258 | 112 | 101 |
| Forages | 110 | 1 | 110 | 1 | 110 | 1 | 9 | | | | | | | | 713 | 33 | 110 | 1 |
| Vegetables | 19 | | 1 | | | | | | 4 | | 4 | | 123 | 53 | | | 19 | |
| Potato | 9 | | | | 9 | | | | | | 9 | | | | 9 | | | 9 |
| Others | | | | | | | | | | | | | 2 | | 27 | 6 | 2 | |
| **TOTAL** | **180** | **34** | **180** | **45** | **142** | **5** | **9** | | **51** | **28** | **13** | | **58** | **56** | **1 221** | **350** | **243** | **111** |

* Long-term (ACC) and other (!ACC) material is counted separately

** The TOT columns show the total number of accessions in storage and the EVA columns the total numbers of accessions evaluated (at least once) for long-term and non-long-term material, respectively

## National Collections

A documentation system for national field and security collections is being developed in cooperation with NordGen. Inventory of the existing evaluation and characterization data to establish needs for further evaluations has not yet been carried out.

A working DNA identification system for MTT fruit and berry collections using the Finnish apple as a model plant has been established. Based on this system, over 300 unnecessary duplicates have been removed from the national collections. Furthermore, markers enable the use of reliable estimates of relatedness as well as amounts of genetic variation within collections.

TABLE 3.10

**Seed distribution 1998–2007: Number of accessions (ACCS) and samples (SAMP) distibuted, Finnish material to Finland, foreign material to Finland, Finnish material to other countries and foreign material to other contries. Where SAMP is greater than ACCS one or more accessions was distributed more than once.**

| DISTRIBUTION OF SEED MATERIAL1998-2007 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1998–2002** | **1998** | | **1999** | | **2000** | | **2001** | | **2002** | | | |
| | **ACCS** | **SAMP** | **ACCS** | **SAMP** | **ACCS** | **SAMP** | **ACCS** | **SAMP** | **ACCS** | **SAMP** | | |
| FIN>FIN | 11 | 11 | 5 | 5 | | | 17 | 17 | | | | |
| FIN>OTH | 26 | 26 | 37 | 37 | 83 | 89 | 88 | 130 | 67 | 71 | | |
| OTH>FIN | 22 | 22 | | | | | 5 | 5 | 26 | 26 | | |
| OTH>OTH | 909 | 968 | 411 | 417 | 489 | 561 | 1 053 | 1 358 | 566 | 626 | | |
| ALL>ALL | 960 | 1 027 | 453 | 459 | 572 | 650 | 1 163 | 1 510 | 654 | 723 | | |

| 2003–2007 | 2003 | | 2004 | | 2005 | | 2006 | | 2007 | | TOT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ACCS | SAMP | ACCS | SAMP | ACCS | SAMP | ACCS | SAMP | ACCS | SAMP | ACCS | SAMP |
| FIN>FIN | 33 | 35 | | | 181 | 183 | 3 | 3 | 66 | 66 | 295 | 320 |
| FIN>OTH | 64 | 65 | 181 | 193 | 124 | 156 | 213 | 230 | 163 | 196 | 621 | 1 193 |
| OTH>FIN | 22 | 22 | 3 | 4 | 6 | 6 | 14 | 14 | 112 | 112 | 197 | 211 |
| OTH>OTH | 754 | 813 | 1 042 | 1 163 | 2 031 | 2 592 | 1 730 | 2 059 | 1 228 | 3 928 | 5 772 | 14 485 |
| ALL>ALL | 859 | 935 | 1 224 | 1 360 | 2 330 | 2 937 | 1 956 | 2 306 | 1 503 | 4 302 | 6 481 | 16 209 |

## 3.7 Germplasm Movement

Nordic Genetic Resource Center (NordGen) is the institute providing Nordic seed samples and potato germplasm for the potential users all over the world. Table 3.10 demonstrates the seed distribution from NordGen during the period 1998 – 2007. Material of Finnish origin has bee distributed both to Finnish and foreign users. However, Finnish users have used less foreign than domestic germplasm, which may be an indication of the need for material adapted to the northern conditions. In total, NordGen had distributed 16 209 seed samples during the period.

## 3.8 Roles of Botanical Gardens

The Universities of Helsinki, Turku, Oulu, and Kuopio have botanical gardens, whose collections also include plant genetic resources for agriculture and horticulture. The collections have usually been established for research and educational purposes. Some of the collections are temporary and are maintained only for the duration of the relevant study.

FIGURE 3.4
**Helsinki, Turku, Kuopio and Oulu (S to N)**


In 2001 the species cultivated in the test field at the University of Oulu botanical gardens included blueberry (from 18 countries, total of 47 provenances), lingonberry (10 countries, 45 provenances), crowberry (14 countries, 29 provenances), cloudberry (mainly from Finland, about 120 provenances), cranberry (17 provenances), gooseberry (from northern

Ostrobothnia and Kainuu, about 50 strains). In addition, the gardens contain several provenances of rowan and bird cherry. The material has been propagated from seed or cuttings, or by micro-propagation, depending on the species.

There are plans to carry out an inventory of PGR included in the collections of Finnish botanical gardens under the National Plant Genetic Resources Programme. The University of Oulu botanical gardens have already expressed their interest to include valuable PGR in the national information system under development.

## 3.9 Assessment of Needs

Although regional Nordic cooperation in *ex situ* conservation has been very successful, some further needs were identified. For the Finnish national activities the major constraint are the lack of funds for the conservation of field and cryo germplasm collections. The detailed needs based on current analysis are:

- Complementing of cultivar information in the Nordic Sesto information system for Finnish cultivars and, based on information update, acquiring material in relevant cases
- Clarification of procedures and sharing of tasks and possible adjustment of database structure and user interface of Sesto documentation system to better serve national uses of the system
- Adding options in the Sesto documentation system to allow for better consolidation of different views and practices on plant taxonomy and nomenclature
- Strategic plan for germplasm collections including gap analysis in existing *ex situ* collections and consequent collection of the material
- Complementing of safety base storage of seed material of Finnish origin at Svalbard Global Seed Vault
- Diminishing the multiplication gap of collected seed material of Finnish origin
- Improvement of the health status of Finnish onions in *in vitro* collections and other species in national field collections
- Cryopreservation method development for the species which do not yet have functioning procedures
- Improving the security of the national field collections through duplication of the material in another site and cryopreservation
- Extension of the national conservation network to material in botanical gardens, agricultural and horticultural colleges and other actors
- Enhancement of the use of germplasm collections through characterization, evaluation, pre-breeding and research through strategic approach
- Establishment of a germplasm distribution system for national collections
- Stable funding for national conservation activities and field gene banks

CHAPTER 4

# THE STATE OF USE

## 4.1 Importance of Utilization

Due to Finland's location in the northern hemisphere, great attention has always been paid to germplasm that is adapted to this area, where the days are long during the short growing season and winters are cold. In light of the anticipated global warming, it is increasingly important to secure access to germplasm that is useful for plant breeding programmes targeted to the geographical area and conditions of Finland. Finland cannot rely on varieties bred for the more southern latitudes. Today, the domestic varieties cover 2/3 of the arable land of Finland, which emphasizes the use of adapted plant material in agriculture and horticulture also in the future.

## 4.2 Utilization of Conserved Material

Fruit trees and berries selected from national germplasm collections for certain quality specifications as Finnish Elite Plants (FinE) have had a great impact on domestic diversity in horticulture. During the period 1997—2007 the number of plantlets sold by nurseries was over 57 000, according to the FinE selling statistics. In addition, almost 258 000 plantlets of ornamental FinE plants were sold during the same time period.

Table 3.9 presents the use of *ex situ* collections under common Nordic management at NordGen. It can be concluded that the Finnish users of the gene bank are utilizing the material to some extent, and users outside of Finland request Finnish material in growing amounts. In 2005-2007 there has been an upward trend in using Finnish material.

In 1998 a new Council Directive (98/95/EC) opened the possibility to establish specific conditions under which seed may be marketed in relation to the conservation *in situ* and the sustainable use of plant genetic resources. The Parliament of Finland included the idea in the Seed Trade Act of 2000 (728/2000) by allowing the seed of landraces to be marketed uncertified in order to conserve genetic diversity. Under this Act the Finnish Ministry of Agriculture and Forestry issued two decrees, in 2000 and 2001: Decree on Registration of Conservation Varieties (437/2001) and Decree on Seed Trade in Landraces of Cereal and Fodder Plants (117/00).

The Finnish National Plant Genetic Resource Programme also enhances the use of landraces and old varieties as part of the cultural history. This is also reflected in the efforts to raise public awareness.

## 4.3 Utilization Activities

In Finland there is a one company, Boreal Plant Breeding Ltd, which carries out plant breeding for field crops, and one public institute, MTT Plant Production Research, responsible for horticultural breeding. The breeding of major field crop covers spring barley, spring wheat, oats and spring turnip rape, and breeding of some minor crops such as winter rye, winter wheat, peas, potatoes and forages is also carried out. Since 1996 the horticultural plant breeding has produced varieties of apple (11), highbush blueberry (6), strawberry (1) and sea buckthorn (3).

Utilization of PGR in Finland also involves overall germplasm enhancement, such as evaluation and characterization of the collections, research on PGR diversity and plant genomics, as well as pre-breeding.

## 4.4 Assessment of Needs

- Improvement of the Sesto information system for the documentation of evaluation and characterization, as well cultural historical information
- Funding schemes for plant breeding and related research including pre-breeding activities in the Nordic region

- Support to the national elite plant production system that integrates the use of domestic PGR and cryo conservation as a safety preservation method
- Continued support for breeding of minor crops through a National Emergency Supply Agency
- Further development of support systems for the cultivation and seed production of landraces and historical cultivars in Finland

CHAPTER 5

# THE STATE OF NATIONAL PROGRAMMES, TRAINING AND LEGISLATION

## 5.1 The National Plant Genetic Resources Programme for Agriculture and Forestry

### 5.1.1 Preparation of the Programme

The Finnish Ministry of Agriculture and Forestry appointed a working group for the preparation of a Finnish National Plant Genetic Resources Programme, related to the implementation of the CBD and the GPA. The working group was appointed for the period 1 March 1998 – 31 December 2000. The group continued the work of the first Committee for Plant Genetic Resources appointed in 1995. The group's period of office was later extended to the end of April 2001.

The working group was steered by the Ministry of Agriculture and Forestry, and the invited members of the working group were the following organizations: Boreal Plant Breeding Ltd.; Agricultural Research Center of Finland (since 1 March 2001, MTT AgriFood Research Finland); University of Helsinki: University of Oulu; Finnish Forest Research Institute; Ministry of the Environment; Plant Production Inspection Centre; Central Union of Agricultural Producers and Forest Owners (MTK); Association of Rural Advisory Centres, SLF; Central Organisation for Finnish Horticulture; Turku Provincial Museum (which also represented the Nordic Cultural Landscape Society); Maatiainen ry; Kesko Oy; Nieminen S.G. Oy; and Plant Variety Rights Office. The Finnish Advisory Board to the Nordic Gene Bank (NGB) was included in the working group as a sub-division.

The Finnish National Plant Genetic Resources Programme for Agriculture and Forestry prepared by the working group is based on an extensive background survey, which addressed in detail the various issues involved in the conservation and sustainable use of plant genetic resources. These include international and national legislation on genetic resources, agreements and organizations, ownership of genetic resources, their conservation and utilization, as well as research and education concerning genetic resources.

The National Plant Genetic Resources Programme for Agriculture and Forestry outlines the main principles, objectives, and proposals for measures regarding the conservation and sustainable use of genetic resources for agriculture, horticulture, and forestry.

The programme was launched in 2003 to facilitate the conservation of agricultural and forest genetic resources in Finland. MTT AgriFood Research Finland is responsible for the coordination of the programme and for implementing the programme as regards field and horticultural crop genetic resources. The Finnish Forest Research Institute is responsible for the conservation of forest genetic resources. This report covers the field and horticultural crops under the National Plant Genetic Resources Programme.

### 5.1.2 Structure of the Programme

The National Advisory Board for Genetic Resources governs and monitors the National Plant Genetic Resources Programme. The board has broad representation from different ministries, universities, stakeholders and a NGO. This should ensure that different national stakeholders are involved in the planning and implementation of the programme. The Ministry of Agriculture and Forestry appoints the Advisory Board for Plant Genetic Resources for four-year periods of office at a time. The chairman of the Board is a representative of the Ministry of Agriculture and Forestry, and its secretary a person hired full-time at MTT AgriFood Research Finland. At the moment there is one full-time programme coordinator who is in charge of the agricultural and horticultural crops under the programme and also acts as the secretary of the Advisory Board.

The duties of the Advisory Board are:

- To address Nordic and international matters involving plant genetic resources, including international legislation.
- To act as an inter-ministry cooperation body in matters 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 inform about matters related to the conservation and use of plant genetic resources.

The plant genetic resources working groups at MTT AgriFood Research Finland have organizational responsibility for managing the *ex situ* field collections. There are working groups for: 1) Landscape gardening; 2) Fruits and berries; 3) Vegetables, herbs and medicinal plants; 4) Field crops. In addition, there is a group working with the demonstration of the plant genetic resources at the MTT headquarters. The members of the working groups are recognized national experts on the respective crops and genetic resources.

The programme implementation also comprises research and training on and utilization of genetic resources, in addition to conservation.

### 5.1.3 Funding

The funding of the programme has remained the same since it was launched in 2003. The available funds that are included in the budget of the MTT AgriFood Research Finland cover a salary of one full-time programme coordinator. There are also funds available for the coordination of the programme, as well as to cover minor expenses for managing the collections. The programme budget does not include funds for the conservation of national *ex situ* collections. However, MTT AgriFood Research Finland with its research station network has the responsibility to maintain national collections of plant genetic resources.

## 5.2 Training

Research and education on plant genetic resources is carried out to ensure sufficient expertise in all sectors of the conservation and sustainable use of plant genetic resources. University-level education on plant genetic resources is provided at most of the faculties of biosciences in Finland, as well as at the Faculty of Agriculture and Forestry of the University of Helsinki, which also provides education in plant breeding. Some of the research and training takes place on the Nordic and EU levels. The National Plant Genetic Resources Programme participates in the training onPGR issues on both college and university levels.

Information to the public on PGR is provided at the programme website at www.mtt. fi/kasvigeenivarat. The programme also utilizes other channels, e.g. agricultural and horticultural fairs and other events, for communicating on PGR issues in Finland.

## 5.3 National Legislation

### Legislation on Seed and Propagating Material

**Finnish Seed Trade Act (728/2000)**

The marketing of seed in EU is governed by crop-specific seed directives (Directives 2002/54/EC, 66/401/EC, 66/402/EC, 2002/56/EC, 2002/57/EC, 2002/55/EC and 2002/53/EC). The Directives are implemented in Finland by the Seed Trade Act (782/2000).

Under the Act, only certified seed may be marketed in Finland. As an exception to this principle, uncertified seed of landraces may be marketed for the purposes of conserving genetic diversity.

Under the Act, a catalogue of cultivars is maintained on crop cultivars used in agriculture. Cultivars are accepted to the catalogue if they are distinct, stable, and sufficiently uniform, and if they have sufficient value in cultivation and use.

Decisions of acceptance are made by the Plant Cultivar Board. The Board publishes an annual catalogue of the cultivars accepted by it. Once a cultivar is accepted to the catalogue, the acceptance remains valid until the end of the tenth calendar year following the year of acceptance. Acceptance can also be renewed.

Directive 98/95/EC provides for special rules on the marketing of seeds of genetic resources. Provisions of the Directive concerning landraces and cultivars, as well as gene technology, are also implemented in Finland by the Seed Trade Act. New Directive 2008/62/EC on conservation cultivars replaces Directive 98/95/EC. The relevant national legislation is presently under revision to adapt it to the provisions of the Directive.

The production, acceptance, and marketing of seed of the landrace cultivars of cereals and forage and fodder grasses are regulated by Decree 117/2000 of the Ministry of Agriculture and Forestry.

The Decree contains provisions on, for example, inspections, labeling and mixtures of seed, as well as the requirements for cultivation for the conservation of such plants.

### Finnish Nursery Plant Material Act (1205/1994; last amended by 727/2000)

The production, marketing, and import of plants and propagating material for horticulture are regulated by the Finnish Nursery Plant Material Act (1205/1994, last amended by 727/2000). The Act has been harmonized with Community legislation (Directives 42/96/EC on the fruit plant propagating material, Directive 41/96/EC on the marketing of the vegetable propagating material, other than seed, and Directive 96/00/EC on the marketing of propagation material of ornamental plants).

The Act applies to plants and other propagating material of fruits and berries as well as ornamental and vegetable plants, but not to onion sets or seed of vegetable plants.

The objective of the Act is to ensure that plant material marketed in Finland and exported to the single market satisfies the requirements of the Act regarding quality and health. Under the Act, the Ministry of Agriculture and Forestry may impose conditions and requirements regarding the genetic and external qualities, as well as the protection of the health of plant material intended for the market.

## Promotion of Conservation of Plant Genetic Resources for Food and Agriculture

The basic rules in the EU governing rural development policy, as well as the policy measures available to Member States and regions, are set out in Council Regulation (EC) No. 1698/2005. This Regulation sets the general framework for rural development policy in the next funding period 2007-2013. One of the three axes under the Regulation is improvement of the environment and the countryside. Under this axis, support may also be paid for the cultivation of crop cultivars threatened by genetic erosion as well as for specific action supporting their conservation and sustainable use. The Regulation has been transposed into Finnish legislation by several Acts and Decrees. Act 1440/2006 regulates the cultivation of landraces.

### Nature Conservation Act

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 (the so-called Habitats Directive) and 79/409/EEC on the conservation of wild birds (the so-called 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 on nature.

Under the Act, nature conservation must aim at 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.

**Intellectual Property Rights (IPR) Related to Plant Genetic Resources**

Under Directive 98/44/EC, 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, are 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.

In Finland, the only statute addressing the IPR related to genetic resources for agriculture is the Act on Plant Breeders' Rights (789/1992, 238/1999), and to some extent the Patents Act (550/1967). The amendments required by Directive 98/44/EC were implemented in Finland in 2000 by the Act Amending the Patents Act (650/2000) and by the Act Amending the Act on Plant Breeders' Rights (651/2000).

## 5.3.1 Assessment of Needs

- Further awareness improvement of the significance of PGR amongst national political decision makers and the public
- Improvement of the capacities and infrastructure of the national collection holders of PGRFA and crop-specific working groups
- Long-term funding mechanisms for the conservation of national collections and programme coordination
- National support for research on plant genetic resources, plant breeding and other activities promoting the use of PGR
- Capacity building to ensure the expertise for long-term conservation and documentation of national germplasm collections

CHAPTER 6

# THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION

## 6.1 Regional and Subregional Networks

The *ex situ* conservation of seed propagated crops and potato of Finnish origin is organized within the framework of Nordic Genetic Resource Center (NordGen, former NGB). This regional gene bank for five Nordic countries is responsible for seed storage, documentation, evaluation, characterization and regeneration of the material under common Nordic management. The former NGB regional network of crop specific experts has been the backbone of regional cooperation since the conservation activities were organized by the crop-specific working groups. Working groups (cereals, forages, fruit and berries, vegetables, potato, oil and protein crops) have been composed of experts in plant breeding and research from all five Nordic countries. It remains to be seen how the expert network will be organized within the new NordGen organization.

Finland is also a member of the European Cooperative Programme for Plant Genetic Resources (ECPGR). Since 2006 Finland has had a country quota of only 9 for participation in the activities of crop- and issue-specific working groups. However, the participation in the working groups is coordinated together with other Nordic countries and NordGen in order to gain an optimal representation in the working group meetings from the Nordic area. For Finland the most important ECPGR working groups are the ones dealing with cereals, fruits and berries, potato, forages, medicinal and aromatic plants as well as on-farm and *in situ* conservation. It is expected that the new AEGIS system will increase technical regional cooperation within Europe and add a new dimension to the current Nordic arrangements.

In 2006 an ECPGR workshop on "Climatic change and genetic resources in northern Europe" was organized by the Finnish National Plant Genetic Resources Programme. The workshop involved not only PGR experts from the five Nordic countries with territories above 64 N, but also experts from Russia, Canada and USA. In addition to the scientific outcome of the meeting, it was also recognized that inter-regional cooperation for the conservation and use of the most northern PGR is of great importance due to climate change.

Council Regulations (EC) No 1467/94 and No 870/2004 have provided important means to enhance the *in situ*, on-farm and *ex situ* conservation, characterization, collection and utilization with the aim to improving the management of genetic resources for food and agriculture. The projects concerning the Finnish PGR material have been managed by NordGen, expect for a project involving national collections of *Ribes* spp., which was coordinated by Finland.

## 6.2 International Programmes

As set out in the Government strategy, Finland channels support to the international CGIAR system and finances activities of four CGIAR Centers, ILRI, CIFOR, IFPR Iand ICRAF. The present funding is 1.4 million euros/year.

## 6.3 International Agreements

The most important international agreement relevant to plant genetic resources for food and agriculture during the past ten years is the International Treaty on Plant Genetic Resources for Food and Agriculture. It entered into force in 2004 and Finland ratified the Treaty the same year. Finland is fully committed to the provisions of the Treaty. The implementation of the Treaty is under way on both the Nordic and national level.

## 6.4 Global System for Conservation

## 6.5 Assessment of Needs

- Increased involvement of Finnish and Nordic experts in European regional cooperation and crop and thematic working groups to facilitate the effective and safe conservation and use of PGR within Europe
- A platform for cooperation between the countries dealing with PGR from the northern hemisphere above the Arctic Circle.
- Regional funding mechanisms replacing Council Regulations (EC) No 1467/94 and No 870/2004 supporting cooperative, targeted actions for the conservation, characterization, evaluation and use of genetic resources

CHAPTER 7

# ACCESS TO PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE, SHARING OF BENEFITS ARISING OUT OF THEIR USE, AND FARMERS' RIGHTS

## 7.1 Changes in Framework

The framework is described in section 6.3.

## 7.2 State of Access

The guiding framework for the access and benefit sharing policy for all genetic resources in Finland has been the Declaration by the Nordic Council of Ministers on Nordic approach to access and rights to genetic resources (Kalmar Declaration, 2003). Concerning the PGRFA, the Declaration makes reference to the Multilateral System (MLS) of the ITPGRFA. Before the International Treaty entered into force, the long-term Nordic policy has been that the access to all plant genetic resources should be open and without any benefit sharing obligations. In the same spirit, it is recommended in the Declaration that the coverage of the mls should be as broad as possible, while respecting private property rights, and that access to all plant genetic resources should be handled in the same manner.

Concerning the material in the Nordic Gene Bank (NGB, the predecessor of the NordGen), it is recommended that the NGB should provide access to all its accessions according to the terms of the same mta, regardless of whether they are covered by the scope of mls of the International Treaty or not. Access to all its accessions should be facilitated for all purposes, not only for use in the food and agriculture sector. The NGB should not claim any monetary benefits, but promote benefit sharing within the MLS. When receiving plant genetic resources the NGB should make it clear that these will be a part of a common public domain and made available under the MLS. The implementation of the Treaty may require revision of the Declaration text.

The national implementation of the Bonn Guidelines, including the drafting of the necessary legislation in Finland, has been dealt by a working group established under the Advisory Board on Genetic Resources in 2004. The mandate included the examination of the roles and responsibilities in the access to genetic resources and benefit sharing and, where necessary, the obligations set down by other agreements. The background survey presents alternative models for implementing the Bonn Guidelines, as well as the legislative and/or administrative action needed for each of the alternative implementation models. The working group considers that these questions need to be settled before any detailed administrative practices can be created.

CHAPTER 8

# THE CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

## 8.1 Contribution to Agricultural Sustainability

Plant genetic resources are one important factor enabling sustainable agriculture systems.

They form the basis for diversified, secure and high-quality agricultural production. Finland is a country with a wide range of production environments that differ, for example, as regards the length of growing season and soil properties. Finnish plant breeding has been successful in using PGR and breeding of varieties for the different climatic zones of the country. Quality demands by the food industry have also been taken into account in breeding goals. The large number of domestic varieties that cover 2/3 of the arable land of Finland provides evidence of the fact that PGR contribute to the agricultural sustainability of the country.

There have also been attempts to increase the diversity of crops in Finnish agriculture and horticulture. In particular, projects such as "The role and exploitation of biodiversity in crop production" and "Added value of increased biodiversity in crop production – new prospects for environment, farmer and consumer" carried out by MTT AgriFood Research Finland have contributed to more diversified crop production. One example is the production of high-quality caraway (*Carum carvi*) and Finland's position as one of the major producers of this crop in the world.

## 8.2 Contribution to Food Security

Even though domestic plant varieties are essential for food security in Finland, it is notable that almost a majority of the raw materials and inputs (such as oil-based products) used in agriculture are exported to Finland. If the import of key inputs is disturbed, the genetic factors contributing to yield and yield quality become crucial. Finnish varieties are bred for the northern growing conditions with a short growing season and, therefore, contribute to the food security of the country. Changes in self-sufficiency in foodstuffs measured by cereals and sugar is presented in Table 8.1.

TABLE 8.1
**Self-sufficiency in foodstuffs in Finland 1970 – 2007**

| | Production as % of consumption | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Product group** | **1970** | **1980** | **1990** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** |
| Cereals | 114 | 70 | 175 | 103 | 92 | 94 | 104 | 115 | 102 | 96 | 116 |
| Sugar | 27 | 60 | 91 | 71 | 71 | 73 | 61 | 69 | 75 | 52 | 40 |

### Self-sufficiency in Foodstuffs in Finland 1970 – 2007

Finland has a National Emergency Supply Agency that supports the breeding of minor crops and thus contributes to availability of domestic varieties of crop species of national interest to Finland. Such species are, for example, rye and potato. In addition, the National Emergency Supply Agency keeps reserve supplies of certified seed in case of emergencies.

## 8.3 Contribution to Economic Development

Plant genetic resources contribute to the economy of Finland by providing raw materials for plant breeding, which in turn develops varieties for the agricultural production carried out in the extreme growing conditions of the north. Finnish crop breeding programmes have resulted in higher yields, better quality, improved resistance against various diseases and pests, and field stability in the difficult northern growing conditions.

The anticipated climate change will bring along new challenges plant production in Finland, such as new pests and diseases. Positive effects in form of a longer growing season are expected, too. The demand for new sources of bio-energy is also a central question that concerns plant production in the north. These future challenges place further stress on the use of PGR in plant breeding for the benefit of Finnish agriculture, food production and economy.

## 8.4 Contribution to Poverty Alleviation

Development policy is an integral part of Finland's foreign and security policy. Development policy contributes to the global effort to eradicate poverty through economically, socially and ecologically sustainable development.

The main goal of development policy is to eradicate poverty and to promote sustainable development in accordance with the UN Millennium Development Goals set in 2000.

Finland places particular emphasis on the importance of issues relating to climate and the environment. Finland strives to ensure that all the work done in various forums to promote ecologically sustainable development, preserve biodiversity, combat climate change, prevent desertification and depletion of the soil, and protect the environment forms a coherent whole and has an effective impact on all development in both the developed and the developing world.

Development cooperation is a key instrument of development policy. It can be used to promote the strengthening of an enabling environment for development in the poorest countries in order to improve the preconditions for investment and trade and to achieve economic growth.

Development cooperation is not the only policy sector that generates development policy impacts but, for example, trade policy also plays a role. The industrial countries' obligation to change their production and consumption habits in an ecologically sustainable direction is also one form of development policy.

Finland canalizes the support for developing countries and their PGR conservation and use through the CGIAR system, as well as by appointing experts to relevant international PGR programmes and authorities. Finland also supports projects in developing countries, coordinated by the NordGen.

[SourceMinistry of Foreign Affairs(2006)]

APPENDIX A

# *IN SITU* CONSERVATION AREAS

TABLE A.1

**Protected Wilderness Areas**

| Wilderness areas | | | | | |
|---|---|---|---|---|---|
| **Area name** | **Latitude** | **Longitude** | **Km²** | **Establ** | **IUCN** |
| Hammastunturi Wilderness Area | 68°31′00″N | 26°37′00″E | 1 825 | 1991 | VI |
| Kaldoaivi Wilderness Area | 69°42′00″N | 28°04′00″E ° | 2 924 | 1991 | Ib |
| Kemihaara Wilderness Area | 67°56′00″N | 28°44′00″E | 302 | 1991 | VI |
| Käsivarsi Wilderness Area | 69°05′00″N | 21°30′00″E | 2 206 | 1991 | Ib |
| Muotkatunturi Wilderness Area | 69°08′55″N | 26°17′06″E | 1 570 | 1991 | VI |
| Paistunturi Wilderness Area | 69°48′00″N | 26°38′00″E | 1 579 | 1991 | VI |
| Pulju Wilderness Area | 68°18′00″N | 24°43′00″E | 614 | 1991 | VI |
| Pöyrisjärvi Wilderness Area | 68°37′00″N | 24°06′00″E | 1 280 | 1991 | VI |
| Tarvantovaara Wilderness Area | 68°33′00″N | 22°54′00″E | 670 | 1991 | VI |
| Tsarmitunturi Wilderness Area | 68°40′00″N | 28°25′00″E | 150 | 1991 | |
| Tuntsa Wilderness Area | 67°39′00″N | 29°34′00″E | 212 | 1991 | VI |
| Vätsäri Wilderness Area | 69°08′00″N | 28°21′00″E | 1 550 | 1991 | VI |

TABLE A.2

**National Parks**

| National parks | | | | | |
|---|---|---|---|---|---|
| **Area name** | **Latitude** | **Longitude** | **Km²** | **Establ** | **IUCN** |
| Archipelago National Park | 59°54′53″N | 21°52′39″E | 500 | 1883 | II |
| Eastern Gulf of Finland National Park | 60°17′05″N | 27°16′26″E | 6 | 1982 | II |
| Ekenäs Archipelago National Park | 59°49′22″N | 23°27′15″E | 52 | 1989 | II |
| Helvetinjärvi National Park | 62°02′00″N | 23°51′00″E | 49.8 | 1982 | II |
| Hiidenportti National Park | 63°52′22″N | 29°03′31″E | 45 | 1982 | II |
| Isojärvi National Park | 61°41′54″N | 25°00′39″E | 19 | 1982 | II |
| Kauhaneva-Pohjankangas National Park | 62°10′45″N | 22°24′23″E | 57 | 1982 | II |
| Koli National Park | 63°03′27″N | 29°53′14″E | 30 | 1991 | II |
| Kolovesi National Park | 62°15′27″N | 28°49′00″E | 23 | 1990 | II |
| Kurjenrahka National Park | 60°43′14″N | 22°23′01″E | 29 | 1998 | II |

| National parks | | | | | |
|---|---|---|---|---|---|
| **Area name** | **Latitude** | **Longitude** | **Km²** | **Establ** | **IUCN** |
| Lauhanvuori National Park | 62°09′07″N | 22°10′30″E | 53 | 1982 | II |
| Leivonmäki National Park | 61°55′58″N | 26°01′42″E | 29 | 2003 | II |
| Lemmenjoki National Park | 68°34′40″N | 25°36′01″E | 2 850 | 1956 | II |
| Liesjärvi National Park | 60°40′50″N | 23°51′30″E | 22 | 1956 | II |
| Linnansaari National Park | 62°06′38″N | 28°30′34″E | 38 | 1956 | II |
| Nuuksio National Park | 60°18′27″N | 24°29′57″E | 45 | 1994 | II |
| Oulanka National Park | 66°22′32″N | 29°20′19″E | 270 | 1956 | II |
| Päijänne National Park | 61°23′12″N | 25°23′36″E | 14 | 1993 | II |
| Pallas-Yllästunturi National Park | 68°09′32″N | 24°02′25″E | 1 020 | 2005 | II |
| Patvinsuo National Park | 63°06′41″N | 30°42′16″E | 105 | 1982 | II |
| Perämeri National Park | 65°37′22″N | 24°19′10″E | 157 | 1991 | II |
| Petkeljärvi National Park | 62°34′56″N | 31°10′49″E | 6 | 1956 | II |
| Puurijärvi-Isosuo National Park | 61°14′57″N | 22°34′01″E | 27 | 1993 | II |
| Pyhä-Häkki National Park | 62°50′44″N | 25°28′21″E | 13 | 1956 | II |
| Pyhä-Luosto National Park | 67°03′59″N | 26°58′25″E | 142 | 2005 | II |
| Repovesi National Park | 61°11′12″N | 26°54′14″E | 15 | 2003 | II |
| Riisitunturi National Park | 66°13′35″N | 28°29′31″E | 77 | 1982 | II |
| Rokua National Park | 64°33′22″N | 26°30′36″E | 4.3 | 1956 | II |
| Salamajärvi National Park | 63°16′19″N | 24°45′03″E | 62 | 1982 | II |
| Seitseminen National Park | 61°55′38″N | 23°25′32″E | 45.5 | 1982 | II |
| Syöte National Park | 65°44′51″N | 27°54′43″E | 299 | 2000 | II |
| Tiilikkajärvi National Park | 63°39′32″N | 28°18′15″E | 34 | 1982 | II |
| Torronsuo National Park | 60°44′04″N | 23°37′05″E | 25.5 | 1990 | II |
| Urho Kekkonen National Park | 68°12′25″N | 28°14′16″E | 2 550 | 1983 | IV |
| Valkmusa National Park | 60°33′46″N | 26°42′20″E | 17 | 1996 | II |

TABLE A.3

## Strict Nature Reserves

| Strict nature reserves | | | | | |
|---|---|---|---|---|---|
| **Area name** | **Latitude** | **Longitude** | **Km²** | **Establ** | **IUCN** |
| Häädetkeidas Strict Nature Reserve | 62°2′59″N | 22°45′6″E | 5.6 | 1956 | Ia |
| Karkali Strict Nature Reserve | 60°14′26″N | 23°48′2″E | 1 | 1964 | III |
| Kevo Strict Nature Reserve | 69°34′51″N | 26°42′56″E | 712 | 1956 | Ia |
| Koivusuo Strict Nature Reserve | 62°58′32″N | 31°24′12″E | 20 | 1982 | Ia |
| Malla Strict Nature Reserve | 69 3′56″N | 20°40′16″E | 29 | 1916 | Ia |
| Maltio Strict Nature Reserve | 67°23′42″N | 28°43′23″E | 148 | 1956 | Ia |
| Olvassuo Strict Nature Reserve | 65°6′45″N | 27°16′4″E | 71 | 1982 | Ia |
| Paljakka Strict Nature Reserve | 64°42′40″N | 28°2′40″E | 30 | 1956 | Ia |
| Pelso Strict Nature Reserve | 64°26′4″N | 26°14′22″E | 19 | 1982 | Ia |

| Strict nature reserves | | | | | |
|---|---|---|---|---|---|
| **Area name** | **Latitude** | **Longitude** | **Km²** | **Establ** | **IUCN** |
| Pisavaara Strict Nature Reserve | 66°16′54″N | 25°5′43″E | 49 | 1956 | Ia |
| Runkaus Strict Nature Reserve | 66°2′49″N | 25°31′34″E | 70 | 1956 | Ia |
| Salamanperä Strict Nature Reserve | 63°12′28″N | 24°47′51″E | 13 | 1956 | Ia |
| Sompio Strict Nature Reserve | 68°9′34″N | 27°23′37″E | 179 | 1956 | Ia |
| Sukerijärvi Strict Nature Reserve | 66°22′2″N | 28°54′26″E | 22 | 1982 | Ia |
| Sinivuori Strict Nature Reserve | 61°34′28″N | 24°43′44″E | 0.95 | 1956 | Ia |
| Ulvinsalo Strict Nature Reserve | 63°58′21″N | 30°22′28″E | 25 | 1956 | Ia |
| Vaskijärvi Strict Nature Reserve | 60°50′38″N | 22°15′4″E | 15 | 1956 | Ia |
| Vesijako Strict Nature Reserve | 61°21′2″N | 25°6′25″E | 1 | 1956 | Ia |
| Värriö Strict Nature Reserve | 67°44′16″N | 29°38′58″E | 125 | 1982 | Ia |

APPENDIX B

# ABBREVIATIONS AND SPECIAL TERMS

| | |
|---|---|
| **AEGISA** | European Genebank Integrated System |
| **CIFOR** | Centre for International Forestry Research |
| **CBD** | Convention on Biological Diversity |
| **CGIAR** | Consultative Group on International Agricultural Research |
| **CWR** | Crop wild relative |
| **EC** | European Community, now European Union |
| **ECPGR** | European Cooperative Programme for Plant Genetic Resources |
| **EU** | European Union |
| **FAO** | Food and Agriculture Organization of the United Nations |
| **ICBN** | International Code of Botanical Nomenclature |
| **ICNCP** | International Code of Nomenclature for Cultivated Plants |
| **ICRAF** | International Centre for Research in Agroforestry |
| **IFPRI** | International Food Policy Research Institute |
| **IVK** | IVK potatis AB, Umeûa. Organization maintaining Nordic *in vitro* potato cultures |
| **ILRI** | International Livestock Research Institute |
| **IUCN** | International Union for Conservation of Nature |
| **METLA** | Finnish Forest Research Institute |
| **MLS** | Multilateral System of the Treaty |
| **MTA** | Material Transfer Agreement |
| **MTK** | Finland's Central Union of Agricultural Producers and Forest Owners |
| **MTT** | AgriFood Research Finland |
| **NGB** | Nordic Gene Bank (now Nordic Gene Resource Center) |
| **NGO** | Non-Governmental Organization |
| **NordGen** | Nordic Genetic Resource Center (formerly NGB) |
| **PGR** | Plant Genetic Resources |
| **PGRFA** | Plant Genetic Resources for Food and Agriculture |
| **SESTO** | Genebank information system of NordGen |
| **Tike** | Information Centre of the Ministry of Agriculture and Forestry in Finland |
| **UN** | United Nations |
| **Accession** | Germplasm with a particular genetic composition that a genebank is committed to preserve and reproduce under conditions that do not change its genetic characteristics. |
| **Cultivar** | The preferred word for a cultivated plant variant that has been produced by man, through unintentional or intentional selection or breeding. The term is derived from "cultivated variety" |
| **Germplasm** | Plant material that can be multiplied, e.g. whole plants, seeds, spores, tubers, roots, cuttings or any living or dormant tissue from which the plant can be reproduced |

| | |
|---|---|
| **Landrace** | A common but, with reference to plants, somewhat inaccurate term that denotes locally cultivated germplasm that has become adapted to a local environment. The concept was first used by V.I. Vavilov, though he did not use the term landrace but referred to such germplasm (in Russian) as "original types". The term is used widely in the English language but it has been suggested that the terms 'primitive cultivar' or "local cultivar" would be better choices because the word "race" is not a botanic term and because "cultivar" can also be used for clonal material. The corresponding word in Finnish is "maatiainen" |
| **Sample** | A set of seeds, a cutting or any tissue that represents an accession |
| **Variety** | In botanic nomenclature, a denotion of taxonomic rank (abbreviated 'var.' or 'v.') between subspecies (subsp. or ssp.) and form (f.). In legal texts and international agreements the term variety is often used to denote cultivars, in conflict with the definitions given in Botanical Codes of Nomenclature (ICBN and ICNCP) |

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