HELLENIC REPUBLIC
MINISTRY OF RURAL
DEVELOPMENT AND FOOD

GENERAL DIRECTORATE
OF AGRICULTURAL APPLICATIONS
AND RESEARCH
DIRECTORATE OF PHYSICAL
PLANNING & ENVIRONMENTAL PROTECTION

G R E E C E

SECOND COUNTRY REPORT CONCERNING THE STATE ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Supervising Authority
Directorate of Physical Planning and Environmental Protection

Responsible Body of the Report
Greek Gene Bank, National Agricultural Research Foundation

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This report is carried out in force of the 137281/26-08-2005 Decision of the Secretary General (Agricultural Policy and International Affairs) of the Ministry of Rural Development and Food concerning the "Definition of the Supervising Authorities responsible for the preparation of the 2nd National Report of FAO concerning the State of the Plant Genetic Resources for Food and Agriculture".

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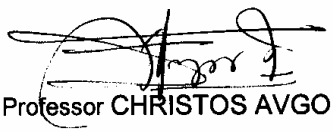
PREAMBLE

Plant Genetic Resources for food and agriculture are probably the most important part of agricultural biodiversity considering their significance for present and future agricultural production and food security. They constitute the basic material for breeding and in this sense they represent a strategic asset for national, regional and global agriculture. Therefore, their protection, conservation, scientific study and effective use are an obligation of both sovereign states and the international community which should adopt all measures necessary in order to guarantee food security, sustainability and the welfare of the agricultural sector.

The 2nd National Report entitled "Greece: Second country report concerning the state on plant genetic resources for food and agriculture" is a step towards the implementation of the International Treaty of FAO (2001) which was ratified by Greece in 2003. In addition, this report constitutes a national exercise for effective planning of the future State policy by identifying the weaknesses and the insufficiencies, evaluating the progress made over the last decade and proposing further coherent actions and initiatives.

The main aim of this report is to present the situation of Greek Plant Genetic Resources (PGR), in the context of a long-term conservation (both *ex situ* and *in situ*), the national plans for conservation of local varieties under cultivation (*on farm*), the marketing of plant propagation material, the legislative framework on PGR, the research being conducted by related bodies, as well as to set the priorities and prospects for a sustainable management of PGR. Furthermore, the report extends to forest PGR which directly or indirectly influence the viable development of agriculture in Greece.

I strongly believe that this report fully reflects the attempts undertaken by Greece as well as the progress made so far regarding the state of PGR. I also hope it will prove to be a strategic tool for the planning of national policy aiming at the conservation and effective use of PGR for Food and Agriculture as well as the sustainable development of agriculture in Greece.



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SECTION I. EXECUTIVE SUMMARY

The Hellenic Ministry of Rural Development and Food is the national Competent Authority for the protection and the sustainable management of Plant Genetic Resources (PGR) for Food and Agriculture. The preparation based on the definition (137281/26-08-2005 numbered Decision of the Secretary General for the Agricultural Policy and International Affairs) which nominated the Working Group and the procedure of the compilation of the report. In addition, the procedure for preparing the Report included the publicity of the writing initiative (website development, letter of notice to stakeholders), the General Secretary's invitation to stakeholders (Universities, Technology Education Institutions, Institutes, private sector, e.t.c.) to take part in the report writing procedure through questionnaires, and the deliberation between the related state services. All these trails aimed at the sufficient depiction of the PGR reality in Greece.

The interest on PGR started in early 1920's, where systematic germplasm collections started in Greece, by the newly established major crop breeding institutes (Cereal Institute, Cotton Institute, Institute of Fodder Crops, etc.) of the country. Successful utilisation of local and introduced germplasm collections led to the development of a series of modern cultivars which made the country self-sufficient for a number of crops crucial to human and animal nutrition and industry (wheat and other cereals, fodder, pulses, vegetables, cotton etc.) as early as since 1957 and shortly afterwards to surpluses and exports. However the early germplasm collections were soon lost for various reasons, most important of them being the limited scientific knowledge on the proper conditions for safe long-term seed storage and the total lack of appropriate storage facilities and equipment.

The modern era for Greece regarding genetic resources conservation and use began in 1981 with the establishment of the Greek Gene Bank (GGB) by the Ministry of Agriculture at the Agricultural Research Centre of Macedonia and Thraki under the support of FAO.

Another important step was the establishment of the National System for Plant Genetic Resources in 1990 (Presidential Decree No 80/1990). The system is directed and supervised by the Directorate of Physical Planning and Environment Protection of the Ministry of Rural Development and Food (former ministry of Agriculture). The Greek Gene Bank of the National Agricultural Research Foundation (N.AG.RE.F) serves as the co-ordinating scientific and implementing body for this project, supported by all the major crop breeding institutes of the country, which also belong to NAGREF. Other conservation and research bodies, such as Universities, Technological Educations Institutions, botanical gardens, natural history and agricultural museums, as well as non-

governmental environmental protection groups and heritage seed networks could be linked through this framework and could contribute to the protection, study and utilisation of the country's genetic resources. Formal cooperation of all the above stakeholders is the main priority for the coming decade, in order to secure task sharing, good coordination and optimal use of all available scientific potential of the country in this field.

Significant progress was made since 1995, the time of compilation of the first national report. The number of germplasm accessions of the GGB was raised from 7,220 in 1995 (belonging to 66 genera and 169 species of crop plants and relatives) to 10,650 in 2005 through a series of collecting expeditions within the country.

A significant part of the accessions (Wheat, Barley, Maize, Rice, Oats, Gabbage, Sugar Beet, Carrot, Onion, Eggplant, Grapevine, Minor Fruits), maintained in the Greek Gene Bank or in the gene banks of certain crop breeding institutes of NAGREF (i.e. Cereal Institute, Agricultural Research Centre of Macedonia and Thraki, Grapevine Institute), were regenerated, characterised and evaluated for a number of important agronomic properties through a number of EU co-funded Programmes such as those of the Regulation 1467/94/EC, other EU initiatives and national funding initiatives. Many Institutions of NAGREF have also participated in relevant crop breeding networks of European Cooperative Programme for Crop Genetic Resources (ECP/GR) which is the major scientific platform for PGR activities for Europe.

In the last years major progress was made with the approval of Project “Plant Gene Bank”, Measure 6.3/Action B in the framework of the Operational Program of Rural Development-Reconstruction of Countryside (3rd Cohesion Fund Support). This project will provide new administration, seed storage and laboratory facilities and will enable a thorough survey of the country through a large number of exploratory and germplasm collecting missions and an extensive regeneration, multiplication and characterisation/documentation of the collected germplasm. The total budget of the project is 2.42 millions € and it ends on 31-12-2008. This project will have to be reevaluated for extension of its facilities taking into account the importance of the PGR in the framework of rural policy in Greece the next decade.

On farm and *in situ* (or Genetic Reserve) conservation should be an apriority among the priorities for the coming decade, through either national or EU programmes. A step towards this direction is also the newly adopted regulation 870/2004 on PGR, replacing regulation 1467/94/EC. The newly also adopted Regulation 1698/2005 offers a context of measures related to agri-environment and the NATURA 2000, which could also

promote the protection and conservation of Plant Genetic Resources for Food and Agriculture (PGRFA).

The future of PGRFA activities in Greece seems to be promosing. Despite the limited resources, all crop breeding institutes and forest research institutes of N.AG.RE.F. made significant steps to improve germplasm conservation (seed storage facilities, field collections or protected areas) and use in their research and breeding programmes. A number of Agricultural Universities have included PGR post-graduate studies in their curricula, and have initiated research projects in this field (especially Agricultural Universities of Athens, Thessaloniki and Thessaly). Botanical Gardens, as well as University departments in the field of Biology have shown earnest interest in promoting either conservation or specific research on certain species or research topics. Biology Faculties and relative institutions have developed actions on '*in situ*' management of wild relatives species or drafting of *in situ* management plans.

There are also significant of non-governmental initiatives, which reveal the real interest and concern of farmers, environmentalists, ecologists and the general public, for the protection and conservation of traditional varieties, cultural systems and processing practices leading to clean, healthy and environmentally sound practices and products.

The major administrative, legal and policy issues for the coming decade are:

1. The establishment of a strong and functional national committee on Plant Genetic Resources under the general supervision of the Directorate of Physical Planning and Environment Protection of the Ministry of Rural Development and Food (former ministry of Agriculture) and the technical coordination of the Greek Gene Bank of NAGREF.
2. The encouragement of the activated role of the Gene Bank as a coordination body at national level and extension of its activities on regional level.
3. The funding of national research projects on PGR (*ex situ, in situ*, pre-breeding, ect.) as well as the support of the conservation activities on PGR.
4. The updating and enforcement of the legal framework taking into account the on going conditions (International Treaty, Bohn Guidelines) at national and international level.
5. The collaboration of PGR bodies of regional and international status in order to develop agreements on the share benefit of the PGR transfer and utilisation.

The major priority issues focused on the management of the PGR are the following:

1. The inventory of PGR, including all the stages and procedures (characterisation, documentation, assessment, ect.), sufficient to a long-term plan of conservation.
2. The implementation of *in situ* and *on farm* conservation schemes, particularly in marginal productivity agricultural areas of the Greek islands and Mainland Mountains, for the protection of landraces and wild relatives.
3. The development of a national plan for the protection of the germplasm of various crops currently facing the danger of extinction.
4. The utilisation in breeding programmes (conventional or advanced genetic engineering tools) for the assessment of the PGR and certainly the adaptation to low input farming systems using traditional landraces as starting material and the promotion of quality products.
5. The establishment of a network for monitoring agricultural biodiversity to prevent further genetic erosion, and the adoption of indicators to monitor the effectiveness of the new EU policies in protecting biodiversity, wildlife habitats and agricultural landscapes.

All the aforementioned priorities and targets should be successfully accomplished as long as all the PGR stakeholders (Universities, research sector, NGO, private sector, ect.) in Greece strongly contribute and cooperate under the auspices of the Ministry of the Rural Development and Food.

Section II. AN INTRODUCTION TO GREECE AND ITS RURAL SECTOR

1.1 Geographical position

Greece is part of the European continent. It is located in the eastern side of the Mediterranean basin, being the most southern part of the Balkan peninsula. It has an area of 131,944 sq. km., 106,777 of which represent its continental mainland and 25,166 its islandic part. Greece extends from 34 48 'N to 41 45' N degrees geographic latitude, and from 19 22' E to 29 38' E geographic longitude. The country is surrounded from 3 sides by sea (by the Ionian sea in the west, by the Aegean sea in the east and the Libyan sea in the south) and only in the northern part has terrestrial borders with other states (Albania, the F.Y.R.O.M., Bulgaria and the European part of Turkey). The Ionian sea separates Greece from Italy in the west, the Aegean sea from Turkey in the East and the Libyan Sea from the northern Africa. Its versatile coastal line is nearly 15,000 km long. Greece has a large number of medium to small size islands. 76 of them, are of considerable size and inhabited.

Figure 1: Map of Greece

1.2 Physiography and Climate

The country is generally characterised as mountainous, having an average elevation of 502 m. above sea level, and presenting more than 40 mountains peaks over 2,000 m. Only 33% of its area is lower than 200 m. in altitude. The remaining part (67 %) is hilly or mountainous. The continental mainland part is crossed from north to south by Pindos, a mountain range which is regarded as the southern branch of the central European Alps. The highest peak in Greece is mount Olympus, 2,917 m. high, renowned from mythical times as the home of Gods.

Its climate ('Mediterranean' type) is characterised by rains during 3 seasons (autumn, winter and spring), and drought accompanied by high temperatures in the summer. In the continental mainland there is wide variation in microclimates attributed to the pronounced mountainous profile, ranging from the mild Mediterranean type to the harsh «Central European» climatic type (characterised by extremely low winter temperatures, broad annual temperature range, prolonged winters and a trend for uniform rainfall distribution throughout the year). Representative areas of this climatic type are common in northern Greece. Main factors affecting the climatic types of Greece are the influence of the Atlantic ocean and the Asiatic continent, the profile of the land and the vicinity and continuous alternation of land and sea. Climatic differences of that scale, even between neighbouring sites, are encountered only in few parts of the world.

1.3 Population

The total population of Greece in 2005 is 10,964,020 of which 5,427,682 are male and 5,536,338 female. 1,664,085 are between 0-14 year old, 7,468,395 between 15-64 and 1,831,540 older than 65. A comparison between Greece's population in 1991 and 2001 is presented in Figure 2.

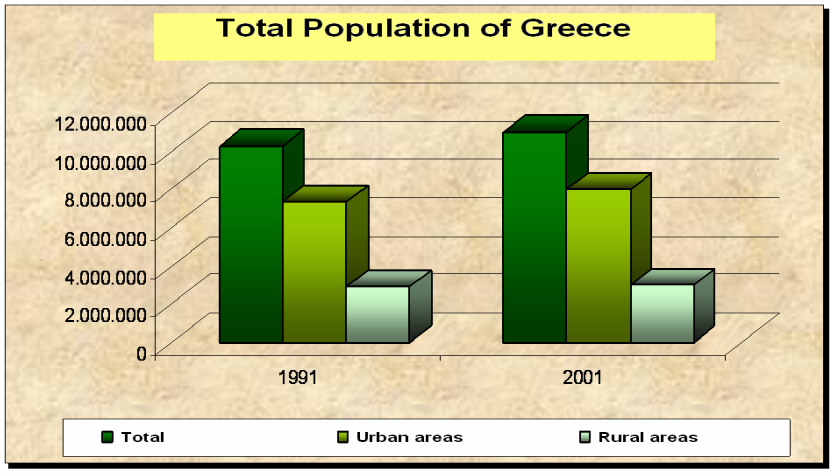

Figure 2: Population status between two decades and allocating in urban and rural areas.

The agricultural population is estimated to 1,448,190 people, distributed according to figures 3 and 4; 202,836 are between 0-14 year old, 166,706 are between 15-24, 184,444 are between 35-44, and 370,541 are between 45-64. The percentage of the agricultural population has dropped from 27% in 1987 to 21.3 % in 1994 and to 13.2 % in 2004. This percentage is still very high comparatively to the EU standards but is expecting to be declined almost 90% of the rural youth seek for occupation outside the farming sector. Figures 3 and 4 present the distribution of the agricultural population per region, age and productive age (plant, animal, forestry and fisheries) as it is today.

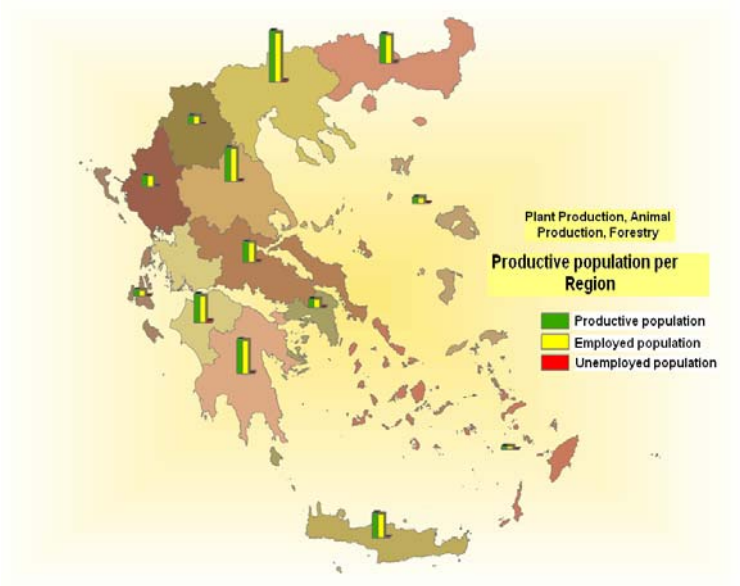

Figure 3: Productive population per region.

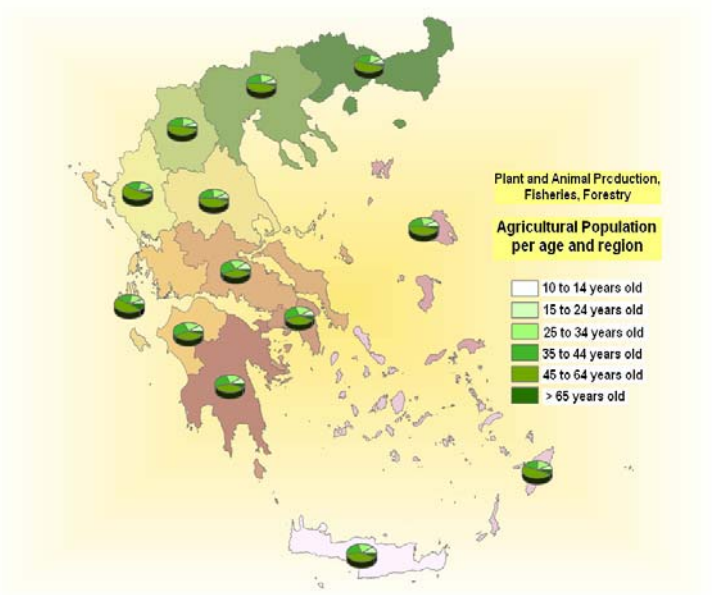

Figure 4: Agricultural Population per age and region.

1.4 Profile of Agricultural Sector

1.4.1 Main Farming Systems and Crops

Nowadays, agriculture in Greece is one of the main sectors of the economy, aiming mainly at the interior, but also with good prospects for the global market. The contribution of agriculture in the gross national product and exports during the last year is shown in Table 1.

Table 1: The contribution of agriculture to the gross national product and exports during last year.

	Jan- Oct 2004		Jan- Oct 2005				Jan- Oct 2004	Jan- Oct 2005
World wide Trade	**Imports ($x10^6$)**	**Exports ($x10^6$)**	**Imports ($x10^6$)**	**Exports ($x10^6$)**	**Imports Trend**	**Exports trend**	**Greek World Trade Balance**	
TOTAL Agricultural Products	4,086.5	2,158.6	4,115.2	2,577.9	**0.7**	**19.4**	-2,209.4	-1,813.6
Livestock	75.7	2.1	67.0	2.8	-11..5	33.1	-73.6	-64.2
Meat	694.1	17.5	780.7	23.1	12.5	32.1	-676.6	-757.6
Milk & eggs	509.6	148.7	527.6	145.3	3.5	-2.3	-360.9	-382.3
Fish	285.4	269.2	296.6	288.4	3.9	7.1	-16.2	-8.3
Cereals	396.4	117.7	373.7	182.0	-5.7	54.7	-278.8	-191.7
Fruit and Vaegetables	534.2	725.1	490.5	858.9	-8.2	18.5	190.9	368.4
Sugar & Honey	115.8	20.3	89.9	35.0	-22.4	72.3	-95.5	-54.9
Coffee, tea, cocoa	198.2	22.2	210.4	20.2	6.2	-9.3	-176.0	-190.2
Fodder	219.1	23.6	204.4	23.0	-6.7	-2.5	-195.5	-181.3
Food	207.3	51.8	205.9	62.1	-0.7	19.9	-155.5	-143.8
Drinks	299.3	110.2	329.6	107.5	10.1	-2.4	-189.1	-222.1
Tobacco	243.9	251.7	252.2	319.8	3.4	27.1	7.8	67.6
Leather	58.1	14.8	63.7	15.5	9.7	5.0	-43.3	-48.2
Oily Seeds	126.8	34.8	108.4	36.2	-14.5	4.1	-92.0	-72.2
Plant fibres	10.7	234.6	10.6	177.8	-0.9	-24.2	223.9	167.2
Oils and Fats	110.3	114.3	102.2	280.2	-7.4	145.2	4.0	178.1
Wheat and Corn starch	1.6	0.0	1.8	0.1	14.9	232.6	-1.6	-1.7

All amounts in EUROS(€)

The agricultural (total) area of Greece is 3.8 million Ha of which 16% is arable land and 5% permanents crops. Beside cultivated land, the animal husbandry is relied in different degrees on natural grasslands and scrublands and cultivations by-products for the coverage of the feeding requirements of ruminants.

This land is allocated to those crop categories that are mentioned in Figure 5, concerning the years between 1995 and 2004. The average set aside land for the same period is about 45.000 Ha.

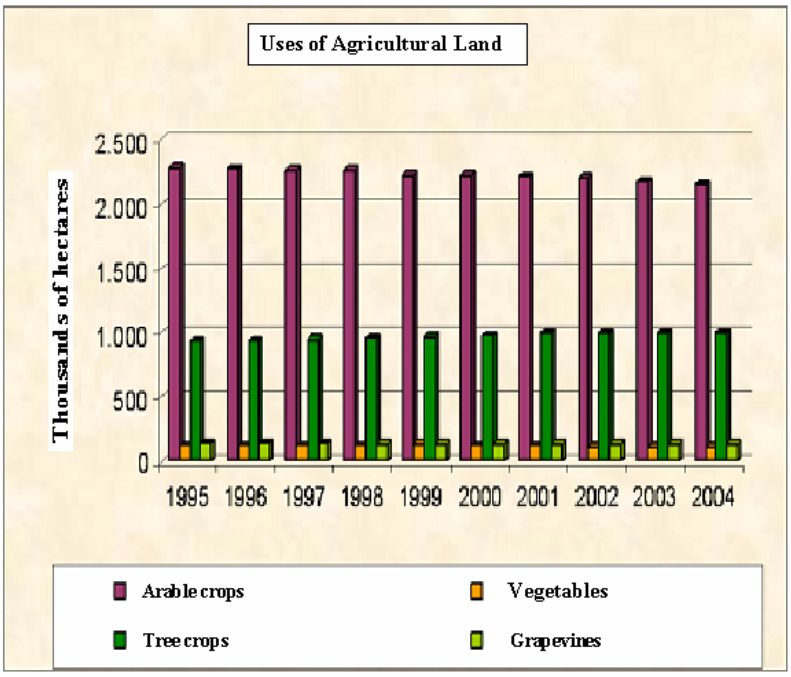

Figure 5: Allocation of agricultural land uses.

1.4.2 Economic significance of the Agricultural sector

The average family lot size in Greece is only 4.2 Ha. The highest average of agricultural areas per holding is located in northern Greece (west Macedonia) and the lowest in west Greece. On the other hand, the highest average of Ha per agricultural area is located in Thessaly region and respectively the lowest in Attica (Fig. 6).

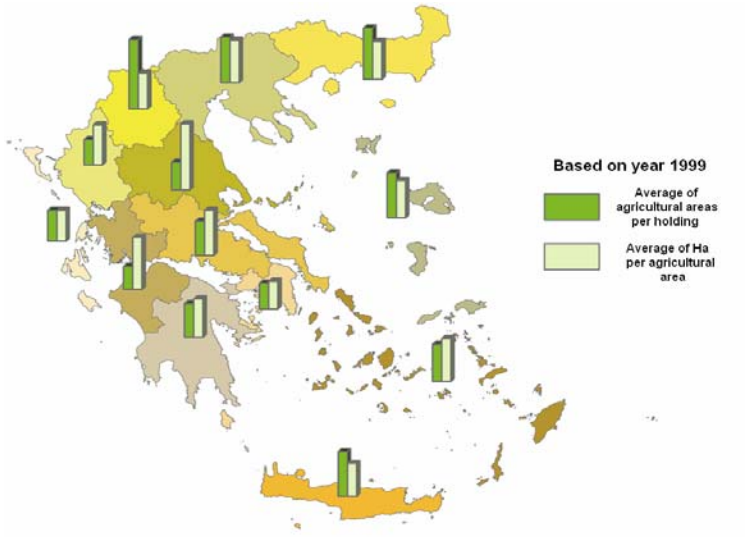

Figure 6: Allocation of average of agricultural area per holding and size (Ha) per agricultural area.

The distribution of the Agricultural lot sizes in Greece (2004) appears in Figure 7.

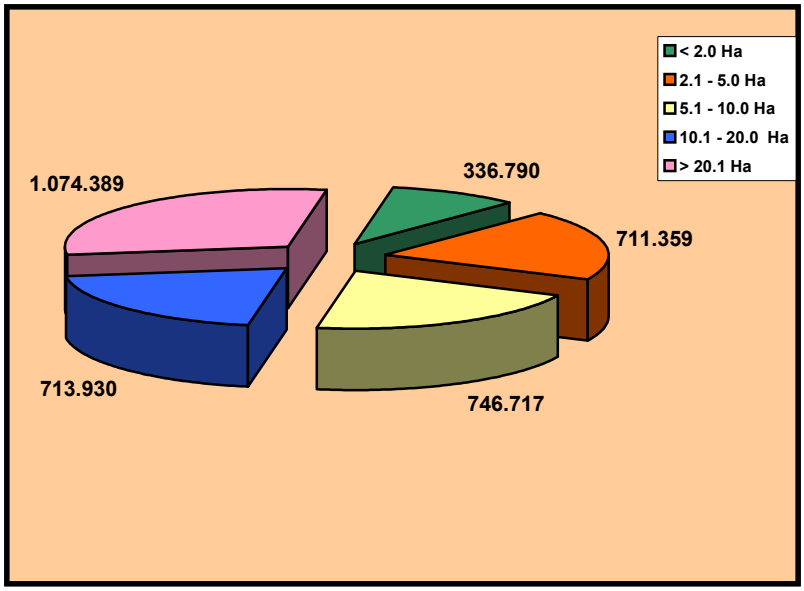

Figure 7: Classification of agricultural lot size according to size category (2004)

Most Greek land is farmed (rangelands included). This fact alone highlights the importance of farming for the European Union's natural environment. Farming supports a diverse rural community that is not only a fundamental asset of Greek culture, but also plays an essential role in maintaining the environment in a healthy state. The link between the environment and the farming practices is very complex. While many valuable habitats in Greece are maintained by extensive farming, and a wide range of wild species rely on this for their survival, agricultural practices can also have an adverse impact on natural resources.

1.5 Profile of the Forest Sector

1.5.1 Characteristics of forest structure in Greece

According to the First National Inventory of Forest (1992) the distribution of forest and other wooded land by origin of forest and by ownership structure are shown in Table 2 and Table 3, respectively.

Table 2. Distribution of forest and other wooded land by origin of forest.

Type	**Area** (1000ha)
Natural	6,250.0
Man-made	224.0
Semi-natural	39.0
Poplar plantation	9.6

Table 3. Distribution of forest and other wooded land by ownership structure.

Status	Forest (1,000ha)	%	Other wood land (1,000ha)	%	Total forest land	%
State	2,200	65.5	2,626	83.3	4,826	74.1
Community	403	12.0	183	5.8	587	9.0
Private	269	8.0	154	4.9	423	6.5
Other	487	14.5	190	6.0	677	10.4
Total	**3,359**	**100**	**3,154**	**100**	**6,513**	**100**

1.5.2 Economic Product of Forest

Investments in the sector of forestry are relatively low compared to other sectors. The annual percentage of gross domestic asset formation of the country ranged from 0.45 to 0.82 % during the period 1985-1994. These percentages are very low in order to protect and develop the forest resources, which cover 50% of the country's total area. Therefore, forestry funding are supported by the Ordinary Budget, the Investment Budget, the Central Fund of Agriculture, Livestock and Forests, the European Union and other sources.

The level of investments in non-state forestry is also very low. Increase and improvement of growing stock, which forms one of the basic objectives of organised forestry, are achieved by applying sustainable forest management, timber reserves, proper silvicultural treatment of forest stands and of course by reforestation, 90% of which are productive.

Lately there is a decrease in timber production because of a lack of forest projects.

During 2003 1,110,718 m^3 timber products have been produced from the State forests of all types (technical, industrial and wood fuel). The above quantities have been mainly logged from main forest species, such as *Abies, Picea, Pinus, Fagus Quercus, Castanea* and some other broadleaves. As far as it concerns the private forest sector, in 2003 have been produced 345,108 m^3 wood products and 194,575m^3 wood fuel.

1.6 Main trends of the agriculture and forestry sectors

With few exceptions, Greece has significant surpluses in almost all major crops. Greece is very deficient in animal products (especially in bovine meat and milk), wood and wood products (paper etc). The balance of the agricultural trade was positive in 1981, but it became strongly negative afterwards, due to the open market under the EU regulations and other international agreements, the higher competition by the imported products and

the increased seasonal demand for food to cover the needs of the high number of tourists visiting the country every year.

Greek agriculture is in a critical transition stage today, facing the adverse effects of a changing common agricultural policy (CAP) of the EU and strong competition in the context of the liberated international agricultural production and trade agreed at the World Trade Organization (WTO).

The Greek agricultural sector faces several constraints. It cannot stand to the easily international competition, neither as an economy of size nor as an economy of low cost. To adapt to the new extremely competitive environment Greece has to take measures to promote the use of novel and thus more competitive crops, to shift towards the production of named quality products and /or to organic farming and possibly to the introduction of energy crops. In addition, it has to support the marginal rural communities with agri-environmental measures for their contribution to the conservation of the agricultural biodiversity, cultural systems and traditional processing practices, the diversity of agro-ecosystems, landscapes and habitats, recognising the multifunctionality and importance of agriculture for the welfare of the rural areas.

The Forest Sector contribution to the GDP is generally low. Over the last decade, a further significant reduction was observed. The main reason is that the country's forests are of low productivity as their role in general is protective. Secondly, the benefits resulting from the role, can not be assessed in economic terms and thus are not registered in the national accounts. Furthermore, the reduction of the forestry contribution to the GDP over the last decade can be attributed to the higher productivity achieved by the other sectors of the national economy.

Section III

Chapter 1: THE STATE OF DIVERSITY

1.1 Introduction

Greece is one of the richest countries in Europe and an important hotspot in the Mediterranean area regarding plant species diversity. The biogeographic position of the country at the crossing of three continents (Europe, Asia, Africa), the high topographical diversity, the complex geological history and the continuous for millennia, relatively mild, human interferences have been resulted in a great diversity of habitats that host a remarkable plant species diversity. The total number of vascular plant species is approximately 5,600 and the total number of vascular plant taxa (species and subspecies) is approximately 6,500. Additionally, about 2,000 species of fungi have been described so far, contributing just a small fraction of the total species number of these little-studied organisms.

The restricted distribution of many plant species is an important feature of the Greek flora. About 1,275 plant taxa (c. 19.6% of the total flora) are endemic to Greece. Many of these taxa have extremely restricted distribution ranges, mainly due to the isolated areas of the Greek islands and the high mountains of the Greek mainland. For this reason, consequently they are very sensitive to disturbance. The geographical and ecological fragmentation of Greece into many isolated areas (islands, mountains, valleys, “edaphic islands”, etc.), its geographical position and its refugial nature during Pleistocene glaciations have positively influenced the formation of the present conditions. As a general rule, the areas of central and northern Greek mainland have high plant species diversity, while the areas of southern Greek mainland and the Greek islands are rich in unique elements (endemic, rare and threatened species).

Although the Greek territory has been systematically explored for several decades, the total picture of the Greek flora is still not complete. The most important publications concerning the Greek flora include “Flora Europaea” and “The Mountain Flora of Greece” which includes mountainous areas over 1,500 m. The “Flora Hellenica Project” is in progress and currently only two out of the nine programmed volumes have been published. The completion of Flora Hellenica will be a valuable contribution to the knowledge of the Greek flora, since descriptions, additional data and detailed distribution maps are provided for all Greek plant taxa.

Pollution of soil, water and air, fragmentation of habitats and loss of wildlife can be the result of inappropriate agricultural practices and land use. European CAP aims at minimising the risks for the environment (e.g. degradation), while encouraging farmers to

continue to play a positive role in the maintenance of the countryside and the environment by targeted rural development measures and by contributing to securing farming profitability. Thus, the environmental issues play a significant role in the CAP, which deals both with the integration of environmental considerations into CAP rules and with the development of agricultural practices in order to preserve the environment and safeguard the countryside. In the framework of the Regulation 1257/99 a few agro-environmental projects were carried out funding by the National Rural Development Plan and the Operational Programme Construction of the Rural Development-Reconstruction of Countryside 2000-2006.

1.2 The state of diversity of crop wild relatives and wild plants for food production

Plant genetic resources in Greece are analogous to its rich natural environment and its long agricultural history. Taking into account its limited size, Greece is considered among the richest countries in natural vegetation and crop wild relatives (CWRs) in Europe. This excessive species diversity has been the result of natural selection forces, spontaneous seed transfers by migrating birds and animals or periodic introductions of seeds and plants by a multitude of human populations that at times have passed through or settled in the country from prehistoric times.

No accurate studies on the wild relatives of cultivated plants have been made in Greece. However, it is thought that at least 10% of the wild plant taxa can be considered as "classical" wild relatives i.e. related to traditional cultivated plants like cereals, forages, etc. This percentage will be much higher (more than 50% of the total flora), if a more modern concept of wild relatives is used i.e. those species related to any cultivated plants, including aromatic, medicinal and ornamental plants. In the broaden context the Greek ones could include:

- A large list of indigenous wild species, relatives of present or past crops, ancestors of cultivated species around the Mediterranean basin (e.g. *Trifolium*, *Medicago*, *Vicia*, *Brassica*, *Raphanus*, *Daucus*, *Prunus*, *Allium*, *Crocus*, *Triticum*, *Hordeum*, *Aegilops*, *Lolium*, *Avena*, etc.). For many of these genera, Greece is an important center of diversity including a significant number of taxa, many of them endemics (e.g. *Allium*, *Crocus*, etc.).
- Wild species used as food or industrial plants and cultivated/domesticated in the past (e.g. *Cichorium intybus*, *Silybum marianum*, *Scolymus hispanicus*, *Portulaca oleracea*, *Punica granatum*, *Sonchus* spp., *Ceratonia siliqua*, etc.).

- A large list of native wild species, relatives of important ornamental plants (e.g. *Tulipa*, *Paeonia*, *Rosa*, *Anthemis*, *Crocus*, *Dianthus*, *Hypericum*, *Galanthus*, etc.). For many of these genera, Greece is also an important center of diversity.
- Wild species directly used for human nutrition, condiments and concoctions (e.g. *Muscari*, *Capparis*, *Origanum*, *Salvia*, *Mentha*, *Sideritis* sect. *Empedoclia*, *Thymus*, *Satureja*, *Ferulago*, *Rubus*, *Fragaria*, *Matricaria*, *Tilia*, *Asparagus*, *Pistacia*, etc.).
- Wild species used in the past to generate the genetic pool of present crops (e.g. *Prunus* ssp., *Tulipa* ssp., *Beta* ssp., *Cynara* ssp., etc.).
- Naturalised representatives of cultivated species integrated in the nature (e.g. *Juglans regia*, *Vicia sativa*, *Sesamum indicum*, etc.).
- Representatives of neglected crops naturalised or integrated in natural areas (e.g. *Genista tinctoria*, *Rubia tinctorum*, *Rosmarinus officinalis*, etc.).
- Wild or naturalised plants used as rootstocks for productive crops (e.g. *Olea europaea* subsp. *sylvestris*, *Prunus mahaleb*, *Pistacia terebinthus*, etc.).

Greece was one of the most ancient cradles of agriculture and the wealth of cultivated plants in the country is analogous to the native ones. Main factors contributing to the this result are the diverse natural environment of the country, the early commercial relations with neighboring areas in the Eastern Mediterranean and the Black Sea, the abundant isolated areas, the early development of scientific and practical knowledge in botany, agriculture, medicine, etc, and the massive human population movements from the Neolithic to modern times.

The combination of a favourable natural environment and the agricultural practices of self sufficiency, in the beginning of the 20th century, have led to the maintenance of a large number of landraces well adapted to the local conditions. The category includes both species originated or diversified in Greece (leguminous crops such as *Cicer, Lens, Vicia, Pisum* and *Lupinus*, vegetables such as *Brassica, Lactuca, Cichorium, Beta*, trees such as *Olea, Ficus,* etc. and grapevine) and species introduced in Greece centuries ago which were afterwards evolved and adapted to the local conditions (many fruit-plants such as *Malus, Pirus, Prunus,* etc., cereals such as *Triticum, Hordeum, Secale,* etc., and vegetables such as *Phaseolus, Lycopersicon, Solanum, Capsicum,* etc.).

However until the end of the 1970s the dramatic depletion of PGR occurring in Greece was not fully appreciated. This situation was the result of the modernisation of the agricultural production and trades. National legislation provided with a generalised protection of the environment and biodiversity but without targeting on species of agricultural board interest.

Chapter 2: The state of *In Situ* Management

2.1 Introduction

A significant part of the CWRs diversity in Greece is included in protected areas under various regimes as it is shown in Table 4. In some cases, there is overlapping of two or more protected areas. This results to the fact that the total size of protected areas in Greece is smaller than the sum of the areas of all categories.

Table 4. National, international and European Union designated protected areas of Greece related to the conservation of CWRs.

Category	no. of areas	area (ha)
Absolute Nature Reserve Area	2	748
Aesthetic Forest	19	32,506
Core zone in National Park	10	34,588
National Park - Peripheral Zone	5	34,254
Nature Reserve Area	5	4,323
Natural Monuments and Landmarks	51	16,840
Ramsar Wetlands	11	167,301
World Heritage Area	2	34,087
Biogenetic Reserves	16	22,261

Nevertheless, general protection of an area does not automatically mean protection of certain species of interest. Therefore protection of genetic resources in such areas should focus on specific targets with management measures in ecosystem and species level.

2.2 Genetic erosion

Most wild species of wide distribution are not facing immediate threat of genetic erosion or extinction (cereals, forages, pulses, aromatic-medicinal plants). However, the danger for certain categories is great and the threat of extinction is a reality. Such species are for example the wild Tulips of Crete (*Tulipa cretica* and *Tulipa saxatilis*) which are grown spontaneously on a limited number of suitable coastal sites and which now face the pressure of tourist development, *Beta nana* on the mountains of the Greek mainland, *Cicer graecum, Crocus goulimyi, C.pelistericus, C. robertianus, Dianthus xylorrhizus, Medicado heyniana, Origanum symes, O. vetteri, Paeonia parnassisa,* ect. Similar but less menacing is the threat for wild *Beta maritima* coastal populations. Among the threatened species are also certain unique aromatic and medicinal plants of the country (*Sideritis ssp*. or 'Greek mountain Tea', *Origanum*

dictamnus, the famous "Dictamon" of Crete etc.) due to their excessive overexploitation, putting at risk the limited natural populations.

With the advent of the modern market oriented agriculture, Greece has suffered dramatic losses in its cultivated germplasm, which was displaced by superior modern varieties produced by the local breeding institutes or was imported from abroad. The erosion was particularly intense and rapid in cultivated cereals, where the local populations and varieties cultivated today hardly account for 1% of the total allocated acreage. An analogues trend, but with a 15-20 years' delay compare to this of cereals, is now becoming apparent for the vegetable crops, where in the last years local landraces are rapidly displaced even from backyard gardens.

Traditional varieties are still used in many tree crops (olive, apples, cherry, apricots, pears, nuts) and in the grapevine. However the number of varieties used at a large scale has been substantially reduced.

The main reason for this genetic erosion was the unquestionable superiority of the modern varieties over their traditional counterparts, their suitability for intense farming systems and their conformity to the demands of the market. Consequently, the success of the scientific genetics and breeding had indirectly and unintentionally led to a depletion of the existing global biodiversity, mainly because even the scientific community had failed to foresee the adverse effects of modern farming and seed production and trade rules on biodiversity and take timely action. It was fortunate that FAO and IPGRI made persistent efforts to raise first the scientific and then the political and public awareness shortly afterwards as early as in the 1970's so that today genetic erosion becomes a major issue, not only for scientific or political circles but even for common people.

2.3 *In situ* conservation activities

In situ conservation of crop wild relatives involves site and species selection, genetic population studies, monitoring the degree of genetic change, adopting certain conservation methodologies, regulating access to the site and abolishing certain agricultural practices, possibly at an economic loss of the local rural communities. Therefore it is essential to have the consent of these communities by raising their interest for the protection of these threatened species as important elements of their natural environment for their genetic, aesthetic, environmental or other value and integrating this protection into local/regional agri- environmental development schemes which will provide direct (financial support or incentives for the activities and/or the farmers involved) or general indirect and intangible benefits to them. Well

informed local communities can participate in and contribute to the protection of GR, can lead to the success of such protection schemes.

The GGB has identified, through its numerous explorations and collecting expeditions over the last 23 years, certain areas rich in indigenous wild relatives of crop plants which merit particular care and protection. Greece is extremely rich in such areas. The most interesting of them have been identified for protective interventions and are reported below.

1. The foothills near Mesti in Evros prefecture of Thraki region. Rich in cereal germplasm, progenitors of the cultivated wheat (*Triticum boeoticum*, *Aegilops speltoides* etc.).
2. The foothills near Anavra in Fthiotis prefecture, central Greece. Also rich in cereal germplasm (*Triticum boeoticum, Haynaldia, Aegilops* etc.).
3. The area of Kipourio in Grevena prefecture of Macedonia region. Rich in Cereal germplasm (*Triticum boeoticum, Aegilops spp*, etc.). Certain species found there were unique and reported for the first time to occur in Greece.
4. The Aegean islands (Limnos, Lesvos, Hios, Samos, Rodos etc.). Rich in germplasm of cereals, vegetables, industrial, medicinal, aromatic and ornamental plants (*Triticum boeoticum, Hordeum spontaneum, Brassica spp, Aegilops spp,* wild Legumes*, Beta spp* etc.).
5. The area of Mount Parnon in Arkadia prefecture, Peloponnese region. Rich in gerplasm of cereals, vegetables and ornamental - medicinal plants.
6. The area of Mani in Lakonia prefecture, Peloponnese region. Rich in germplasm of cereals and aromatic - medicinal plants.
7. The area of Omalos plateau and Samaria gorge in Crete. Rich in germplasm of Medicinal, Aromatic and Ornamental plants (*Tulipa cretica*, *Crocus spp, Brassica* species*, Espec. cretica, Sideritis spp, Origanum dictamnus* etc.).
8. The area of Mount Aenos in Cefallonia island, Ionian sea. Rich in indigenous flora, especially Beta spp, wild vegetables and cereals (*Aegilops spp, Haynaldia spp*), medicinal and ornamental plants.
9. The Gorge of Vikos in Epirus region. Rich in spontaneous flora and in gerplasm of medicinal and aromatic plants.
10. The area of lake Prespa in Florina prefecture of Macedonia Region. Rich in germplasm of forage crops and pulses.

11. The area of the Monastic State of Agio Oros (Holy Mountain). It is the only area in Greece where nature has been left completely intact through the ages. It is among the richest areas of Greece in biodiversity and genetic resources. Also a large number of old Greek landraces are still cultivated and preserved there.
12. The area of Mount Olympos is extremely rich in biodiversity and in germplasm of certain wild relatives of crop plants (*Beta nana, Secale montanun,* etc.)

Targeted activities in these areas have been proposed in the past, but only recently funding was made available, through the Project "Plant Gene Bank", Measure 6.3/ Action B which started in 2003, in the areas of river Evros estuary (extremely rich flora in forage legumes) and village Mesti (rich in germplasm of *Triticum boeoticum* and *Aegilops speltoides*, progenitors of the cultivated wheat) in Thrace and of village Anavra in Fthiotis prefecture, central Greece (populations of wild diploid wheat *Triticum boeoticum*). Futhermore, two more sites are to be included in 2006, the island of Santorini for its threatened population of spontaneous Crocus species, and Olympus mountain for its threatened endemic populations of wild beet *Beta nana*, the latter possibly through international scientific cooperation.

At the EU level the Greek Gene Bank has participated in the EU-funded project "PGR-Forum" (2003-2005) which made a significant scientific contribution to assessing *in situ* and *on farm* conservation methodologies, in selecting promising sites and target species for such protection. This project has served as a scientific platform for making pan-European research proposals and planning national and international actions in this domain.

2.4 *In situ* management of forest genetic resources

According to the General Declaration of the Third Ministerial Conference on the Protection of Forests in Lisbon, origins of native species and local provenances that are well adapted to site conditions should be preferred for reforestation and afforestation purposes. Moreover, if forests are to be of increased value in terms of stability, adaptation, resistance, productivity and diversity, it is necessary to use reproductive material, which is genetically and phenotypically suited to the site. High quality of forest seeds should meet, where appropriate, certain quality standards.

In recognition of this, EU placed in force (1999) the Council Directive 105/1999/EC on the marketing of forest reproductive material, in light of the fact that forests cover a large area of the E.U. and play an important social, environmental, economic and cultural role. The Directive ensures the supply of high quality forest reproductive

material (FRM) of the species used within the EU by stipulating that FRM may not be marketed unless if it is not certified according to one of the four categories specified. The categories differ in the stringency of the quality criteria, which must be fulfilled by the marketed material. This is crucial for determining whether any particular FRM is suitable for a site under consideration.

As a Member State of the EU, Greece harmonised in its legislation (Presidential Degree -17/2003) the Council Directive 105/1999/EC and the specific measures anticipated by the Directive (implemented by Commission Regulations and Decisions).

It is well known that the selection of suitable forest species is one of the most serious and complex tasks, requiring consideration of many factors (ecological conditions, plant species characteristics, target).

Since 1970 the Directorate of Reforestation and Watershed Management of the General Directorate of Development and Forest Protection and Natural Environment, in collaboration with the Institute of Mediterranean Forest Ecosystems and Forest Products Technology (MFE & FPTI), started to identify, select and register forest seed stands with superior quality traits and growth properties of native species, throughout the country. All stands of the native species have been selected in natural forests.

The selection was based on certain criteria like isolation, uniformity, volume production, wood quality, stem form and growth habit, health, resistance to pests and diseases, effective population size (genetic diversity), purity of stands, age and development.

Table 5: In Situ selected stands by species

In Situ management of forest seed stands	
Abies spp.	*Pinus pinea*
Picea abies	
Pinus halepensis	*Pinus silvestris*
Pinus brutia	*Cupressus sempervirens var. horizontalis*
Pinus nigra	*Cupressus sempervirens var. pyramidalis*
Pinus leucodermis	*Platanus spp.*

A big number of stands were selected in order to achieve better representation of the forest species within a wide geographical range. The goal was to collect seeds from

provenances with similar ecological conditions to those of the areas proposed for reforestation. A summary of the *in situ* selected stands by species is given in Table 5.

2.5 *On farm* conservation

On farm conservation schemes should be based on the identification and recording of all landraces which have been escaped from genetic erosion and currently exist in the promising target areas. The conservation trials should focus on the delimitation of their zone of cultivation, the appointment of their maintainers, the elaboration of a system of management of their populations to secure the maintenance of their genetic integrity, their cultivation preferably using environment-friendly methodologies, the production of named agricultural and processed products and finally their promotion through use at local or national scale and through appropriate agri-environmental support measures, meetings and festivities.

These measures should also be accompanied with interventions that restore, protect and exhibit essential elements of the associated natural and agricultural landscape, such as terraces, stone walls, hedgerows, water or wind mills, traditional processing plants, stone paths and narrow agricultural roads, tree alleys, associated niche of wildlife habitats etc, as well as other characteristics reminiscent of the agricultural tradition, history and culture of these areas which are rich in crop diversity.

The GGB has identified and proposed for protection certain areas where traditional agricultural systems and a limited number of associated landraces still survive, resisting the pressure of modern times.

a) The plateau of Lassithi on Crete island. An impressive agricultural landscape in the island of Crete. It is a 4,500 ha fertile plain situated at an altitude of 850 m above sea level. Traditional agriculture based on diverse local germplasm is practised in a spectacular landscape. The area is mainly devoted to potato cultivation, but many other crops, i.e. vegetables, cereals, are also grown.

b) The plateau of Englouvi on Lefkas island of the Ionian sea is a 300 Ha fertile plain cultivated with traditional cereal (wheat, barley, rye) and legumes (principally lentil) landraces. Agriculture is practised under harsh traditional labour intensive conditions.

c) The Aegean islands (Limnos, Lesvos, Samos etc.). Characterised by poor agricultural landscapes, cultivated with cereal landraces. These landraces give good yields despite of drought and warm winds, being tall and

providing straw for the livestock and bearing awns to resist the attacks of migrating birds. They are also of high quality and have sgood adaptation to low-input ecological farming.

d) The Kalavryta area in Peloponnese region, a mountainous area of approx. 1.000 m altitude, where landraces of cereals and pulses are still cultivated over large areas under traditional cultural systems.

However many other promising sites throughout Greece have been identified by breeders of various institutes of NAGREF, such as sites with interesting orchards of threatened traditional fruit-plants varieties (stonefruits, pommefruits, nuts, neglected-underutilised species etc) or stands of wild relatives by the Institute of Deciduous Fruits of Naoussa, similar sites with threatened Olive, *Castanea* or *Citrus* varieties by the Institute of Olive and Subtropical crops of Chania, Crete, sites with threatened Fig varieties by the Institute of Olive and Horticultural crops of Kalamata, sites with threatened rare local Grapevine varieties by the Institute of Viticulture and the GGB, etc. A number of threatened forest species and sites have also been proposed by the Institute of MFE, along with the appropriate methodologies.

Regarding the involvement of NGOs, some of them are directly interested in the protection and use of the traditional Greek landraces. Especially, s'PELITI' maintains a network of predominantly but not exclusively ecologically oriented farmers who are interested in protecting and conserving traditional Greek landraces through *on farm* cultivation. "Aegilops" is another NGO that has similar orientation and structure, but also interested in collaborating and getting assistance from the formal sector (Gene Bank, Universities, Breeding Institutes) for optimal conservation, proper evaluation and possibly participatory breeding. The "Laboratory of Ecological Practice" is primarily interested in using local landraces in ecological farming systems, and for ecological and not conventional seed production.

The basic EU tool for Agricultural Biodiversity actions and associated environmental protection activities is the Council Regulation 1698/2005 (replacing 1257/99/EC). It gives priorities to the genetic resources protection actions apart from the agro-environmental schemes of the national agricultural plans of the Members States (article 39).

On farm and *in situ* conservation should be a priority for the coming decade. The main conclusion is that monitoring programmes and protection policies should be developed for certain species, biodiversity hotspots and landraces through either national or European programmes, like the newly adopted regulation 870/04/EC.

Chapter 3: THE STATE OF *EX SITU* MANAGEMENT

3.1 *Ex situ* management of landraces and crop wild relatives

Significant categories of indigenous wild and weedy species that are close relatives or ancestors of cultivated plants are present in Greece like**:** Cereals (*Triticum, Aegilops, Hordeum, Haynaldia, Avena, Secale* etc.), Forages (*Trifolium, Medicago, Festuca, Lolium, Phleum* etc.), Pulses (*Lens, Vicia, Lupinus* etc.),Vegetables (Cruciferae*,* Compositae*,* Umbelliferae*,* Liliaceae*,* Chenopodiaceae*)* Grapevine *(Vitis* ssp), Olive (*Olea* ssp), etc.

There is also a plethora of wild species directly used for human nutrition, with industrial or other uses and for ornamentation. In this category belong certain wild species used as condiments or as decoctions (*Origanum ssp, Ocimum, Majorana, Capparis, Sideritis , Matricaria*), aromatic plants used for the production of essential oils and perfumes (*Salvia, Mentha, Lavandula* etc) or medicinal plants (*Digitalis, Papave*r etc).

Only a limited part of the broad spectrum of the wild relatives grown in Greece has been collected and conserved at the Greek Gene Bank. There was a 32 % increase in the number of accessions of the most important wild and weedy relative species conserved in the GGB over the last decade as it is shown in Table 7.

The collection is excellent in terms of certain wild cereals (i.e. *Aegilops ssp, Haynaldia ssp, Hordeum ssp*.), legumes and pulses which are considered potentially promising donors of genes to cultivated cereals for resistance to drought, diseases etc. On the other hand it is rather poor, comparing to the existing genetic resources in Greece, in wild vegetables, trees, ornamental plants, wild forages and pulses, as well as in medicinal and aromatic plants.

The existence of a favourable natural environment for the cultivation of a broad spectrum of species in conjunction with the agriculture of local sufficiency or subsistence that was the rule in the beginning of the century, have led to the maintenance under cultivation of a large number of local landraces well adapted to the local conditions and preferences. This category includes both species originated or diversified (leguminous crops such as *Cicer, Lens, Vicia, Pisum and Lupinus*, vegetables such as *Brassica, Lactuca, Cichorium, Beta*, trees such as *Olea, Ficus* etc. and grapes), as well as species introduced in Greece centuries ago but having afterwards evolved and adapted to the local conditions, many fruit-trees such as

Malus, Pirus, Prunus etc, Cereals such as *Triticum, Hordeum, Secale* etc, and vegetables such as *Phaseolus, Lycopersicon, Solanum, Capsicum,* etc.

Table 7: Indicative list of accessions of wild and weedy relatives species conserved in the GGB and other institutions of NAGREF and their change during the last decade.

SPECIES	1995	2005	% CHANGE
Aegilops caudata	162	170	4.94
Aegilops comosa	185	199	7.57
Aegilops lorentii	265	302	13.96
Aegilops ovata	140	159	13.57
Aegilops spp	79	90	13.92
Aegilops triaristata	153	169	10.46
Aegilops triuncialis	225	253	12.44
Agropyrum spp	21	28	33.33
Allium spp	39	89	128.21
Beta maritima	262	263	0.38
Beta nana	28	28	0.00
Brassica cretica	46	50	8.70
Dactylis glomerata	150	173	15.33
Festuca arundinacea	32	32	0.00
Haynaldia villosa	118	134	13.56
Hordeum bulbosum	54	66	22.22
Hordeum spontaneum	85	91	7.06
Lathyrus ssp	43	58	34.88
Lavandula stoechas	13	13	0.00
Lolium perenne	57	57	0.00
Lolium spp	16	16	0.00
Lotus corniculatus	19	24	26.32
Lupinus spp	78	92	17.95
Medicago spp	100	517	417.00
Oreganum spp	10	13	30.00
Phleum spp	12	13	8.33
Salvia ssp	38	39	2.63
Trifolium campestre	13	13	0.00
Trifolium cherleri	13	18	38.46
Trifolium hirtum	21	21	0.00
Trifolium resupinatum	9	12	33.33
Trifolium spp	123	274	122.76
Vicia sativa	47	47	0.00
	2,658	3,523	32 %

The number of accessions of the most important crops maintained in the Greek Gene Bank is shown in Table 8. A limited increase of 11 % in the number of accessions over the last decade reflects the dramatic degree of genetic erosion and irreversible loss of the traditional landraces in Greece and the difficulty to find and save such germplasm in our days.

Table 8: Indicative list of accessions of landraces conserved in the GGB and other institutions of NAGREF.

SPECIES	1995	2005	% CHANGE
Allium cepa	50	52	4.00
Allium porrum	61	64	4.92
Allium sativum	12	19	58.33
Aveva sativa	39	47	20.51
Beta vulgaris	443	448	1.13
Brassica oleracea	128	138	7.81
Capsicum annuum	31	38	22.58
Cicer arietinum	179	183	2.23
Cucurbita maxima	39	52	33.33
Ervum ervilia	12	16	33.33
Gossypium hirsutum	305	305	0.00
Hordeum vulgare	99	111	12.12
Lactuca sativa	38	53	39.47
Lathyrus sativus	15	18	20.00
Lens culinaris	99	102	3.03
Lycopersicon esculentum	33	75	127.27
Medicago sativa	16	18	12.50
Nicotiana tabaccum	488	488	0.00
Phaseolus coccineus	22	30	36.36
Phaseolus vulgaris	371	436	17.52
Pisum sativum	43	46	6.98
Prunus spp	142	142	0.00
Solanum melongena	16	22	37.50
Triticum aestivum	111	126	13.51
Triticum boeoticum	48	50	4.17
Triticum durum	139	154	10.79
Vicia faba	162	171	5.56
Vigna unguiculata	29	37	27.59
Vitis vinifera	567	567	0.00
Zea mays	294	353	20.07
	4,031	4,361	11 %

The collection is particularly rich in germplasm of Cereals, Tobacco, Cotton, Pulses, Forages, Grapevine and Prunus accessions.

Significant progress was made since 1995, the time of compilation of the first national report. The number of germplasm accessions of the Greek Gene Bank was raised from 7,220 in 1995 (belonging to 66 genera and 169 species of crop plants and relatives) to 10,650 in 2005 through a series of collecting expeditions within the country. But there is a gap in collecting the associated symbiotic strains of microorganisms (eg. *Rhizobium)* for legume germplasm.

The new national project “Plant Gene Bank”, (that is funded by the Operational Programme of Rural Development-Reconstruction of Countryside 2000-2006), gave the opportunity for a large number of collecting expeditions throughout the country. It will be the platform for a number of expeditions until 2007, which are expected to yield

another 4,000 accessions of traditional landraces and wild crop relatives, according to a plan of collecting expeditions covering all Greek territory.

Indicatively, the collecting expeditions of 2004 from May to November, covered a wide range of regions in Greece and gave the following results:

1. Pieria and Pella counties (19 accessions of local landraces) in Northern Greece
2. Estuary of Evros river and Mesti village. Promising target sites for *in situ* conservation of wild cereals and forages
3. Chania and Rethymno counties on Crete island. (115 accessions of local landraces and 351 accessions of wild relatives)
4. Aetoloakarnania and Fokis counties of Central Greece, Lefkas island (46 accessions of local landraces and 348 accessions of wild relatives)
5. Achaia, Ilea, Korinthia counties on Peloponnese and Zakynthos island (40 accessions of local landraces and 273 accessions of wild relatives)
6. Larisa, Magnisia counties of Central Greece and Skopelos island (49 accessions of local landraces and 214 accessions of wild relatives)
7. Preveza, Ioannina and Arta counties of Northern Greece (62 accessions of local landraces and 218 accessions of wild relatives)
8. Evros county and Samothraki island (34 accessions of local landraces and 139 accessions of wild relatives)
9. Gavdos island (6 accessions of local landraces and 73 accessions of wild relatives)
10. Drama, Kavala counties (39 accessions of local landraces).

The old long-term storage facilities (Base Collection) of the Greek Gene Bank have a capacity of 40 m^3 and can hold approx. 10,000 samples. Seed is stored in sealed galvanised tin cans or in aluminium foil packages placed on fixed shelves under -18 to -21 ^oC. There is no need to control air humidity in the Base Collection due to the air-tight and moist-proof sealed packaging. Under these conditions seed viability of most “Orthodox” species is maintained for more than 20 years. Short to medium-term storage facilities (Active or Working Collection) have a capacity of 40 cubic meters and can hold approx. 10,000 samples as well. Seed is stored in non sealed packaging (ordinary paper or cloth bags) placed on fixed shelves under 0 ^oC to + 5 ^oC temperature and 30 % relative air humidity. Under these conditions seed moisture

is maintained at a very low level (5-6 %) in equilibrium with the humidity of the surrounding air which is practically dry (25-30% relative humidity), allowing reliable seed conservation for at least 10 years. Under the aforementioned project “Plant Gene Bank”, improved seed storage facilities with five times higher capacity (250 cubic meters) are planned for the new national Plant Gene Bank, expected to be fuctional in 2006-2007.

Apart from the Greek Gene Bank of N.AG.RE.F., a number of Institutes, Universities and other organisations have established *ex situ* facilities and participate in the collection and long-term conservation activities. Thus, the major crop Breeding and Research Institutes of NAGREF have important seed storage facilities or field collections where germplasm of landraces or breedering material is conserved and assessed for use in breeding. These constitute the most important collection considering their importance for Greek breeding and agriculture. These collections belong mainly to Universities and Institutions and below there is a short presentation of them.

The Institute of Cereal Crops of Thessaloniki maintains a collection of 1,582 Greek accessions belonging to 57 species, and 3,699 accessions belonging to 57 species introduced from international gene banks and crop research centres, predominantly of soft and durum Wheat, Barley, Rice, Maize, Oats, Secale and Triticale. The Institute of Forage crops and pulses of Larissa maintains a collection of 890 Greek accessions of Forage crops and pulses collected through expeditions in the period 1980-1985.

Grapevine Institute in Athens maintains an almost complete collection of Greek grapevine varieties (567). The abovementioned grapevine collection is duplicated in the Agricultural Research Centre of Makedonia and Thraki. Important field collections of *Prunus*, various fruit trees, nut species and minor fruit germplasm are maintained at the Pomology Institute in Naoussa. Greece is rich in medicinal and aromatic plant species and an excellent herb collection is maintained both in the field and in seed form by the Aromatic and Medicinal Plants Department at ARCMT. An excellent collection of 116 Greek and introduced Olive varieties is maintained at the Institute of Olive and Subtropical crops of Chania. A number of ornamental species as well as threatened species of the Greek flora are maintained at the newly established Balkan Botanic Garden of Kroussia and the field collection of the Floriculture section of the Agricultural Research Centre of Makedonia-Thraki of NAGREF. Minor field collections of clonal germlasm, traditional varieties and breeding material, particularly

of vegetables or minor crops are maintained in various other crop research Institutes or Stations of NAGREF.

Apart from NAGREF, a number of field collections, or seed samples of traditional crop varieties or breeding material are also stored at a number of Agricultural Universities, Technological Education Institutions, Botanical Gardens and other scientific organisations. Although this germplasm is mainly used for scientific research, to a lesser degree for varietal breeding, there is a growing interest for conservation of these genetic resources and their deeper scientific study and a trend for more involvement in pre-breeding activities given the opportunities provided by the advancing of biotechnological and molecular tools for their successful utilisation.

The Mediterranean Agronomic Institute of Chania (MAICH) on Crete island, has modern long-term seed storage facilities where the germplasm of endangered endemic Cretan plant species and of old vegetable varieties is safely conserved (approx. 2000 accessions). It has also facilities for storage of the DNA of 60 olive varieties and a number of varieties of tomato, melon, beans and eggplant (DNA gene bank).

The National Kapodistrian University of Athens - lab of Botany possesses a collection of 417 accessions, including species which satisfy the tutorial and scientific purposes of the lab.

The e*x situ* conservation in Greece includes Botanical Gardens. The most important Botanical Gardens of Greece are the following:

1. The Ioulia and Alexandros Diomides Botanical Garden that lies in the suburbs of Athens and occupies an area of 186 ha. It includes 7 specialised sectors, hosting more than 2,000 plant taxa. Especially it preserves in its premises 500 species *in situ* and 685 sample seeds and 725 accessions in *ex situ*.
2. The Balkan Botanic Garden of Kroussia (BBGK) is one of the new Gardens in Greece and generally in Europe. It was initiated by NAGREF and has been financed by INTERREG II - 'External Borders and National Funds'. It is located in the Prefecture of Kilkis within the deciduous oak forests of Mavrovouni. The Kroussia Mountain range has an extensive network of forest roads through dense vegetation, gorges and watercourses. The Kroussia Mountains host a rich flora including at least 1,072 plant taxa.
3. The Mediterranean Agronomic Institute of Chania (MAICH) established a botanical Garden in Chania (Crete) in 2000 and in an area of 3.0 ha. It hosts

endemic and endangered species of Cretian flora as well as local landraces of fruits and vegetables.

4. A Botanical Garden is under construction at the University of Patras. It will be focused on the *ex situ* conservation of endemic and rare species and it will be based on the existing know-how of the cultivation of several species and the scientific expertise of the Botanical Laboratory.

An important tool for the collection and taxonomic determination of PGR in Greece is the Herbaria of various Universities and institutions. Among them, the most important one is the Herbarium of Patras University (Lab of plant Biology). It processes up to 150,000 specimens which represent more than 5,000 species.

3.2 *Ex situ* management of forest genetic resources

Reforestation plans require genetically improved seeds. This task has been partly fulfilled by the establishment of seed orchards of *Pinus nigra* (Black pine), *Pinus halepensis* (Aleppo pine) and *Pinus nigra* var. maritima (Corsican Pine). Currently, a new seed orchard of *Cupressus sempervirens* has been established whereas the establishment of new ones is planned for other important forest species. Additionally, clonal banks of *Populus* spp. and *Platanus* spp. (species/clones) have been established.

A summary of the *ex situ* selected stands, seed orchards and gene bank by species is given in Table 7.

Table 7 : *Ex situ* selected stands, seed orchards and gene bank by species

***Ex situ* management of forest species**	
Seed Orchards	Gene bank
Pinus nigra *Pinus halepensis* *Cupressus sempervirens*	*Populus* spp. *Platanus* spp

3.3 Remarks on *ex situ* and *in situ* management

Conservation of plant resources is based on *in situ*, *on farm* and *ex situ* activities. The conservation status of PGR is in close relationship with the great issues of global policies and is influenced strongly by them. Some of them are the following :

- The dramatic human impact on ecosystems (direct destruction, climatic change, pollution etc.) is obvious a great threat for natural and anthropogenic ecosystems that harbor genetic resources. The loss of such ecosystems and their plant resources could be irreversible. In such cases the *ex situ* collections cannot replace the continuous evolutionary adaptation of species in their natural ecological niche, and in this field the scheme of modern Noah's Arks of PGR (Gene Banks) could fail. For example, the expansion of building constructions near seashores might harm the species *Beta maritima* and in long term there is the possibility that sea, due to its level rise, could cover such areas. Therefore policies and measures that help the preservation, restoration and improvement of environment are of crucial importance for the long-term sustainability of PGR.
- Poverty influences negatively the conservation of PGR through the over-exploitation of natural environment. Policies for the elimination of poverty would be beneficial for both humans and PGR. In this context mutual sharing benefits and Farmers' Rights are very important.
- The introduction of Genetic Modified Organism of cultivated plants could alter dramatically the genetic traits of their wild relatives. So the scepticism about the further use of G.M.O should also take in consideration this factor.

Thus the actions of international community should contribute in creating a positive environment for the conservation of PGR in directly or indirectly connected matters.

Regarding the CWR's exploitation at local level in Greece, there is a lack of references which *taxa* should be used in various projects (*on farm* and *in situ*) or initiatives contributing to the welfare. There are many *taxa* with agronomic value that would be exploited to ornamental and floriculture purposes. Many of them can constitute challenge for niche markets (greenhouses, market seed, gardening, ect.) and its profits should contribute to local communities (marginal and mountain areas).

Chapter 4: THE STATE OF USE

4.1 Breeding status of PGR

The genetic resources of the country have been used intensively in the past in national breeding programs, particularly during the period 1925-1970, when the first modern Greek varieties were produced in almost all major crops by selection from local landraces or by crossing these landraces with introduced varieties from abroad. After that initial stage, breeding has been based on the improved Greek germplasm and on introduction of improved varieties or breeders' material from major international breeding centers .

As regards the germplasm collected by the Gene Bank and the crop breeding and research institutes of the country in the recent years, its use has been rather limited, mainly because its evaluation has been far from adequate to permit identification of promising populations or genes for immediate exploitation in breeding programs.

However today, the evaluation has progressed on certain species through a number of national or EU-funded programmes, and a number of populations have been regenerated, evaluated and used in a number of breeding programmes by Cereal Institute (Wheat, Barley, Maize, Rice, Triticale), by Fodder Crops and Pastures Institute (*Phaseolus, Lens, Trifolium, Festuca, Lolium* etc), by the Grapevine Institute of Athens (evaluation of Greek grapevine varieties, selection and breeding), by the Department of Aromatic and Medical Plants (selection of new clones of *Origanum* and production of promising hybrids in the Greek mountain tea *Sideritis* ssp.), by the GGB (selection of biotypes of *Triticum, Capsicum, Allium*, Lettuce and Grapevine), by the Aristotelian University of Thessaloniki (cytogenetic studies on *Vicia* ssp, characterisation- evaluation of genetic resources of cereals, vegetables, etc), by the University of Thessaly (such as *on farm* evaluations of selected germplasm for adaptation to low input farming), by the Agricultural University of Athens (phenotypic and molecular characterisation-evaluation of genetic resources of Cereals and other crops *Lycopersicum esculentum* and *Vicia faba*) and by various other users for either demonstration, teaching or research.

A few recent characteristic examples of its use by the breeding institutes of NAGREF are presented below:

1. Cereal Institute of Thessaloniki. A number of modern Greek varieties were produced through breeding programmes using Greek germplasm over the last decade. Most successful of them are cvs Doirani, Elissavet, Oropos, Apollonia of

bread Wheat, cvs Aias, Pontos, Anna, Papadakis of durum Wheat, cvs Thessaloniki, Demetra, Persefoni, Byzantio, Palaiologos, Konstantinos, Ippolytos, Andromeda of Barley, cvs Flega, Pallini of Oats, cvs Makedonia, Dion, Melas, Olympiada, Alexandros, Demetra of Rice and cvs Aris, Dias, Anthippi, Ptolemaios of Maize.

As regards characterisation and evaluation, 202 local populations of maize were characterised (and 50 of them introduced to the Maize Core collection of the EU), 350 rice varieties were evaluated for agronomic and quality traits and resistance to pest *Sesamia nonagrioides*, 600 barley varieties for resistance to diseases *Erysiphe Gramminis*, *Rynchosporium secalis* and *Elminthosporium terres* , and 900 oats varieties were evaluated for agronomic and quality traits, in the framework of a number of various E.U. projects (Regulation 1467/94, ect.).

2. Institute of Forage Crops and Pulses of Larissa. It has effectively used in breeding mainly indigenous, but also to a significant extend introduced material, for breeding modern Greek varieties of forage crops (*Medicago*, *Trifolium*, *Lolium*, *Festuca*, *Dactylis*) and pulses (*Lathyrus*, *Vicia*, *Pisum*, *Lens*, *Phaseolus,* etc.).

3. Cotton and Industrial Crops Institute. It has successfully bred 16 new Cotton cvs in the last decade using Greek germplasm for its optimal adaptation to the climatic conditions of Greece.

4. Institute of Deciduous Fruits of Naoussa. It has made clonal selection for fruit quality, productivity, earliness, frost resistance, resistance to pests and diseases, adaptation and rootstock breeding on almost all major fruit tree species (Peach, Apple, ect.), nuts (especially Almond, Walnut) and minor fruits.

5. Grapevine Institute of Athens. Characterisation, evaluation, breeding of new varieties and clonal selection on traditional Greek varieties, particularly for earliness, seedlessness, disease resistance and improved table and wine quality. Development of virus-free germlasm.

6. Tobacco Institute of Drama. New Greek varieties of improved quality have been developed with resistance to pests and diseases and conformity to the changing consumer demands.

7. Institute of Olive and Subtropical Crops. Evaluation of 31 indigenous olive varieties. Clonal selection for improved agronomic and quality characters. Clonal selection of *Citrus* species for rootstock development, adaptation and resistance to viruses and diseases.

8. The ARCMT. The GGB, as a department of the above Centre, has made characterisation- evaluation of a number of species through EU-funded programmes (*Allium, Daucus, Beta, Brassica, Vitis*) or national programmes (Wheat, Barley, various vegetable species). The department of Vegetable crops has an active breeding and seed production programme of Greek varieties on Beans, Peas, Pepper, Okra, Melon, Eggplant, Tomato and Cucurbits. The department of Medicinal and Aromatic plants has selection and breeding programmes on indigenous germlasm of Greek "Mountain Tea" (*Sideritis* spp., *Origanum, Foeniculum vulgare,* etc) and carries out also evaluation of their essential oils. The section of Floriculture has initiated a collection of promising indigenous plants for further breeding as floricultural species.
9. Institutes of Forest Research. Breeding for disease resistance in natural Walnut, Chestnut and Elm forest stands and establishment of seed-orchards.

Apart from NAGREF and its research institutes and stations, there is a growing optimism for its rapidly growing use for research and breeding by a number of Agricultural Universities, Agricultural Institutes and Agricultural Seed Companies, directly linked to the agricultural sector, or scientific bodies of broader environmental orientation, which recently have shown real interest in getting involved in PGRFA work, as a side-activity of relevance to biodiversity and nature conservation and education.

Thus, the Agricultural University of Thessaloniki has included plant genetic resources for food and agriculture (PGRFA) in the curriculum of "Genetics and Breeding" M.Sc. courses and assigns M.Sc. and Ph.D. research topics to its students, often with the collaboration of the Greek Gene Bank and the Crop Breeding Institutes of NAGREF. The Agricultural University of Athens has used germplasm of the GGB for a number of PGR phenotypic and molecular characterisation and evaluation projects (Greek landraces of Durum and Bread Wheat, Tomato, Eggplant, Pepper, etc).

The School of Agriculture of the University of Thessaly has carried out projects of assessment of traditional and improved bread and durum wheat varieties for suitability to ecological farming. The MAICH of Chania, Crete and the Floriculture department of the University of Thessaloniki are currently evaluating indigenous ornamental shrubs and wild flowers, aiming at their improvement and introduction into cultivation.

On the other hand the Botanical Gardens of Ioulia and Alexandros Diomedes, the Botanical Garden and the Botanical Museum of the University of Athens and the

Botany departments of the Greek Universities have a much broader mandate than conservation of plant genetic resources (education, recreation, raising consciousness for the protection of nature and ecosystems, relevant scientific studies). However, their role in the conservation and study of PGRFA has been recently recognised and appreciated. There are high expectations for their more active involvement in this field, by moving from mere conservation to advanced biosystematics, distribution and genetic studies on a number of selected crops and relatives of national importance and perhaps to some steps towards pre- breeding of these species.

Apart from these attempts, the main core of the breeding programmes in Greece is profited by the free access to the germplasm produced by major international research and genetic resources centres such as CIMMYT (wheat and maize), ICARDA (wheat, pulses), IRRI (rice), CIAT (potato) etc, granted in the framework of respective scientific collaboration programmes.

There is a growing interest particularly from ecological organisations for the use of old traditional varieties. This trend is expected to lead in the coming years to the creation of new non-governmental organisations devoted to the conservation and use of traditional varieties (heritage seed programs) and to their eventual use in ecological farming systems. Small seed samples have been entrusted by the GGB to such evolving groups, on a trial basis to enable and assess the feasibility of such an approach.

4.2 Crop improvement programmes and seed distribution

Plant breeding in Greece has moved onwards, from the phases of improvement of local landraces and varieties and utilizing introductions of improved germplasm from abroad for selection of locally adapted types, to more advanced breeding methodologies, already from the first part of the 20th century. Over the last decades it is almost exclusively based on crosses of good modern Greek varieties with promising introduced varieties leading to the creation of new varieties combining the advantages of their respective parents. Basic parameters of the breeding programs are superior yield, adaptation to local conditions, earliness, superior quality and resistance to adverse biotic (diseases and pests) and abiotic (predominantly drought and frost) factors.

The early breeding programs in Greece aimed at attaining self-sufficiency of the country on the main foodstuffs and on providing the raw materials for its rapidly developing processing industry, which was largely based on agricultural products. This target was met through successful breeding programs already in the 1960s.

After that time breeding had as main objective the creation of varieties suited for the international markets to enable increased exports of particular products (tobacco, cotton, vegetables etc) in the deficient EU market.

Greece has long successful tradition in breeding over a number of crops of major importance for its economy (cereals, tobacco, cotton, pulses, forages etc). On the other hand certain traditional sectors of its agricultural economy, such as the cultivation of Olives, Grapes, Figs, Fruit trees, oranges, nuts etc. is almost exclusively based on old traditional local varieties or on selections made on early introductions adapted to the local conditions long time ago. However, due to the fact that breeding, seed production and distribution in Greece were until early '80 almost exclusively state supported, the whole sector recently run into great difficulties for maintaining their position in the market, having to compete with the much more flexible and better funded big breeding and seed trading companies of the private sector. In the early '90, the majority of the plant breeding institutes was transferred to a new scientific body of the Ministry of Agriculture, N.AG.RE.F. operating as a legal entity of the private sector.

However, in the recent years there has been a growing interest and trend for the establishment of many private seed production and trading companies, and a few plant breeding ones.

4.3 Benefits derived from the Use of Plant Genetic Resources

PGR is usually a material not suitable for direct commercial exploitation but a potentially unique and useful material, especially for breeders, in order to keep stable or to improve the yielding ability, stability and plant health of cultivated plants, or to exploit new environments.

The importance of their protection and conservation especially in the case of the "in situ" conservation, comes from the fact that this material represents the updated situation of the interference with the environment.

Keeping in our mind the fact that most of the cultivated plant varieties are, because of the law for seed certification, monogenotypic and consequently that these varieties are unable to be adapted in changing environments, unless they will change their genotype by the means of gene incorporation from freely reproduced PGR. Based on latter issue it is clear the necessity of PGR protection and conservation in our days.

However many efforts required to take place in the field of evaluation and utilization of PGR by the breeders. Evaluation, characterization and registration of genes controlling critical characteristics and properties like pathogen resistance, adaptability, yielding ability and quality must be done immediately, to meet the needs of near future.

GGB has a short history, therefore the number of apparent direct benefits resulting from the use of the genetic resources it maintains, is limited. The first benefits are just now becoming apparent, with the identification and selection of promising material which is used in certain breeding programs. Many Universities and Institutions in Greece and abroad have been provided with germplasm for their research projects by the GGB and the NAGREF Institutions. Although no new varieties were developed until now the benefits from these actions is expected to be high, especially in the field of adaptation and disease resistance.

On the other hand landraces may constitute a challenge for the agro-industry sector. They should provide propagation material to the organic farming and low input agricultural systems as well as competitive products (high quality-diversification use).

4.4 Improving PGR utilization

In the current phase the most important asset of PGR work in Greece is their conservation *per se*. Less important are the immediate benefits from their attempted limited use in breeding or in ecological farming programmes.

Although the country is rich on PGR, it has developed systematic large scale breeding programmes only on certain main crop species of particular importance to its agriculture (cereals, cotton, tobacco, pulses, forages, a number of fruit plants and nuts, and certain vegetables). There are also certain periodic attempts for breeding other species. So, for the main bulk of the conserved species there are specific breeding programmes currently running to be directly benefited from them. The country has, however, a good number of experienced breeders and long tradition in breeding so as to support in the future years an extensive characterisation and to evaluation of the conserved germplasm and initiate breeding by using promising germplasm thus identified, particularly on vegetable crops that have increasing importance for the country.

In the past, the lack of close collaboration between the breeding institutes and the respective university faculties has been an obstacle to further progress in the past. That collaboration would provide a harmonic link between basic research which would enable certain advanced cytogenetic interventions (gene transfer from wild

species etc) and applied research, breeding and seed production. Another significant bottleneck was the delays in the acquirement of modern technology that would facilitate the study, evaluation and utilisation of PGR. One of the main reasons for this delay was the prolonged reform and the reassessment of goals and priorities of the agricultural research. This reassessment is ending and now it is the time for the final decisions to be made on the number and the directions of the main research institutes of the country, as well as for the necessary infrastructure and the financial and human resources needed to implement the new policies. Particularly regarding PGR much is based on the activation of the national programme and, to a lesser extent, on the EU PGR program, whose contribution is in essence complimentary to the national effort. Only a national programme can focus the necessary attention and care on crops crucial for the national economy and on its natural and cultivated germplasm in general.

Apart from improving the infrastructure, it is of similar importance to create a new generation of well trained scientists, both theoretically and technically, which will have the capacity to take advantage of the new opportunities provided by modern science and technology. Many opportunities for training and scientific exchanges are offered through EU research or training and mobility programs or by the EU PGR programme and other scientific collaboration schemes at the European or Global level.

Thus the percentage of Greek cultivars in the market dropped dramatically. This situation has two consequences: a. well-adapted cultivars for our microenvironments are not always used and b. there is small interest from the sprivate sector to invest in Greek cultivars. This worsens by the relatively small market and the changes of CAP which might reduce the interest for cultivation of some crops.

The small percentage of Greek cultivars in the market is a serious hinder for the proper utilisation of PGR. However the relative new trends for organic farming, quality and named products could contribute to a better position of Greek cultivars in the market.

4.5 Transfer, production and trading of PGR

In Greece, the production, distribution and trading of the propagating material is regulated by law 1564/85 referring to the "Organisation of production and trade of plant propagating material". According to this law:

1. Local seed production or nursery companies can supply farmers, with seeds or other kind of propagating material for their cultivation needs. This material can also be provided to our farmers by local or international trading companies, which are allowed to market this material through our territory, according to national and/ or EU rules. All these companies are under the supervision of state authorities. The above mentioned trading companies are also allowed to import material from other Member States or Third Countries according to national and/or EU rules, especially considering the phytosanitary status, the varietal purity and the germination of the material.
2. The trading of seed or propagating material of a variety is allowed only if this variety has been previously registered in the National or the respective EU Catalogues of Varieties of Plant Species, reproduced by a responsible maintainer and being monitored by the official organs of the Greek seed propagation and control authority.
3. For species that are not included in the above-mentioned Catalogues the marketing of their propagating material is under the supervision of the state authorities.

In this respect, the distribution and trading of reproductive material of traditional varieties (not listed in the above mentioned Catalogues) are considered illegal. The only outlet enabling the marginal survival of these varieties is that the law dose not forbidd the conservation and use of seed or other kind of propagating material of local landraces by the farmers using them for their needs, but not for trading. Consequently, although it has discouraged the use of local varieties by excluding them from the commercial channel, and contributed in this way in the loss of precious germplasm, a significant proportion of this germplasm has been preserved to date because the farmers reproduce them for their own use in family size enterprises. This is a common practice only for local varieties for which there is no general marketing interest and only in some specific areas in our territory, where these varieties were known and cultivated for many years.

During the recent years, the majority of the EU Directives concerning the marketing of propagating material of Agricultural Species, Vegetables, Vine and Fruit Plants, have been amended. A very important amendment concerns the issue of the legal

basis under which seed or other kind of propagating material should be marketed in relation to the *in situ* conservation and the sustainable use of plant genetic recourses. They are also associated with specific natural and semi-natural habitats and are threatened by genetic erosion. These new amendments have been transferred in our National Legislation for each species, although until now there has been no adoption of specific requirements for this kind of propagating material.

Such requirements, concerning the marketing of this kind of propagating material only for the agricultural species and vegetables, are now under discussion at EU level and is to be regulated and enter into force. If no decision is taken in EU regarding these requirements, our country is thinking of adopting specific requirements by National Legislation, taking into account the discussions at EU level, at least for the Agricultural species and vegetables. For the other species National Legislation will be issued according to future needs.

Transfer of PGR is also a subject to the provisions of Law 1564/85. Due to the peculiarities of the PGR and their primarily scientific and non commercial value, transfer by the research institutes of the ministry of agriculture and other scientific institutions of small quantities, ranging from 50 gr. (for small seeds) to 1000 gr. (for large seeds and ornamental bulbs) and up to 50 pieces of clonal reproductive material (cuttings etc) is exempted.

Propagating material transfer within the limits of EU has been further simplified by Directive 2000/29/EC of EU, for the implementation of which in Greece has been issued the Presidential Decree 365/2002 (phytosanitary control). This directive also liberates seed transfer within the EU regardless of the quantity.

As regards phytosanitary control, the small seed samples exchanged by GGB in the EU territory are exempted from the obligation to be accompanied by a phytosanitary certificate, according to the previously mentioned EU directive 2000/29/EC. For transport of germplasm from or to non EU countries the standard phytosanitary control measures apply according to the national or international legislation in effect. Although, with Presidential Degree 141/1998 (according to which Directives 95/44/EK and 97/46/EK have been implemented to our legislation) some specific rules have been introduced considering the phytosanitary status of propagating material, which is going to be imported or transferred for trials or scientific reasons in the country or into protected zones.

There are no particular restrictions regarding the use of PGR by the breeding institutes of the country. The responsibility to implement quarantine measures and avoid the introduction of new pathogens in the country belongs to the researchers

that use this germplasm, which therefore have the obligation to take every necessary precaution. Although, for vine and fruit plants propagating material, the pathogens that are involved in the existing certification schemes should be taken into account during distribution of this kind of material.

There is no specific legislation for the transfer of germplasm *in vitro*. This way of transfer is covered by the general provisions referred to clonal material, for which there is an allowance for free transfer of limited quantities for scientific purposes. Although, with Directive 2002/11/EC, the legal basis has been issued for the production of vine propagating material by *in vitro* techniques and it is one of the priorities of the Commission to adopt specific provisions for this kind of material.

It is assumed that the abolishment of the trade of unimproved seeds was founded on good intentions and had as a goal to secure a certain reward to the breeders of modern varieties, and to protect the interests of the farmers, by supplying them with good quality seeds of high germination and stable genetic composition, securing good yields and quality in a modern competitive market. It is believed that when those views on the protection of breeders' rights had prevailed in the international scene, their destructive consequences on PGR were not foreseen by practically no one. For this reason it is expected that there will be no substantial loss to the modern breeding to view today the situation from another perspective and open the field for a limited use and trade of local landraces on local markets to be used in protected areas of traditional or ecological agriculture, an approach encouraged by the national and EU policies and the modern views on agriculture and natural environment.

Concerning the Protection of Plant Varieties Rights, in article 8 of Law 1564/85, the legal basis for granting such rights was provided but so far has not been in effect. Nevertheless, our country as a Member of EU, applies Regulation 2100/94, under which Plant Varieties are protected through EU. According to this Regulation, our country is obliged to protect these Plant Varieties for which this kind of Protection has been granted, and also all the varieties created in our country can be protected by all other Member States of EU if they have granted this Protection in Community Plant Variety Office (CPVO).

Our country has not signed the convention on the Protection of the Rights of the Breeders of Varieties (UPOV), but after the sign of EU on 27 of July 2005, our country considers its aspects concerning UPOV.

Chapter 5. THE STATE OF NATIONAL PROGRAMMES, TRAINING NEEDS AND LEGISLATION

5.1 National Programmes

Until recently PGR conservation, evaluation and utilisation in breeding and agricultural production on a national scale was essentially implemented only by NAGREF, its Gene Bank and its crop breeding and research institutes, with their limited financial means. Therefore, contribution of NAGREF over the last 14 years to the conservation of the precious national plant genetic resources, either in seed gene banks or in field collections of national importance (fruit trees, nuts and minor fruits, grapevine, olive, aromatic medicinal and ornamental plants, forest species etc.), and also to their scientific evaluation and utilisation in breeding for the creation of the modern Greek varieties, practically without specific funding but at the expense of its limited research budget, is immense and invaluable.

The national projects that concern exclusively the conservation of the PGR on national level are the following:

1. The Directorate of Physical Planning and Environmental Protection of the Ministry of Rural Development and Food, as the Competent Body for the protection of agricultural biodiversity, included the Project "Plant Gene Bank", Measure 6.3/ Action B in the Operational Programme of Rural Development-Reconstruction of Countryside 2000-2006 (3rd Cohesion Fund Support). This project is being co-funded with 69.7% by FEOGA and the rest by the National Programme of Public Investments.

   The specific project intends to the creation of a Plant Gene Bank with suitable facilities (building, modern laboratories, ect) in Thermi, Thessaloniki (Subprojects I, II and IV) as well as to the collection of all the remain genetic material in Greece. This task has been entrusted to GGB in order to execute a large number of exploratory missions around Greece (Subproject III, under the supervision of the N.AG.RE.F.). The total budget of the project is 2.42 millions € and it ends on 31-12-2008.

2. A number of projects received significant funding from NAGREF ('Demetra 95 & 96' programme). All Crop Breeding and Research Institutes of NAGREF have basic long-term genetic resources programmes associated with their scientific

identity and mandates. Therefore they carry out activities of germplasm conservation, characterisation, evaluation, documentation and utilisation in their respective breeding and seed production programmes, or maintain and assess important national field collections of clonal material, aromatic, medicinal and ornamental crops or plantations and seed gardens/pedigree plantations of forest germplasm etc. These activities were performed in the past, as a part of strong state- funded national programmes. However they have to rely today on the limited regular or research budget of the respective institutes. These projects are presented separately below :

a) Cereal Institute: Project B.95/5/58: Demetra 95. Creation of Bread Wheat varieties with incorporation of germplasm of relative species. Assessment of offspring at various environments. Project D.95.I/63: Demetra 95. Creation of Durum Wheat varieties with resistance to drought, broad adaptability and good quality characteristics.

b) Institute of Forest Research: Project 95. IV/13. Genetic improvement of Robinia pseudoacacia L.

c) Institute of Grapevine of Athens in corporation with GGB: Project I 9 & I 26 Demetra 95. Protection, ampelographic description and identification with classic and biotechnological methods of the autochthonous grapevine genetic resources of the country.

3. Cereal Institute: Project “Creation of Bread Wheat varieties with incorporation of germplasm of relative species (*Agropyrum elongatum*)“.

4. Institute of Mediterranean Forest Ecosystems and Technology of Forest Products: a. Genetics and Breeding of Conifers, b.Genetics and Breeding of Broadleaves- Genetics and breeding of Eucalyptus and c.Production of reproductive material-seed orchards.

5.2 EU- funded Genetic Resources projects

A significant number of competitive research programmes on plant genetic resources were successfully claimed and carried out in the period 1996-2004 by various institutes of NAGREF in the framework of the European Genetic resources programme of the Regulation 1467/94/EEC. The program started in 1995 and ended in 2003.

The GGB and the breeding and research institutes of NAGREF have participated actively in a large number of projects promoting collaborative research, characterisation, evaluation, documentation, collection and germplasm exchange and use in breeding of a large number of EU-countries over the period 1996-2003. Some of these projects are the following:

a) Greek Gene Bank: Genetic Resources (GR) of *Allium* (RESGEN-CT95-20), GR of *Beta* (RESGEN-CT95-42), GR of *Brassica* (RESGEN-CT95-109), GR of *Daucus* (RESGEN-CT95- 105) and GR of *Vitis* (RESGEN-CT96- 81) the latter in coorperation with the Grapevine Institute of Athens

b) Agricultural Research Centre of Makedonia and Thraki., dpt of Vegetables: Eggplant GR (RESGEN-CT95- 113)

c) Cereal Institute: GR of Maize (RESGEN-CT96- 88), GR of Rice (RESGEN-CT95-37), GR of Barley (RESGEN-CT98- 104) and GR of Oats (RESGEN-CT99-106)

d) Institute of Deciduous Fruit-Plants: GR of Minor Fruits (RESGEN-CT95-29)

e) Forest Research Institute: GR of Elm (RESGEN CT-96 - 78)

f) Institute of Olive and Subtropical Crops of Chania: GR of Olive (GENRES-CT/97).

Under the above projects a great part of accessions of the respective crops and relative species were regenerated, multiplied, evaluated for important genetic and agromomic properties, documented and safely conserved. Promising material identified through screening and evaluation procedures was promoted for use in breeding programmes.

Taking into account the first call (September 2005) of the new Regulation (870/2004/EEC) Programme, it is concluded that the specific requirements of the Regulation (self budget or private participation up to the percentage of 50%, low threshold of the proposed budget for the numerous candidates, ect) and the late “call for interest” at the end of the summer created discouraging conditions for interest to many national PGR bodies. However the above requirement of 870/05/EEC for participation of private sector with 50% of the total expenditure hinders very seriously the application of this regulation.

In the framework of other EU-research programmes the following projects have been carried out:

1. Greek Gene Bank

a. INTERREG II. Breeding of Grapevine germplasm and production of improved viticultural products on Crete, Ioannina and Limnos (in corporation with the Grapevine Institute of Athens).

b. EU-5th Framework Programme: European Crop Wild Relative Diversity Assessment and Conservation Forum (EVQ2-2001-0192), a concerted action programme coordinating a network of all European countries (participation of non EU- European countries was funded by ECP/GR) for the study of methods of In Situ (or reserve) conservation of wild crop relatives and On Farm conservation of traditional European landraces, the selection of priority crops of national and European interest and the identification of promising sites for such protection.

c. European Plant Genetic Resources Information System (EPGRIS). This programme is also a EU-Funded Concerted action (2001-2003) for the documentation of all plant genetic resources of the European Region in one major European data base integrating all individual national databases and made available in the web. The product of the EPGRIS programme was EURISCO, the European search catalogue, accessible through a web page.

d. ARCMT-Section Floriculture: AIR/PL93/2472. Adaptation of spontaneous ornamental trees/shrubs to drought and salinity.

2. Institute of Green Vegetables and Floriculture-Balkan Botanical Garden of Kroussia (BBGC). In the INTERREG initiative (EU-cofunded Programme) NAGREF participated with the implementation of great importance projects regarding the ornamental and wild flora of Balkan area. These projects gave the opportunity of survey of large parts of the Greek and Balkan territory for rare and endangered species. Representative samples of these species were taken fro safety conservation at the botanical Garden of Kroussia and the field collection at the ARCMT-section Floriculture. The projects for the BBGC are the following:
   a. INTERREG II. Establishment of Botanical Garden
   b. INTERREG IIIA : Conservation and utilization of the Balkan flora
   c. INTERREG IIIA: Promotion of the multifunctionality of the Balkan Botanical garden of Kroussia.

   The aforementioned projects gave the opportunity to survey large parts of the Greek and Balkan territory for rare and endangered species. Representative samples of these species were taken for safety conservation at the Botanical Garden of Kroussia and the field collection at the ARCMTH- Floriculture section.

3. In the framework of various EU/FAO-research programmes, the Institute of Deciduous Fruit trees carried out the following projects: “exploration, identification, mapping, collection and conservation of stonefruit germlasm from the Greek territory”, “exploration, collection, evaluation and conservation of germlasm of minor fruits” and “international network of Stonefruit germplasm”.

4. Mediterranean Agronomic Institute of Chania (MAICH). It participates in the project entitled “Demonstration network for the creation of micro-reserves on local level” (co-funding by EU-LIFE Nature). It aims at *in situ* protection of endangered wild species on Crete Island and under the combination of *ex situ* conservation on local level. The project work-programme includes awareness activities of local stakeholders. It also participates in the project entitled “European native seed conservation network” (EU-FP 6th) that its scope is to coordinate the European Gene Banks throughout Europe. Deliverables of this project are the common accepted “protocols” that the gene banks should use.

5. The Laboratory of Systematic Botany and Plant Geography of the Botany Faculty-Aristotle University of Thessaloniki. It participates in the project “NATURA 2000” that was carried out between 1994-1999 and aims at the inventory, identification, evaluation, and mapping of the habitat types and flora and fauna species in Greece (Directive 92/43/EEC, co-funding by EU and Ministry of Environment).

6. Aristotle University of Thessaloniki, Laboratory of Forest Genetics: Project Cascade CT1999-00065: “Securing gene conservation, adaptive breeding potential and utilisation of a model multipurpose tree species (*Castanea sativa* Mill.) in a dynamic environment”.

5.3 Documentation of PGRFA

The genetic resources collection of the Greek Gene Bank is documented in its computerised Data Base as EXCEL tables or as ACCESS files. However most information relates to the Passport data of the accessions, i.e. information relating to its collection (genus and species, collection date and collection site coordinates, or information on its donor if the sample has been provided by another institute).

Only a limited number of accessions have undergone regeneration, characterisation and some preliminary evaluation, yielding data, which will eventually be used to create species- specific characterisation and evaluation databases. The adopted format is the EPGRIS format which was agreed by all European countries in order to allow for data integration to a uniform European Data Base. The Greek Gene Bank

data are accessible in the internet at the EURISCO (European Search Catalogue of National Databases) Web site, providing access to the plant genetic resources databases of all European countries.

All crop breeding and research institutes of NAGREF hold respective databases for their genetic resources and breeding material and have provided relevant data for incorporation at European and global central crop databases, held at certain institutes, such as the German Gene Bank in Braunschweig acting as a Central Data Bank for *Beta* germplasm, the Dutch Gene Bank at Wageningen being responsible for the European *Brassica* landraces, the British Gene Bank at Wellesbourne being responsible for *Allium* and *Daucus* germplasm etc. or at the IPGRI/ECP-GR. The data for the germplasm maintained by the GGB is also accessible through the above channels or through GRIN, the FAO's documentation system. Information on commercial crop varieties is registered at the respective national and international catalogs.

Regarding the wild species the Lab of plant Biology (University of Patras) has developed a data base where all disposal data of its work is approachable to any one through a website.

5.4 Training needs

There is a certain difficulty in providing training to new scientists in that field, since the Greek universities do not provide post graduate studies in this sector. However, they provide training at an M.Sc. level and a number of PhD's in plant breeding, conventional and molecular genetics, as well as in relevant nature and natural resources and ecosystems study as well as protection fields like Biology, Botany, etc. These scientists (agronomists, breeders, botanists, biologists etc.) can be successfully employed in the research and protection of the indigenous PGR with an additional short theoretical and practical training. This complementary training can be provided by the GGB, or by other collaborating Gene Banks or University faculties of the country or abroad (CIMMYT, ICARDA, CIAT, Birmingham University etc) using short training scholarships of EU, FAO, other international organisations or the Greek government. On the other hand important training centres are those collaborating in the framework of the national programme, the research institutes of N.AG.RE.F and the relevant University faculties.

The GGB has wide experience on explorations and collecting expeditions, on the scientific germplasm sampling, on seed treatment procedures, germplasm characterisation, evaluation, documentation and breeding of a substantial number of

crops, on legislation, policies etc. In the collaborating university faculties there is invaluable knowledge, in addition to some of the above mentioned activities, in statistics, plant taxonomy, plant protection, teaching and training.

Relevant short training courses can be given to post-graduate students or to holders of M.Sc. or PhD. titles in Botany, Plant Biology, Breeding, Plant Protection etc, from a team of specialists of the GGB, Universities and Institutes, occasionally supported by a number of internationally recognised visiting scientists who will be invited for a series of advanced lectures. Today, the scientific staff of the GGB participates in short periodic training sessions of farmers, agronomists and University students, aiming at providing information and training on matters related to PGR protection.

In conclusion, the country has significant scientific potential, which, when properly coordinated, can organise and provide high level of PGR training. In case of gaps, there could be covered by specialists employed in other Gene Banks or research institutes and participating in the courses through EU, FAO or IPGRI funding.

As far as it concerns the stakeholders outside NAGREF, relevant but not PGRFA-specific databases are maintained at MAICH (database MEDUSA for the identification, conservation and use of the indigenous plant species of the Mediterranean), as well as at other nature conservation networks like NATURA 2000, Natural Reserves, Wetlands, Botanical Gardens etc. that have much broader mandates.

5.4 Legal framework

The legal framework concerning the protection and management of the PGR for food and agriculture is the following:

1. The production, distribution and trading of the propagating material is regulated by Law 1564/85 referring to the "Organisation of production and trade of plant propagating material". Its article 14 “conservation and protection of the genetic material” outlines in general terms all the proper initiatives (provisions, funding, ect) that have to be entrusted for those purposes.
2. Germplasm collections are protected by Presidential Decree Nr. 80/1990 "For the Protection of the PGR of the country", which established the ‘National System of Conservation and Protection of the Genetic Resources of Cultivated Plants", and included: a) The Greek Gene Bank, b) Field collection-Plantations, c) Zones for protection of wild relative species (*in situ* protection) and d) Zones for protection of traditional farming (*on farm* protection).The Greek Gene Bank was designated

by this Degree as the coordinating and implementing organ of the National PGR System under the supervision of the competent authorities of the Ministry of Agriculture. GGB coordinates and supervises all activities, keeps updated computerised records of the protected germplasm and introduces new activities to the Directorate of Physical Planning and Environmental Protection of the Ministry, following relevant proposals by the responsible Crop Institutes of the country. As regards the designation of zones for the protection of wild species, the authority is shared between the Ministries of Agriculture and Environment, Physical Planning and Public Works.

3. The Law 3165/2003 "Ratification of the International treaty on plant genetic resources for food and agriculture" ratified the International Treaty of FAO concerning the PGRFA.

The legal framework that could generally concern the protection of plant genetic resources (including the forest genetic resources) is the following:

1. The 1975 Constitution, Laws 86/1969, 998/1979 and 1650/1986 constitute the basic legal framework of the country for the protection and management of forest and other wooded land.
2. The Law 86/1969 constitutes the Forest Code and regulates matters concerning the protection, management, real property rights on forest land of the country.
3. The Law 998/1979 "On the protection of the country's forest and other wooded land" determines the specific protection measures for maintaining, developing and improving forest and other forest land of the country.
4. The Law 1650/1986 "On the protection of the Environment" includes a specific chapter "On the Protection of Nature and Landscape" which proposes new categories of protected areas and introduces changes in the administration and management of protected areas.
5. The Law 856/1973 legislatively regulated protected areas for the first time in 1937. This law was incorporated into the Forest Code (Law 86/1969) and later amended by Law 976/1971, which is still in force today. By implementing the above laws, 10 national parks, 19 aesthetic forests and 50 protected natural monuments have been designated until today.
6. The Presidential Decree 67/1981 "On the protection of endemic flora and wild fauna and the determination of the procedure for coordinating and controlling them'', includes a list of the protected species of plants and animals. This

P.D. is a useful tool for the protection of the endemic, threatened and rare species of the Greek flora, as it is accompanied by an extensive plant list with more than 700 protected species. An update of the already existing plant list is necessary, because the last two decades have been added many new data for the taxonomy, distribution and population status of the species. Additionally, the same period, about 100 new Greek species have been described as new to science (most of them rare endemics). None of these species is under any legal protection status of national level.

7. The Convention of Biodiversity (Rio 1992) that was ratified by the Law 2204/1994.
8. The Convention on International Trade in Endangered Species of Fauna and Flora known as CITES, ratified in 1992 by the Law 2055/1992.
9. The Common Ministerial Decision (3318/1998) compiled in the national legal framework the EU Directive 92/43/EEC “Conservation of Natural Habitats and Wild Fauna and Flora”.

Chapter 6: THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION

6.1 International Collaboration

Greece had always collaborations at sub-regional, regional and global levels on issues related to the protection and conservation of nature and biological resources, human nutrition, health, education etc. It has signed all pertinent agreements formulated under the umbrella of the UN. Greece has adopted Agenda 21, the Convention on Biological Diversity and, the FAO's Global Plan of Action on PGRFA and, recently, the International Treaty on Plant Genetic Resources for Food and Agriculture. It also cooperates in the framework of OECD on issues related to Economical Aspects of Biodiversity protection, on the selection of Indexes to monitor changes in the available biodiversity and assess the effectiveness and efficiency of the applied policies. Finally, it takes part in all competent international policy and scientific bodies, working on crucial issues for the conservation and utilisation of PGRFA, particularly on 'Access and Benefit Sharing' terms in relation to scientific use or granting trade- related variety rights, or financing the function and the implementation of the programs of the International Treaty.

Greece has maintained strong collaboration links with the CGIAR (Consultative Group for the International Agricultural Research) centres for many years. The collaboration with IPGRI (former IBPGR) collaboration has proved to be optimal and particularly beneficial to the country. It has been profited significantly over the last decades by its coorperation with the CGIAR centres (particularly by CIMMYT for Cereals, by IRRI for Rice, by Icarda for Cereals and Pulses etc) by receiving promising material or segregating germplasm of various important crops and testing it for local adaptation and eventual use in its breeding programmes, by relevant information and publications and by invitations for periodic short training visits.

6.2 Regional Research Centers

Greece has similar close collaborations with ICARDA, the regional centre of Consultative Group for the International Agricultural Research (CGIAR) situated in the East Mediterranean, for many years, particularly in cereal crops, forages and pulses. The collaboration includes a normal supply of segregating material or finished cultivars of these species, which are send to the collaborating institutes for evaluation and selection, as well as germplasm exchange and short training visits.

6.3 Running Cooperation programs on PGRFA in Europe -Programme ECP/GR

It is the European Co-operation Programme for Crop Genetic Resources Networks. It represents the European branch of the programme of the IPGRI, which belongs to the CGIAR. It has a rather limited budget and supports mainly coordination at European level of national activities and programmes (Working groups, ad hoc expert groups or networks etc.) in a broad range of major European crops. Nevertheless it is important for the whole European region, because it is the basis for the scientific collaboration between experts, gene banks etc. Practically, it is the only scientific organisation that supports work on plant genetic resources over the whole European region. It also supports participation of non-EU states in EU programmes, an approach of mutual benefit for all European countries, in view of their common agricultural interests.

Breeders and researchers of the respective crop institutes of NAGREF have participated in a substantial number of Crop Working groups and Crop Networks in the last decade, and benefited from the European collaboration by forming European crop databases, exchanging germplasm and organising joint research activities with the support of either the ECP/GR or EU-funded research platforms. Recently ECP/GR has shifted priority to studies and projects for *in situ* conservation of wild relatives and *on farm* conservation of endangered traditional varieties, and established two respective ad hoc working groups. Another specific working group was also recently established for improving the scientific cooperation in the region.

6.4 Bilateral Cooperation programs

A large number of bilateral cooperation programmes on a broad spectrum of research and technology fields between Greek and Foreign research organisations (Institutes, Universities, Botanical Gardens, Wetlands etc.) has been approved and funded by the Greek Ministry of Development.

Particularly for Plant Genetic Resources, the GGB took part in the following bilateral scientific cooperation programmes:

1. Between Greece and Cyprus (1997-1998). Endeavors for the conservation and utilisation of PGRFA of Greece and Cyprus *in situ* and *ex situ* (in cooperation with the Cyprus Gene Bank).

2. Between Greece and Spain (1998-1999). Recollection, long-term conservation, documentation of PGRFA in the Mediterranean region (In cooperation with the Spanish Gene Bank).
3. A bilateral scientific cooperation programme has been signed between NAGREF (Greek Gene Bank) and CLIMA (Centre for Legumes of the Mediterranean Agriculture) of Australia in 1999 for a 5-years period, coupled with an MTA granting access to the germplasm collected through joint expeditions under certain benefit sharing terms (primarily scientific benefits).
4. A number of other short exploratory visits have been made aiming at the creation of strong scientific links for future cooperation by a number of researchers of NAGREF. These visits took place in Serbia-Montenegro, Bulgaria, Turkey and China. The Directorate of Physical Planning and Environmental Protection of the Ministry of Rural Development and Food has organised in 2004 a short collaboration visit to the Turkish Gene Bank as a first step for the establishment of effective scientific cooperation links.
5. Also, a mutual scientific exchange programme between the Greek Gene Bank and the Academy of Sciences of Anhui department of China has started in 2005, focusing initially on *Brassica* genetic resources. This project is extended to extent to a large range of crops in the coming years.

The GGB has collaborated with a number of international research centers, universities and gene banks, in carrying out joint collecting expeditions of mutual interest in Greece. Some of them are :

1. Collection of *Allium* GR (1996), in the framework of *Allium* EU-RESGEN programme.
2. Collection of *Allium* GR (1997). In the framework of *Allium* EU-RESGEN programme.
3. Collection of Forage legumes (1998). In cooperation with CLIMA of Australia.
4. Collection of Forage legumes (1999). In cooperation with CLIMA of Australia.
5. Collection of Forage legumes (2000). In cooperation with CLIMA of Australia.
6. Collection of *Brassica cretica* (1999). In cooperation with Japan.
7. Collection of Daucus and *Allium* (2000). In cooperation with USDA.
8. Collection of *Linum*, *Sesame* and *Trigonella* (1999). In cooperation with the Canadian Gene Bank

9. Collection of *Daucus* (2003). In the framework of *Daucus* EU-RESGEN programme.
10. Collection of *Beta nana* germplasm (2005). In cooperation with USDA.

These exploratory missions have been carried out under the article 10 of the PD 80/90 and the GGB had a strict monitoring and awareness participation in them. The results of these collecting missions that took place the last decade were beneficial (many times on the platform of scientific collaboration). GGB has gained valuable experience, in terms of technology transfer, conduction of common projects, ect.

6.5 Perspectives within the framework of the international arenas

The predominant international convention in the domain of Biological Diversity is the Convention on Biological Diversity (Rio, 1992). It normally deals with major environmental and biological issues and represents the highest international forum of global collaboration, where these issues are discussed, resolved and agreed upon with consensus. Nevertheless, its specific scientific body (SUBSSTA) has started to pay attention to agricultural biodiversity issues. However, one of its major contributions, however, is that it is the first time that genetic resources have been recognised as being subject to " National Sovereignty" and that they have “commercial value”. This is literally referred to PGRFA, but one can assume it holds true for all categories of biological diversity.

Another major international agreement in this domain, and actually the predominant agreement for the global collaboration on PGR, is the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) of the FAO, approved by the FAO Conference in November 2003. This legally binding Treaty superseded the International Undertaking on Plant Genetic Resources for Food and Agriculture of 1993, which considered PGRFA as a “Public Domain Good”, a "Common Heritage of Mankind", and harmonised it with the CBD, by recognising, among others, "National Sovereignty" and “commercial value” of those resources.

The Global Plan of Action (GPA) is another international umbrella supported by FAO which coordinates international activities on PGR in terms of national, regional and international initiatives. The GPA supports activities, predominantly but not exclusively, in less developed countries which are the origin centres of diversity, in recognition of the contribution of their farmers to the selection and conservation of the traditional germplasm until nowadays. This contribution that recognize the issue “Farmers’ Rights“,

has been seen as a balance to the recognition of Plant Breeders' Rights, which reward the achievements of modern breeding.

Biodiversity protection has been prioritised in FAO in accordance with the degree of genetic erosion and the importance for global agriculture and food security. Crop plants and domestic animal breeds have received the highest priority, since they can survive only under human protection. For example, a plant variety can survive only under cultivation. If it is not sown for a few years and its seed dies, it will be lost for ever. Contrary to these wild plants can propagate without any human help in nature, being able to compete with the natural vegetation. The same applies to other organisms, like insects, soil microbes etc., which in this respect face lower risks. Therefore Global Inventories and GPAs have been drawn up already for PGRs and are under preparation for Animal Genetic Resources, and are foreseen within a decade for other biotic categories. The latter, however, are being taken care of already, at least as case studies or limited scale applied projects by the CBD program.

On the other hand, the new agricultural Policy of the EU (Agenda 2000- EU Biodiversity Strategy), provides for the first time a support and collaboration framework for the protection of the biodiversity and Europe's rural Heritage. In this way it marks a new trend for qualitative and environment- friendly agriculture, as opposed to the up to now prevailing low cost and maximum efficiency extremely competitive agriculture.

Agricultural biodiversity is progressively gaining in importance, because of the unprecedented progress in man's capacity to manipulate and utilise it efficiently for commercial profit, coupled with the contested new trade and Intellectual Property Rights legislation, granting patterns on biological material (plant varieties, animal breeds) and biotechnological processes. In particular, PGRs have been raised to a state of Strategic Good for global food security and agriculture. From this point of view a state has either to take care of maintaining its own strategic genetic resources , or look for global cooperation arrangements that guarantee an easy or facilitated access to these resources, as a premise for their research, breeding and agricultural production.

Nevertheless PGR are used increasingly for commercial purposes and hence profits. Thus the fundamental principle of PGR use for humanitarian aims (e.g. global food security) is not always applicable. Consequently, the above related issues should not be overlooked in the context of an integrated review of the progress so far (especially regarding benefits sharing and farmers' rights).

Chapter 7. ACCESS TO PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE, SHARING OF BENEFITS DERIVED FROM THEIR USE AND FARMERS RIGHTS

7.1 Access to PGRFA

Free or facilitated access to plant genetic resources was one of the major cornerstones for the immense progress made by crop breeding and agriculture over the last 60 years, and a driving force for global cooperation under the auspices of the FAO, UNDP, CGIAR and IBPGR for PGRFA conservation, scientific study, training and capacity building, particularly in the centers of origin or diversity of the most important crops and relative species for global agriculture and food security.

The global interdependence of all countries and the predominant international agreements in this field (FAO's International Undertaking and Code of Conduct, CBD, ITPGRFA) emphasise the need for facilitated access to PGRFA, alongwith an agreement regulating certain terms for benefit sharing, depending of the purpose of use, the importance of the crop, the type of material, the type of variety protection etc.

The first international agreement regulating access to PGRFA was the FAO's International Undertaking (IU), a non binding international agreement developed by the Commission on Plant Genetic Resources of the FAO in 1983. Under this agreement (and before it), Plant Genetic Resources were considered a "Public Domain good", a "Common Heritage of Mankind", freely accessible for the benefit of global agriculture. This concept was the inspiring force that made possible the establishment, under the umbrella of FAO, UNDP and CGIAR, of a large number of national Gene Banks all over the world and a number of major global Gene Banks at the Agricultural Research Centres of CGIAR, and the associated big progress in plant breeding and agriculture.

Greece has been supported by FAO in 1980-1985 for establishing its first national Gene Bank and carrying out collecting expeditions and other PGR activities. On the basis of the EU and the closely associated "Code of Conduct of Germplasm Collectors and curators", GGB exchanges germplasm with other gene banks on a mutually beneficial Bona Fide basis, sending small seed samples for scientific purposes to requesting institutes or Gene Banks after previous consent of the Ministry of Agriculture and the appropriate research centres of the country. A large number of exploratory missions in a wide range of Greek areas has been carried out,

under the “Plant Gene Bank” project (starting in 2003), in order to collect and register the remaining Greek germplasm that faces the danger of erosion.

The IU was superseded by CBD in 1992. CBD focuses on the preservation of biodiversity, especially of those genetic resources with pharmaceutical and industrial rather than agricultural uses. This new legally binding international convention recognises that countries have “ national sovereignty ” rights over their GR, and that these resources have“ commercial value ”, therefore access to them should be linked with some sort of “Benefit sharing”, with the aim of “sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilisation of genetic resources with the Contracting Party providing such resources”. Such sharing shall be upon mutually agreed (bilateral) terms.

The specific international agreement for the genetic resources of crop plants is ITPGRFA of the FAO, adopted by the FAO Conference in November 2001. This was the result of the revision of the IU in harmony with the CBD. However, one major advantage of ITPGRFA over CBD is that in place of the bilateral agreements advocated by CBD, that may lead to discriminating preferential terms or exclusions, the ITPGRFA favors multilateral agreements through a Multilateral System of Access and Benefit sharing. Under the Multilateral System, access is provided under certain terms, of which most important are :

- Access is provided solely for the purpose of utilisation and conservation for research, breeding and training for food and agriculture, provided that such purpose does not include chemical, pharmaceutical and/or other non-food/feed industrial uses.
- Recipients shall not claim any intellectual property or other rights that limit the facilitated access to the PGR for food and agriculture, or their genetic parts or components, in the form received from the Multilateral System.
- Facilitated access shall be provided pursuant to a standard Material Transfer Agreement (MTA), which shall be adopted by the Governing Body

The Multilateral System does not apply to all crops of importance to agriculture. It is limited to only those crops listed in Annex I, established according to criteria of food security and interdependence, which includes all major food security crops and many of wild relatives. Minor crops and relative species not included in the list, may be handled with the CBD access and benefit sharing rules.

Access to foreign collecting missions in Greece is granted under the provisions of article 10 of Presidential Decree 80/90. According to this article permission is granted to the applicant, following a favorable opinion of the GGB and the responsible crop institutes and scientific bodies of the country, by the Directorate of Land Planning and Environment Protection of the Rural Development and Food (former Ministry of Agriculture) and its respective regional services of ASgriculture at the counties where the exploration will take place. The foreign collecting missions should be accompanied by a researcher of the GGB or a competent research organisation, to facilitate contacts with farmers and local authorities and to keep part of the collected seed and the associated collection data for the GGB.

7.2 Benefit sharing

The concept of "benefit sharing" was introduced by the FAO Resolution 5/89 as an essential element of Farmers' Rights, counterbalancing Plant Breeders' Rights. Under CBD it was extended to include benefits resulting from research and development as well as from commercial and other utilisation of PGRFA. Such sharing should be "upon mutually agreed terms", i.e. bilaterally.

Under the ITPGRFA the major scientific benefit results from the participation *per se* to the Multilateral System, the facilitated access to the immense genetic diversity contained in the gene banks of its member countries and the increased opportunities for scientific cooperation, information exchange, training etc.

On the other hand, benefits arising from the use-including commercial-of plant genetic resources for food and agriculture under the Multilateral System shall be shared fairly and equitably through the following mechanisms: the exchange of information, access to and transfer of technology, capacity-building, and the sharing of the benefits arising from commercialisation, taking into account the priority activity areas in the rolling Global Plan of Action, under the guidance of the Governing Body. The terms of fare and equitable sharing of benefits shall be included in the text of a Standard Material Transfer Agreement (MTA) to be drafted by a group experts appointed by the FAO Commission on Plant Genetic Resources with consensus. Of particular interest are the terms related to sharing of benefits arising from commercialisation, particularly if access to the product for further research and breeding is restricted. In that case the recipient who commercialises, shall be encouraged to make a payment (i.e. a fixed share of royalties) into a mechanism to be decided by the Governing Body, as a contribution to the implementation of agreed

plans and programmes, especially in developing countries or in countries with economies in transition, which in most cases coincide with the countries of origin and diversity of the most important crops.

Greece belongs both to the users as well as (primarily) to the donors of germplasm. Consequently by granting facilitated access through the Multilateral System to its germplasm it is justified to expect certain scientific, training and capacity building benefits. These can be adequate support to improve the infrastructure of its national PGR network or postgraduate training opportunities to create the new generation of PGR specialists needed to further advance protection, evaluation and eventual utilisation. It is obvious that benefits from an eventual commercial exploitation of successful recipients and users of Greek Germplasm will be mostly channeled for the support of developing countries and not the developed ones. Greece coordinates its PGRFA policy with the policies agreed upon at the European Community level. In this direction, the EU favors free or facilitated access to PGR for scientific purposes but recognises the need for some compensation by the donor countries. It also supports the idea of providing free access to its conserved germplasm to all underdeveloped countries, from which most of this material has been collected in the past.

Despite its wiliness for collaboration GGB is often unable to satisfy many requests for germplasm, since the maintained seed is of minimal quantity and funding and expertise shortages are not allowing massive regeneration under scientifically acceptable standards to produce sufficient seed quantities for both conservation and distribution. In this context the financial support of GGB, through the sharing benefits system from various national and international bodies, might prove beneficial for all partners involved (donors and users).

Although much work has been done in various organisations (CBD, OECD, WTO etc.) regarding Access and Benefit terms to PGRFA, the international community recognises the leading role and expertise of FAO in this field and awaits the results of the Group of experts working on this issue under the mandate of the FAO Commission. There is optimism that consensus may be achieved at the meeting of this group in June 2006, and that the long expected MTA will be finally agreed, establishing globally applied common rules securing easy access to PGRFA for use in research and breeding, providing substantial tangible and intangible benefits to germlasm donors and organising conservation plans and projects in centers of origin and developing countries in need of such support. This will be a big step towards

global consensus, understanding and cooperation for the benefit of plant breeding, agriculture and food security for the present and coming generations.

7.3 Farmers' rights

Farmers' Rights were first recognised during the Eighth Regular Session of the FAO Commission on Genetic Resources in Article 15 of the revised International Undertaking (IU). It was a fare balancing step for the earlier recognition of Plant Breeders Rights under the UPOV convention.

The recognition of the enormous contribution of the farmers or "informal breeders" to crop domestication, selection, development and conservation of the traditional crop varieties through the centuries is a very positive step and may provide a platform for measures guaranteeing the effective *ex situ* and *on farm* conservation of this precious genetic heritage and its appropriate use for crop breeding, ecological or environment friendly farming or niche farming for broadening and diversifying food supply and meeting particular demands and preferences.

Despite its international dimension, Farmers' Rights can be practicably materialised only at national level. According to article 9 of the ITPGRFA, the responsibility for realising Farmers' Rights rests with national governments, which should adopt, according to their needs and priorities, and subject to national laws, measures to protect traditional varieties as well as traditional knowledge relevant to plant genetic resources for food and agriculture, to implement benefit sharing and to ensure the participation of farmers in decisions on issues of relevance to PGRFA.

However, the need to respect relevant national (and international) laws, that in many cases contradict the provisions of Farmers' Rights, makes their implementation questionable for most developed countries, particularly regarding the rights to conserve, use, exchange and sell propagating material held on their farms.

Under the relevant national and EU- legislation, seed trade is allowed only for varieties registered at the National (Law 1564/85 regulating "Production and Trade of propagating material") and European Community Seed Catalogues of plant varieties. Farmers' supply with seeds is secured by local and international seed production and trading firms and this applies to all varieties registered in the National and EU Catalogues of Plant Varieties. Some farmers are allowed to use the seed (farm saved seeds) and they take advantage of this privilege for certain autogamous plant species.

Some landraces are not registered in these catalogues, so their seed trade is considered illegal. Therefore, until recently, there were no state incentives provided to the farmers to maintain the landraces. Those varieties that survived to date owe their existence to the interest and care of individual farmers for the agricultural tradition of their villages, and to their high quality and suitability for the local conditions and preferences. Farmers using traditional varieties and thus contributing to the conservation of the agricultural biodiversity in Greece, were actually disfavored for their choice, by not being eligible for incentives for using not registered seed. The law, however, does not forbid the use of seeds of local varieties by farmers maintaining their own seeds over the years, but this applies only to seed trade.

It is worthwhile to point out the NGO's interests for the adoption of a relevant legal framework that will permit the trading of the traditional varieties. This fact will make the conservation and promotion of landraces realistic in the agricultural production.

It is assumed that the abolishment of the trade of unimproved seeds was founded on good intentions and had as a goal to secure a certain reward to the breeders of modern varieties, and to protect the farmers' interests, by supplying them with good quality seeds of high germination and stable genetic composition, securing good yields and quality in a modern competitive market. It is believed that when those views on the protection of breeders' rights had prevailed in the international scene, their destructive consequences on PGR have not been foreseen by practically noone. For this reason it is expected that there will be at no substantial loss to the modern breeding to view today the situation from another perspective and open the field for a limited use and trade of local landraces on local markets to be used in protected areas of traditional or ecological agriculture, an approach encouraged by the national and EU policies and the modern views on agriculture and natural environment.

Now, it is generally acknowledged that modern agriculture had a serious side effect: the dramatic genetic erosion of landraces. International community has the experience and the responsibility to take all the needed measures to save the remaining landraces helping and not hindering farmers to do what they were doing for centuries.

Both in Greece and internationally there is a general awakening and raising of consciousness, not only of the scientific community but also of the general public, for protection of PGR, in the framework of a broader interest for the protection of the environment and biodiversity. This provides an opportunity for measures at national

and EU level to implement certain aspects of Farmers' Rights, particularly for their conservation, participatory breeding (especially for low-input agriculture) and participation of farmers to relevant decisions etc. There is a growing interest now in Greece for using local landraces in organic farming programmes by individual farmers or ecologically sensitive groups, since local gemplasm is best suited for low input farming, or for their fine quality and suitability to local traditional preferences and tastes.

Towards this direction, the Ministry of Rural Development and Food is currently preparing a nation-wide pilot programme for the protection of a number of valuable traditional landraces, in collaboration with the Greek Gene Bank and other competent Scientific Bodies.

There is a growing interest now in Greece for using local landraces in organic farming programmes by individual farmers or ecologically sensitive groups, since local gemplasm is best suited for low input farming, or for their fine quality and suitability to local traditional preferences and tastes. GGB has initiated an informal collaboration with certain ecological organisations and provided to them small seed samples on a trial basis, to be multiplied and afterwards assessed for potential reintroduction into cultivation. Certain of these groups are keenly interested to initiate activities on conservation and utilisation of seeds of traditional landraces.

Chapter 8: THE CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

8.1 INTRODUCTION

Greece has attained self-sufficiency in staple crops in early 1960's through the successful exploitation of its rich PGR and germplasm introductions, predominantly from the CGIAR system, by state funded national crop breeding programmes. For decades it had large surpluses of plant products and a strong orientation to exports. Only recently Greece faces seasonal deficits in certain plant products and has to rely on imports to meet the increased demand created by the millions of tourists visiting the country in summer. In general, it has a high level of food security.

However the dramatic improvements of the recent decades towards globalisation, international understanding and cooperation, trade liberalisation and diversification of markets, make food security essentially a matter of international interdependence and complementarity in needs and supplies, than a mere internal problem for all developed countries, and a matter of international aid and development assistance for the developing countries. Crop breeding and seed production of the most important crops is today addressing the global market and is controlled by big private international interests, thus security of seed supply (and also other inputs like fertilisers, etc.), is guaranteed by the international market.

Regarding the sustainability of its crop breeding sector in Greece, which is essential for the production of new competitive Greek varieties, not only for major crop species, but particularly for secondary crops of significance for the particular needs and preferences of the country, is extremely rich in plant genetic resources and safely maintains a significant part of these in the GGB and the major crop breeding institutes of the country and in field collections for clonally propagated material.

Also GGB is planning their protection under *in situ* and *on farm* conditions to promote their evolution through adaptive changes, initiated by natural and human selection pressures. Such safely conserved plant genetic resources will be useful not only for the national, but also for the global agriculture and food security, to which they are available through a number of relevant international cooperation agreements or schemes (ITPGRFA, CBD, Multilateral System etc.)

Greece contributes to global food security, poverty alleviation, recovery from natural disasters etc. either individually through specific national Aid Programmes or broader

European Community Programmes like the Food Aid and Food Security Programme of the European Commission of EU regulation n°1292/96.

8.2 Agricultural policy based on new E.U. CAP

The provisions on rural development in Agenda 2000 provide a framework to integrate environmental considerations into the agricultural policy, biological diversity being a fundamental and predominant aspect of an integration strategy. A major role in such a strategy, concerning the biodiversity objective, is devoted to the agricultural and environmental measures, specifically aiming at supporting agricultural practices to preserve the environment, safeguarding those the countryside and preserving member states and Europe's generally rural heritage. These measures are the only compulsory element of the new generation of rural development programmes.

Other measures involve implementation of ecological programmes such as Natura 2000, maintenance of isolated areas, conservation of wild flora etc. The major element of the CAP reform of 2003 was the introduction of decoupled direct payments to farmers for the land they cultivate or keep their animal on. The CAP payments have essentially become direct income supports for Europeans in the rural areas.

This change was driven not only by the need to make the EU farm sector more competitive in the face of the increasingly open global trading regimes, but also by the need to respond better to society's concerns about the relationship between farming and environment, by removing incentives to intensification of production processes.

The simultaneous introduction of 'Cross-compliance', which is the second major and possibly more radical change in the CAP reform of 2003, provides that Member States take environmental measures they consider appropriate in order to promote sustainability, health and safety. Member States have had different options to implement such requirements

Greece has opted for an environmentally sound set of rules taking into consideration biodiversity, habitats, high natural value farmlands, traditional landscape and water. Among others, conditions applied include protection of wild species in farmlands, preservation of hedges and similar structures, minimum and maximum stocking rates for cattle or sheep, compliance with specific conditions for the cultivation of sloppy land, rules for chemical inputs and special conditions for sensitive areas (NATURA and Nitrate zones).

The results of these changes either short-term or long term, could be:

- the extensification of farming,
- the reduction of inputs,
- the reduction of pollution and water consumption.
- the promotion of coherent production systems, like organic farming or integrated crop management
- the development of sound agricultural practices taking biodiversity into account (e.g. crop rotation)

In addition, it is anticipated that, farmers could be motivated to take part in programs of *in situ* protection of species and preservation of the plant genetic resources due to the decoupling of payments, if they are given an extra incentive from the Rural Development Fund.

8.3 Food security and the CAP reform

Born 50 years ago, when the founding members of the EU had not long emerged from a decade or more of food shortages, the Common Agricultural Policy (CAP) began by subsidising production of basic foodstuffs in the terms of self-sufficiency. The CAP of today, on the other hand, emphasises on direct payments to farmers as the best way of guaranteeing farm incomes, food safety, food security and quality, and environmentally sustainable production. This approach makes obvious the role of the farmers in improving food quality, food safety and finally food security. This change began when the EU realised that the policy of self-sufficiency in major foodstuffs resulted in excessive production of huge surpluses. CAP after all is not just about guaranteeing a fair living for farmers. Consumers have a right to a high quality and safe food. EU ensures the highest standards of animal welfare and hygiene, through the food chain, from farm to fork.

Concerning the Genetically Modified Organisms (GMOs) issue, there is social anxiousness expressed from various stakeholders regarding the cultivation of GMOs in Greece. This anxiety is derived from both the risks to the environment (agricultural and non) and the dangers posed to human health. So far, the cultivation of GMO crops is not permitted in Greece. It will be allowed in the near future by a new specific legal Act regulating the co-existence of organic, conventional and GMO crops. This act is under development and will provide sufficient protection of the non GMO plants. Notwithstanding, because of the provisions of Cross Compliance, the Greek NATURA 2000 areas are assigned as GMO free zones.

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ABBREVIATIONS

ARCMT	Agricultural Research Centre of Macedonia-Thraki
BBGK	Balkan Botanical Garden of Kroussia
CAP	Common Agricultural Policy
CBD	Convention on Biological Diversity
CGIAR	Consultative Group for International Agricultural Research
CIAT	Investigation Centre of Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Centre
CITES	Convention International Trade in Endangered Species
CLIMA	Centre for Legumes of the Mediterranean Agriculture
CPVO	Community Plant Variety Office
CWR	Crop Wild Relatives
ECP/GR	European Cooperative Program for Crop Genetic Resources
EPGRIS	European Plant Genetic Resources Information System
EU	European Union
EU-FP	European Union Focal Point
EU-INCO	European Union International Cooperation
EURISCO	European Search Catalogue of National Databases
FAO	Food and Agriculture Organization
FEOGA	European Agricultural Fund of Orientation and Guarantee
FPTI	Forest Products Technology Institute
FRM	Forest Reproductive Material
GDP	Gross Domestic Product
GGB	Greek Gene Bank
GMO	Genetically Modified Organisms
GPA	Global Plan of Action
GR	Genetic resources
Ha	Hectare
IBPGR	International Board for Plant Genetic Resources
ICARDA	International Centre for Agricultural Research in the Dry Areas
IPGRI	International Plant Genetic Resources Institute
IRRI	International Rice Research Institute
ITPGRFA	International Treaty for Plant Genetic Resources for Food and Agriculture
IU	International Undertaking
MAICH	Mediterranean Agronomic Institute of Chania
MFE	Mediterranean Forest Ecosystems
MTA	Material Transfer Agreement
NAGREF	National Agricultural Research Foundation
NGO	Non Governmental Organizations
OECD	Organisation of Economic Cooperation and Development
PD	Presidential Decree
PGR	Plant Genetic Resources
PGRFA	Plant Genetic Resources for Food and Agriculture
SBSSTA	Subsidiary Body on Scientific, Technical and Technological Advice
UN	United Nations
UNDP	United Nations Development Programme
UPOV	Union for the Protection of Varieties
USDA	United States Department of Agriculture
WTO	World Trade Organization

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