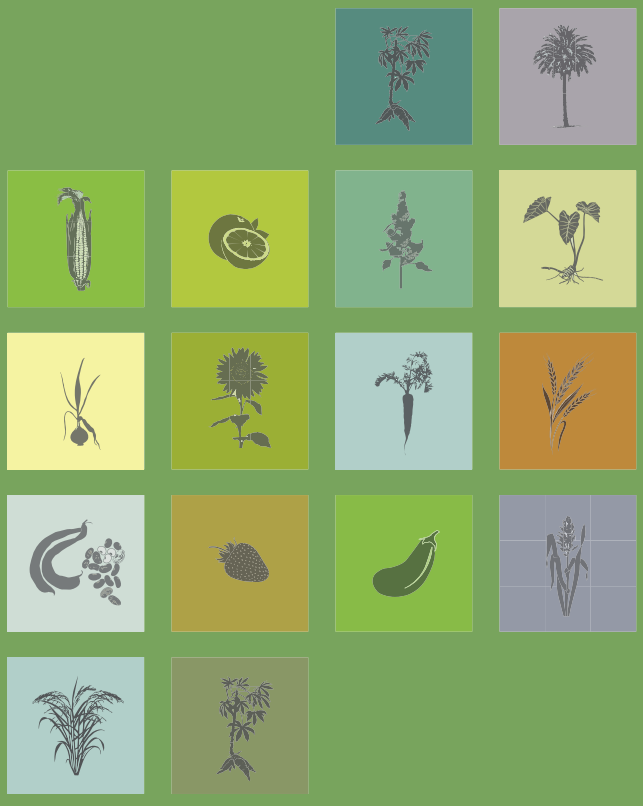
COUNTRY REPORT ON THE STATE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

GEORGIA



National Report on the State of Plant Genetic Resources for Food and Agriculture in Georgia

Tbilisi Botanical Garden and Institute of Botany
Tbilisi, Georgia

International Center for Agricultural Research in the Dryland Areas (ICARDA)
Aleppo, Syria

Lead Author: David Bedoshvili (ICARDA/CIMMYT)

Contributions:
Guram Aleksidze (Georgian Academy of Agricultural Sciences)
David Magradze (Institute of Horticulture, Viticulture and Oenology)
Marina Mosulishvili (National Museum)
Ana Gulbani (Georgian Institute of Farming)
Tamar Jinjikhadze (Tbilisi Botanical Garden and Institute of Botany)
Tina Barblishvili (Tbilisi Botanical Garden and Institute of Botany)

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LIST OF ACRONYMS AND ABBREVIATIONS

ACDI/VOCA	Agriculture Cooperation Development International/Volunteer Oversee Cooperation International
ACIAR	Australian Centre for International Agricultural Research
AWCC	Australian Winter Crop Genebank
BBG	Batumi Botanical Garden
BSU	Batumi State University
CACAARI	Central Asia and Caucasus Association of Agricultural Research Institutes
CBD	Convention on Biological Biodiversity
CGIAR	Consultative Group for International Agricultural Research
CIMMYT	International Center of Maize and Wheat Improvement
CIP	International Potato Center
CLIMA	Centre for Legumes in Mediterranean Agriculture
CWR	Crop Wild Relatives
DUS	Distinctness, uniformity and stability
EU	European Union
FAO	Food and Agricultural Organization
GAAS	Georgian Academy of Agricultural Science
GCDT	Global Crop Diversity Trust
GEF	Global Environmental Facility
GFAR	Global Forum for Agricultural Research
GIF	Georgian Institute of Farming
GIPA	Georgian Institute of Public Affairs
GIPI	Georgian Institute of Plant Immunity
GNSF	Georgian National Science Foundation
GPA	Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture
GRDP	Georgian Rural Development Program
GSAU	Georgia State Agricultural University
GTZ	German Society of Technical cooperation
IADA	International Agriculture Development Association
IBB	Institute of Biochemistry and Biotechnology
ICARDA	International Center of Agricultural Research for Dryland Areas
IF	Institute of Forestry
IHVO	Institute of Horticulture, Viticulture and Oenology
IMB	Institute of Molecular Biology
IPK	Leibniz Institute of Plant Genetics and Crop Plant Research
IS	Institute of Sericulture
ISTC	International Science and Technology Center
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
ITSCTI	Institute of Tea and Subtropical Crops and Tea Industry
IUCN	International Union for Conservation of Nature
KRIA	Krasnodar RI of Agriculture
KSU	Kentucky State University
MA	Ministry of Agriculture
MEPNR	Ministry of Environment and Natural Resources
MES	Ministry of Education and Science
MSU	Maryland State University
NAC	National Accreditation Center

NARS	National Agricultural Research System
NAS	National Academy of Sciences
NATO	North Atlantic Treaty Organization
NCGRP	National Center for Genetic Resources Preservation (Fort Collins, CO, USA)
NIPC	National Intellectual Property Center
NSFSVPP	National Service for Food Security, Veterinary and Plant Protection
PA	Protected Areas
PFU	Private Farmers Union
PGR	Plant Genetic Resources
PGRFA	Plant Genetic Resources for Food and Agriculture
TBGIB	Tbilisi Botanical Garden – Institute of Botany
UN	United Nations
UNDP	United Nations Development Programme
UPOV	International Union for the Protection of New Varieties of Plants
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
VIR	Vavilov All-Russian Institute of Plant Industry
WB	World Bank
WIEWS	Global Network of World Information and Early Warning System on Plant Genetic Resources
WSU	Washington State University
WTO	World Trade Organization
WWF	World Wildlife Fund

EXECUTIVE SUMMARY

The present (first) country report reviews the status of plant genetic resources (PGR) in Georgia with emphasis on the state of (1) biodiversity, (2) *in situ* conservation management, (3) *ex situ* conservation management, (4) the PGRFA use, (5) national programs, training and legislation, (6) regional and international cooperation, (7) access to PGRFA, benefits sharing arising out of their use and farmers' rights and (8) contribution of PGRFA management to food security and development of the country.

Georgia is very rich in biodiversity due to variation of soil and climate. The Georgian flora is characterized by high endemism and large number of plants that have economic importance. The Georgian flora of cultural plants is also very rich as the country is located in proximity of the Near East Center of origin of crop plants. Many crop wild relatives, particularly cereals and legumes, are found in Georgia. There are numerous Georgian land races of wheat, barley, sorghum, millet, maize stored in different collections of the world, while various old varieties of pip fruits (apple and pear) and grape are still found in farmer gardens. Underutilized and minor crop species present a challenge for researchers for harnessing their potential for the economy of the country. Numerous taxonomic studies of this diversity have been carried out and resulted in detailed inventories. However, this diversity has to be revisited by researchers for more detailed and profound studies based on modern achievements of science including molecular methods.

The *in situ* conservation is based on a system of protected areas. It covers well enough the unique natural biodiversity of the country, which is largely associated with the mountainous areas. However, many crop wild relatives remain uncovered by the present system as are confined with the habitats across the roads and crop fields. There is a need to emphasize agrobiodiversity in the national strategy of biodiversity conservation. There is no a national program for on-farm conservation of agrobiodiversity to provide farmers with incentives for growing traditional varieties and allow for their participation in formulation of the PGR conservation strategy.

The *ex situ* conservation of plant genetic resources is carried out by research institutes, which used to have sufficient staff, land and facilities in the near past. At present, the institutes are deprived most of their land through reformation, are under-funded and their research staff and programs have been curtailed. Therefore, their capacity of preserving collections of plant genetic resources has declined. Nevertheless, some effort has been made and a field crop genebank and a field collection of grapevine have been established and expanded during the recent years. There is a need to revive collections of other crops such as pip fruits, vegetables, citruses and subtropical crops, fill the gaps in the existing collections through germplasm exchange and collection missions and make safety duplications. There are some on-going efforts on characterization and documenting of the existing collections, however, much deeper studies are needed for facilitating access to the local plant genetic resources for plant breeders. There is an urgent need to establish a national program for coordination and optimization of *ex situ* conservation efforts.

The level of utilization of the local PGR is very low in Georgia, as most of the seed and sapling material production companies multiply exported varieties. This has been a quick solution for the agricultural entrepreneurs, which responded to rapidly growing demand for quality seed and planting material during the recent years. However, the imported varieties are not sufficiently adapted to local conditions, and their import is associated with high costs. Therefore, strengthening of the local capacity of plant breeding at policy, human resource and facility levels is of the highest priority, which will promote competitiveness of the Georgian agriculture. There is a need for developing a plant breeding strategy for each important crop, in order to respond better to the needs of agricultural production under the rapidly changing political and economical environment.

The curricula of the agricultural education centers generally include courses on genetics, plant breeding and seed production, but do not emphasize courses that are required specifically for management and conservation of plant genetic resources. There is a need to strengthen teaching of biochemistry, molecular biology, modern breeding methods and statistical analysis to allow the local graduates for carrying out modern research of plant genetic resources and continuing their education abroad.

Georgia does not have a legal framework for regulating access to PGRFA and sharing benefits arising out of their use. MA has reserved the right to restrict intellectual property rights of plant breeders in benefit of the Georgian farmers, if seed is saved for domestic use.

There is a need for an integrated national strategy for management and use of PGRFA. At present, the functions and the elements of an integrated strategy are distributed among the three ministries and several government agencies that should work closely and cooperate intensively with other stakeholders of the plant genetic resources, such as research institutes, education centers, farmers, agricultural and environmental NGOs, etc.

The importance of PGRFA for food security is widely understood by the scientific community, but much higher efforts are needed to attract attention of the local policy makers and the informed public as well as of potential users (such as farmers) to the issues of PGRFA.

INTRODUCTION

1. Geographical Information

Georgia is located between latitudes 41°05′-43°30′ north and longitudes 44°10′-47°15′ east. It occupies the central and western parts of South Caucasus and is bounded by Russia from the north, Azerbaijan from the East, Armenia from the southeast and Turkey from southwest. In the west, Georgia is contiguous of the Black Sea. Its total area is 69 700 km^2. By its area and population (~5 million), Georgia occupies the 121st and 118th places in the world.

The terrain of the country is mostly rugged and mountainous. Geologically, it belongs to the Alpine system of Eurasia and can be divided into following landforms: the range of the Greater Caucasus in the north, the mountain system of the Lesser Caucasus in the south and the intermountain area in the middle. Georgia occupies the south slopes of the western and central parts of the Greater Caucasus and the northern part of Lesser Caucasus, as well as the northwest of the Transcaucasian depression. These areas mainly consist of Meso- and Cenozoic deposits, while more ancient deposits, such as Precambrian and Paleozoic are of lesser importance. Altitudes in the country vary from 0 m at the Black Sea coast up to 5 201 m on the top of the Shkhara Mountain.

Georgia is very diverse climatically. Its climate varies from very severe with permanent snow in the high mountains to humid and warm subtropical at the Black Sea coast and semi-arid in the East Georgia. It is caused by the variability in altitudes, presence of natural barriers in the North and South, such as the Greater and Lesser Caucasus, strong influence of the Black Sea in the West of the country and closeness of its eastern parts to the arid areas of Front Asia. Numerous mountain chains and gorges that stretch along both meridians and parallels establish conditions for complicated air circulation.

The climate of the lowlands of the West Georgia (Colchis lowland) is humid subtropical. The annual temperature at the Black Sea cost is about 13-15°C. The average monthly temperature reaches 22-240 C in summer and declines to 0-7°C in winter. The absolute winter minimums are -10-15° C. The summer maximums can reach 40-43°C Annual precipitation at the Black Seas coast exceeds 1 200 mm and is more or less equally distributed across the seasons. In foothills of Adjara as much as 2 500 mm have been recorded in some years.

The climate of the lowlands of East Georgia is more continental and temperature maximums and minimums are sharper accentuated. Penetration of humid air masses from the West to East part of Georgia is blocked by longitudinal mountain chains Likhi and Meskheti. The annual temperature varies from 10 to 13° C. The average monthly temperature reaches 23-25°C in summer and declines to -2-0°C in winter. The absolute winter minimum is -20-25°C. In contrast to West, the East Georgia is drier. Annual precipitation varies in the East Georgian lowlands from 350 to 650 mm and most of it falls during the warm season.

In the mountains, the temperature average declines for as much as 0.3-0.8°C across the altitudinal gradient per every 100 meters. E.g. it drops to as low as -2-30 C at the level of 2 000 asl on the southern slopes of the Greater Caucasus. In contrast to the temperature, the precipitation increases in the mountains. It varies from 1500 to 3900 mm in the west and from 1000 to 1600 in the eastern parts of Georgia.

The soils of Georgia are also very diverse, which reflects the variability of geology, orography and climate. The most widespread types in the West Georgia are bog, podzolic, red, yellow and yellow-brown soils, which have mainly acid reaction. Grey, black, and chernozem soils are widespread in the lowlands of Eastern Georgia and are characterized with neutral reaction. In some areas of the East Georgia saline soils are observed; soil salinity is secondary and mostly results of the poor irrigation practices. Alluvial soils are found across the numerous rivers in all areas of Georgia. Brown soils are typical for the Georgian forest zone in the range of 800-2 000 meters above the sea level. At the higher altitudes, mountain-forest and mountain-meadow soils can be found.

The vegetation cover is also very variable in Georgia. Semi-desert and steppe vegetation, as well as light forests are confined mainly to the intermountain part of East Georgia. Botriochloa, wormwood and stipa dominated communities are the most widespread in semi-deserts and steppes. Light forests are presented by pistache woodlands, juniper open woodlands and communities dominated by Pyrus and Celtis. Interzonal xerophyllous shrubwood communities occur in every mountain bell, except for the highlands.

Forest is the prevailing type of vegetation. The forest area exceeds 40% of the countries total area. In Georgia, lowland forests are spread on swamps, flood plains and the lowlands, where closeness of the ground water stimulate the development of forest vegetation. Swamp forests occupy the Colchic lowland with its mainly damp and poorly drained soils. The leading tree variety is alder. Flood forests are met on river banks. Lowland hardwood forests are found in East Georgia, where species of oak, maple, linden and other trees dominate. Lowland coniferous forest is dominated by a relict species of pine and is found at the Black Sea coast.

The largest areas of forests are found in the mountains. The forests of Oriental beech occupy as much as 50% of the total forest area in the country and occur in both West and East Georgia. In East Georgia the beech wood belt spreads from 900 m to as high as 1 500-2 000 m above the sea level and often form continuous belt there. The large mountain areas in the West and western part of the East Georgia are also covered by dark coniferous forests, which are dominated by Nordmann (Caucasian) fir (mostly in West) and Oriental spruce. They never form a continuous belt in the mountains though. There are some areas covered by pinewoods. Forests of the Iberian oak (and several other varieties), chestnut, alder and several varieties of birch are also frequently found in the country. Negligent areas are covered by Caucasian hornbeam, linden, European ash, several species of maple, yew, zelkova, etc. Crook stem birch forests and Rhododendron shrub communities are often found at the upper limits of the forests and are considered as the near-timberline vegetation.

High-mountain vegetation comprises the area above the climatic limit (1 800-2 300 m asl) of dense forests and is characterized by wide diversity of habitats. One of the peculiar communities is the sub-alpine tall herbaceous vegetation, which occupies the most favorable habitats with rich soils in the high mountains. Forb and grass-forb meadows are found mostly in the subalpine belt, while the grass meadows cover large areas of both subalpine and alpine belts. Both forb and grass meadows are associated with wide diversity of habitats (from swamps to dry southern slopes) and are dominated by different grass and forb species. Tragacanthic (*Astragalus*) communities are found in the dry inter-mountain valleys in the northern slopes of the Greater Caucasus. The upper limits of the alpine vegetations varies from 2 900m up to 3 100m and is followed by the subnival belt, where distribution of contagious vegetation is limited and open plant groups dominate.

2. Description of the Country and its Economy

The first Georgian states were Colchis and Iberia originated in 6th and 4th centuries B.C., respectively. The latter was one of the first countries in the world to adopt Christianity as the official religion (in 4th century A.C.). The unified kingdom of Georgia was formed in early 11th century, which was followed by two centuries of cultural and economical flourishing. After, Georgia went into decline and eventually was fragmented into several kingdoms and principalities. The late medieval centuries were marked by continual fight against Ottoman and Persian Empires. In the 19th century Georgian kingdoms were step by step absorbed by Russia. Georgia had enjoyed independence from 1917 to 1921 before it was annexed by the Soviet Union.

During the Soviet Era, Georgia was one of the most prosperous Soviet Republics due to its unique and diverse environment favoring production of numerous crops (including citruses, tea and grape). Georgia achieved its independence in 1991, after which the country began reformation of the socio-economic system and transition from centrally planned to market driven economy. However, the difficulties of the transition period were aggravated by the civil war and separatist conflicts, which remained unresolved. However the hostilities were ceased through international mediation, which allowed for economic stabilization and development.

The political turmoil after independence resulted in the collapse of the Georgia's economy. The cumulative decline in real GDP is estimated to have been more than 70% between 1990 and 1994, and by the end of 1996, Georgia's economy had shrunk to around one-third of its size in 1989.

After 2003, the new government restarted reformation of the Georgia's economy and reoriented it toward privatization, free markets, and reduced regulation. The government combated corruption, stabilized the economy, decentralized the political system and brought order to the budget. During the recent years, the number of taxes has been reduced from 21 to 7 and a flat income tax of 12% was introduced. The government has significantly reduced the number of licenses a business requires, and introduced a simplified procedure for opening new businesses. The importation regimes have been also simplified and import duties declined.

Economic growth has remained strong since 2004, reaching 8% in 2006 and exceeding 10% in 2007. The inflation has fluctuated between 7 and 10% in the same years. A strongly negative balance of trade is offset by inflows of investment and assistance from international donors.

The most important source of capital in Georgia is foreign direct investment. The investments support new plants and equipment and introduce modern management systems and technologies. From 2002 to 2006, most of the foreign investments went to the construction of the Baku-Tbilisi-Ceyhan oil pipeline and the South Caucasus gas pipeline and averaged 9% of GDP. Since 2006, more than half of the foreign investments went to the banking, manufacturing, and tourism sectors.

During the Soviet era, as the Soviet Government strove for reducing its dependence on foreign currency, Georgia was obliged to supply other Soviet republics with citruses and tea. Georgia used to grow and supply almost 90% of the citruses and 95% of tea consumed by the whole USSR. Not surprisingly, Georgia remained closely linked to the Russian market after gaining independence in 1991. However, the trade relations were plagued by politically motivated interruptions when Russia imposed bans on all Georgian exports of wine, fruits and vegetables, and mineral water in 2006. It significantly reduced the volume of exports of these products from Georgia in 2007 and negatively affected the whole agricultural production. In light of these restrictions, Georgian businesses are actively seeking new markets for their products in the EU, Eastern Europe, North America, and elsewhere. The exports began recovering in 2008 as new markets were accessed by the Georgian producers.

Today, Agriculture produces the largest share of Georgia's GDP. It is followed by trade, manufacturing, and transport. Georgia's main exports are metals and ores, wine, nuts, and aircraft.

As a result of the wars and unemployment, a significant portion of the population lived below the official poverty line. Many of them migrated to different countries and the population of Georgia declined from 5.5 millions in 1991 to 4.65 million (July 2007 estimate). According to the 2007-year estimates, Infant mortality rate is 17.36 deaths/1 000 live births, while Life expectancy is 76.3 years. Georgians constitute about 83.9% of the total population. Other ethnic groups are represented by Azeri 6.5%, Armenians 5.7%, Russians 1.5% and other 2.5%.

3. Description of Agricultural Sector

The Georgians have been cultivating land since the ancient times. The diversity of the climate and the rich soils supported a great variability of crop production. The area of arable land is about 790 thousand ha (11.5%), while the permanent crops cover about 268 thousand ha (3.8%). Hay meadows spread over 142 thousand ha, while the pastures occupy 1 800 thousand ha. The forests cover almost 40% of the country area. All agricultural lands along with forests occupy as much as 85% of the total area of Georgia.

Most of the East Georgian lowlands are irrigated, pre-dominantly by flooding. The irrigation system collapsed in the mid 1990-ies, but it has been renovating during the recent years through privatization and the government investment programs. In the West, all crops are rain-fed and irrigation is not used because of the sufficient and excessive rainfall.

Large areas of tea, citruses, sub-tropical fruits and nuts are located in the humid subtropical lowlands West Georgia. West Georgia is also rich in rare grape varieties, which are used for the production of expensive wines. Chestnut is harvested in native forests of West Georgia significant amounts. Among the annual crops in the West, maize is the most widespread and there are a number of local maize food varieties cultivated across the lowlands, foothills and mountains. Maize is often inter-planted with common beans. The soybean area has also increased during recent times.

Most of the seed and stone fruit, and grape plantations are located in East Georgia. The major field crops of East Georgia are winter wheat and sunflower, which are cultivated in the dryland areas. Maize for feed, beans and alfalfa are sown frequently in irrigated areas. Potato and barley are important crops in the mountain areas of West East and South Georgia. The irrigated part of South-East Georgia is specialized in early vegetables and early potato growing.

Large areas of Georgia are covered by meadows and pastures which provides favorable conditions for the development of livestock production. Cattle, sheep and pig production have always been important sectors in Georgian agriculture and there are several high capacity poultry farms in Georgia. Georgian honey is known for its outstanding quality. Fish farming developed more widely during the last years and Georgia has significant resources for its further development. There are about 856 lakes and 44 artificial water reservoirs, with total area of about 8 800 and 7 800 ha, respectively in the country. Also, there are numerous rivers with about 1 400 ha suitable for fishing.

The fruit production is less than half of that, what it had been in the end of 1980-s and before disruption of the ties with the traditional markets. At present, grape production is a third, citruses one eighth, while tea is one twentieth of the level of that in the late eighties. According to the Agricultural Census of 2004[1], the area of fruit production was as big as 130.5 thousand ha in 1988, but has declined to as little as 37 thousand ha. During the same period, the area of grapes

[1] Agricultural Census of Georgia – Ministry of Economic Development of Georgia. Tbilisi 2005.

has reduced from 117.7 ha to 37.7 thousand ha, citrus from 27.1 ha to 8.7 thousand ha and tea plantations from 65 ha to 11.5 thousand ha. In contrast, the area under annual crops, such as maize, wheat and sunflower has almost doubled. Nevertheless, the total area of utilized arable land has decreased from 785 to 421 thousand ha, which is largely due to reduction of the area under feed crops (from 344.8 to 20.3 thousand ha). There was significant reduction in the numbers of cattle during the same period from 1 650 thousand to 1 250 thousand. For pigs and sheep the numbers reduced from 1 150 to 730 thousand and 2 000 to 700 thousand respectively.

The traditional structure of landownership in Georgia was radically altered in 1929 to 1930 with introduction of the system of collective and state farms by the Soviet government. Most of the agricultural land was transferred to big farms, which employed modern large-scale machinery and equipment and high amounts of the inputs were supplied under the centralized investment program. The land privatization reform, which was launched in Georgia after achieving independence (since 1992) resulted in abolishment of more than 2 000 big farms and most of their land was transferred to new owners: former farm employees, rural population and some residents of the urban areas that were linked to agricultural production. According to the Agricultural Census of 2004, there were about 691.5 thousand farms, which owned agricultural land (including hay-meadows and pastures). The share of small farms that used less than 1 ha of agricultural land was as much as 75%. About 23% of farms owned from 1 to 5 ha land. Only 2% of farms use more than 5 ha land in agricultural production. During the last years, the remaining agricultural land is being sold on auctions in form of bigger plots, which will affect positively the average farm size in Georgia. A significant portion of land is being purchased by foreign companies.

Farmers experienced significant problems with increased prices on inputs and decreased prices on commodities during the transition to free market. The competitiveness of the Georgian agricultural products was adversely affected as was the income of Georgian farmers. At present, many farms in Georgia are managed inefficiently because of land fragmentation, lack of machinery, lack of credit, deficit of good quality seed and planting material, and often the inefficiency is due to the lack of appropriate farming knowledge and experience.

CHAPTER 1

THE STATE OF BIODIVERSITY

1.1 Basic Main Value of the Plant Genetic Resources

The diversity of the genetic resources of Georgia provides sustainable basis for food security and agricultural production in the country. According to the recent edition of Flora of Georgia, about 4 200 vascular plants have been registered in Georgia. The 10 leading families are *Compositae* (538 species), *Gramineae* (332 species), *Leguminosae* (317 species), *Rosacea* (238), *Cruciferae* (183), *Scrophulariacea* (179), *Umbeliferae* (177), *Labiatae* (149), *Caryophyllacea* (135) and *Liliacea* (129). Out of all the vascular species distributed in Georgia, 380 (9.0%) are endemic to the country and 600 (14.2%) are endemic in the Caucasus region. This is a high proportion compared with that of larger countries of Europe and Asia. The generic endemism of Georgia's flora is also high. There are 16 endemic genera in the flora of Georgia, which are endemic to the Caucasus at them same time: *Alboviodoxa, Woronowia, Chymsydia, Trigonocaryum, Symphyoloma, Pseudobetckea, Charesia, Mandenovai, Sredinskaya, Cladocheta, Pseudovesicaria, Gadellia, Agasyllis, Paederotella,* and *Kemulariella*.

The Georgian flora is rich in economically important plant species. According to N. Vavilov, Georgia is part of the West Asian center of origin of the cultural plants. West Asia is considered as a major center of domestication of barley, wheat, pea, lentil, vetch, grapevine and numerous fruit trees.

More than 2 000 species of the Georgian flora have direct economic importance for food, timber, edible fruits and nuts, forage and fodder, medicine, colorants, industry and essential oil production. In addition, there are many traditional varieties and wild relatives of cultivated species. A variety of crops, such as cereals (wheat, barley, rye, sorghum, millet), legumes (faba bean, grass pea, chickpea, lentil, cowpea), also flax, onion, garlic, and various fruits (grape, apple, pear, quince, medlar, peach, apricot, plum, cherry, cornelian cherry, etc) have been cultivated here from ancient times. Starting from the 17th century, many American crops were introduced such as maize, potato, tomato, tobacco in the country and which were followed by the citruses and tea in the 19th century and kiwifruit in 20th century.

1.2 Diversity Within and Between Crops

1.2.1 The State of Diversity of Major Crops

Cereals

- **Wheat** (*Triticum*) is one of the most important food grain crops of Georgia, which is used for production of the staple food – bread. There have been identified 14 cultural species of wheat in Georgia, out of which 4 species are endemic to the area: *Triticum makha, Tr. timopheevii, Tr. zhukovski*, and *Tr. georgicum*. Georgian farmers cultivated numerous land races of bread wheat, such as dolis puri, khoulugo, ipqli, rachula etc. The Georgian wheats have been widely used in breeding of wheat as they represent rich sources of genes conferring resistance to diseases and drought. E.g. ***Tr. timopheevii***, is a known source of resistance for scab and rusts, which have been incorporated into some improved varieties. None of the old varieties are grown now as they have been replaced by breeder's varieties during the 20th century. The area of wheat has varied from 75 000 to 200 000 ha during the last decade depending on availability of inputs and market prices.

- **Barley** (*Hordeum*) is one of the oldest cultivated crop plants of Georgia. Many varieties were distributed in different regions of Georgia in the past. Barley was used by the mountain population for forage, food and production of beer, as well as an attribute of traditional rituals and important means of the folk medicine. Breeder's varieties of barley dominate in Georgia. At present, only few local landraces remain cultivated on very small areas, mainly in the remote high-mountain regions in Khevsureti and Tusheti. The cultivated area under barley has varied from 75 000-100 000 ha during the last decade.

- **Foxtail** millet (*Setaria italica*) was the most important food crop in West of Georgia in the past. Cultivated Italian millet *Setaria italica* subsp. *colchica* was represented with 32 landraces and had been widely spread before the 17th century. Italian millet was replaced by maize and it is rarely found in piece gardens in West Georgia.

- **Millet** (*Panicum*) was one of the important cereal crops in Georgia in the past. There was a considerable diversity of the millet varieties in Georgia varying in the length of growing season from 70-80 days to 100-120 days. Early-maturing varieties were grown in the mountains, while the late-maturing varieties fitted the lowland conditions. Their area has declined since introduction of maize and at present they cover negligent areas.

- **Maize** (*Zea mays*) was introduced in Georgia in the 2nd half of 17th century. At present it covers about 250 000 ha and is staple food for the population of West Georgia. It is also grown in East Georgia, predominantly for feed. During the last three centuries, the introduced maize has given birth to several distinct local farmer varieties differing from each other in maturity, which varied from 85 to 140-150 days. The early maturing varieties spread as high as 1 300-1 500 m asl, while the late-maturing varieties are grown in the lowlands. At present the farmer varieties are mostly replaced by breeder's varieties.

Food legumes

- **Legumes** were historically important food crops of Georgia and were widely spread in the country. Legumes (family *Fabaceae*) are represented in Georgia by 51 genera and 317 species, most of which were used as food or forage. Species and varieties of bean (*Phaselous*), pea (*Pisum*), faba-bean (*Vicia faba*), cow pea (*Vigna*), lentil (*Lens*), chickpea (*Cicer*), vetch (*Vicia*), grass pea (*Lathyrus*) and other legume genera and species have been cultivated in Georgia since the ancient times.

  Some of the food legumes are native to Georgia, e.g. pea (Georgia is part of the area, which is considered as domestication center of *Pisum*). Despite the fact that genus *Phaselous* is represented in the flora of Georgia by 6 species and one of them is widely spread common bean (*Ph. vulgaris*), cultural bean, were brought to Georgia in the 2nd half of 16th century. The Georgian botanists and agronomists identified 61 varieties and 406 forms of common bean of the local origin. There is great diversity among forage crops as well. Clover (*Trifolium*), sainfoin (*Onobrychis***),** alfalfa (*Medicago*), vetch (*Vicia*), hickling pea (*Lathyrus*), trefoil (*Lotus*), sweet clover (*Melilotus*) and some other genera are widely spread in the meadows and pastures of Georgia.

  The production area of legumes is small at present. Common bean is the most popular food legume, which covers not more than 10 000 ha. Among the forages, alfalfa and sainfoin are the most remarkable. The alfalfa area is growing in the irrigated areas with the development of livestock production. Sainfoin is widespread in the mountains and drylands.

Fruits

- **Grape**. Grapevine has been cultivated in Georgia since the time immemorial. Georgia is considered as on of the places of grapevine domestication. The oldest pips of cultivated vines (*Vitis vinifera*) were found in Georgia and they belonged to the period of 6 000 BC. The mountainous countryside and isolated villages have preserved for us a unique heritage: about 525 indigenous grape varieties (Ketskhoveli 1960). The most distinguished are Rkatsiteli, Saperavi, Khikhvi, Khisi, Budeshuri, Aladasturi, Kakhuri Mtsvane, Alexandreuli, Goruli Mtsvane, Ojaleshi, Krakhuna, Chkhaveri, Tsitska, Usakhelouri, Chinuri, Khvantchkara, MujureTuli, Tsolikouri, Kharistvala etc.

- **Fruits, nuts and berries**. Different pip fruits (apple, pear and quince), stone fruits (peach, plum, apricot, cherries), mulberry and nuts like hazelnut (*Corylus*), almond (*Amygdalus*), walnut (*Juglans*) fig (*Ficus*) pomegranate (*Punicum*), etc. are widely grown in Georgia. These fruit species have been diversified through human selection over hundreds of years. There are still significant numbers of local varieties and landraces of these fruit crops in Georgia. As many as 28 and 27 local varieties of apple and pears, respectively, were reported by the GEF/UNDP project to be grown at the farmer homesteads in South Georgia. The recent introduction of modern foreign varieties of apples and some other fruit crops has posed a serious threat of genetic erosion to the local cultivars.

The rich diversity of wild and cultivated fruit crops and berries cover large areas in Georgia and represent rich material for future breeding activities. Among them are cornelian cherry (*Cornus* mas), medlar (*Mespilus germanica*), wild plum (*Prunus cerasifera*), blackthorn (*Prunus spinosa*), Caucasian wild pear (*Pyrus caucasica*), red fruit thorn (*Crataegus monogyna*), black fruit thorn (*Crataegus pentagyna*), mountain ash (*Sorbus aucuparia*), Cherry laurel (*Laurocerasus officinalis*), also berries: blueberry (4 species of *Vaccinium*), raspberry (*Rubus ideus*), alpine currant (*Ribes alpinum*) etc.

- **Citruses** and **tea** are not native crops of Georgia. They were introduced in the 19th century and became the most important crops in the Soviet period. They are still the major fruit crops of West Georgia and could play a role in the food security, if the ties with the old markets are restored or new markets accessed by Georgian farmers. The most widely spread citrus in Georgia is mandarin (*Citrus reticulata*). There is considerable production of Oranges (*Citrus sinensis*), lemon (*Citrus ×limon*) and grapefruit/pompelus (*Citrus paradisi*) in West Georgia. There are also numerous subtropical fruits in Georgia, which are grown in the same area as tea and citruses such as feijoa, kiwi, persimmon, fig etc. Similar to citrus and tea, they are not native to Georgia and were introduced in the 19th and 20th centuries.

1.2.2 Diversity of Minor Crops and Underutilized Species

The minor and underutilized crops play an important role in crop diversification and development of new agricultural products. The minor crops can make significant contribution to the life of local people through diversifying and increasing their incomes. Georgia is rich with genetic resources of minor and underutilized crops too.

The surveys of minor crops of economic importance, such as woody plants, medicinal plants and some others have shown that their abundance in natural habitats is declining. Even medicinal plants, such as *Origanum vulgare*, *Helichrysum plicatum* and *Hypericum* spp,. which were once very widespread in the country are endangered. These plants are collected by the rural population not only for domestic use but also for sale. Bulbs of *Leucojum aestivum*, which is native to wetlands of the province of Guria (West Georgia) and seeds of Caucasian fir (*Abies nordmanniana*) are harvested by local entrepreneurs in huge amounts for export and are also in danger of decrease.

Georgia is reach with valuable woody plants such as Imeretian oak (*Quercus imeretina*), other oak (*Quercus* spp.) species, sweet chestnut (*Castanea sativa*) and oriental beech (*Fagus orientalis*). However their resources are declining due to over exploitation for timber.

There numerous ornamental plants in Georgia. Plants, such as Iris iberica, *Tulipa eichleri*, *Scilla* spp., *Lilium szovitsianum*, *Fritillaria* spp., *Cyclamen coum*, *Colchicum speciosum* and *Helleborus caucasicus* are harvested in great amounts and sold at local markets. Branches of some evergreen ornamental plants such as boxwood (*Buxus colchica*), yew (*Taxus baccata*), holly (*Ilex colchica*), butcher's broom (*Ruscus colchicus*), etc. are collected and sold for profit by the local population during whole year, as they are widely used as decoration in bouquets. The ornamental plants are endangered and require protection.

1.2.3 Wild Crop Relatives and Wild Plants for Food Production

In the Georgian flora, the genera of the highest economic importance are *Malus, Pyrus, Prunus, Corylus,* as well as wheat and barley. The highest CWR diversity is presented for crops, which are widely used for fodder/forage production: clover, alfalfa, sainfoin, fescue, meadow grass, broom grass, etc.

The genus *Aegilops*, a wild relative of wheat, is represented by 7 species. These species naturally grow in various habitats including dry slopes and sandy places, open woodlands, semi-deserts and steppes in the lowland, foothill and **mountainous** areas of Georgia. Genera *Hordeum* and *Secale* are represented by 5 species each. Wild species of all three genera are sources of important genes for cultivated wheat, barley and rye, respectively. The highest diversity of the grass family (Poaceae) is represented in the following genera: *Festuca* (21), *Poa* (19), *Bromus* (15), *Alopecurus* (13), *Avena* (8 species), *Trisetum* (7), *Agrostis* (7), *Lolium* (7), *Phleum* (6), *Setaria* (6) and *Panicum* (5). One of the negative factors affecting the natural habitats of the grass species (meadows and pastures) is over-grazing and the consequent land degradation. Therefore some of grass species are in danger of decline.

Family Fabaceae, is specifically rich with diversity of CWR taxa. It is represented with 317 species in the flora of Georgia. Many of them are used as forage and/or food. The genera rich with species are: *Astragalus* (72 species), *Trifolium* (36), *Vicia* (33), *Medicago* (22), *Onobrychis* (19), *Lathyrus* (14) and *Trigonella* (10).

Family Rosaceae is represented with 237 species; many of them are endemics. Genera rich with species are *Alchemilla* (61), *Rubus* (36), *Potentilla* (31), *Rosa* (30), *Sorbus* (12), *Pyrus* (11), and *Crataegus* (8).

Diversity of the main fruit crops and their wild relatives is decreasing due to anthropogenic affects. Fruit and berries of many species are harvested by the local population and small enterprises in the wild for sale and processing. The same can be said about the species, which have valuable roots and tubers and therefore they are dug up in their natural habitats. All these species are under threat.

One of the most economically important Georgian crops is grape (*Vitis vinifera*). It has a wild relative species *V. sylvestris*, which grows naturally in the riparian forests of both West and East Georgia. At present, the area of the riparian forests is declining and the wild grapevine is under great threat and requires protection. Introduction of an American fungal disease is another factor causing reduction of the natural population.

The genera and families with important CWR taxa are shown in Annex 1.

1.3 Diversity of Modern Breeder's Varieties

Modern breeder's varieties occupy most of the arable and permanent crop areas. The latest official edition of the Catalogue of the Georgian Released Varieties of 1997 (published in 1996) listed 195 varieties of field and vegetable crops and 195 varieties of fruits. The field crop varieties included 42, 23, 7, 18, 6 and 3 varieties of cereals, food legumes, potato, forages (including legumes), tobacco and sunflower, respectively. The remaining 96 varieties represented vegetables: cabbage (9), cucumber (8), tomato (9) cauliflower (1), radish (4), spinach (1), beets (6), onion (7), garlic (2), carrot (3), leek (1), sweet pepper (2), chili pepper (4), eggplant (2), melon (4), water-melon (2), pumpkin (3), squash (1) and turnips (1). The rest were herbs and varieties of different crops adapted for silage and feed production.

There was also a diversity of varieties of the perennial crops, such as apple (15), pear (4), quince (4), cherry (3), sweet cherry (7), plum (6), cherry-plum (3) sour cherry (5), apricot (5), peach (14), grapevine for wine (26), table grape (10), tea (9), mandarin (11), orange (10), lemon (4), grapefruit (4), persimmon (5), fig (6), pomegranate (7), hazelnut (8), cornelian cherry (11), mulberry (17) and strawberry (1).

Not all varieties have been used in production. At present, seed or sapling material production exists only for few of them. These varieties were part of the collections that existed in the end of 1980-ies and beginning of 1990-ies at the major NARS germplasm research centers and variety trial stations of the former State Commission of Protection of Plant breeding achievements. However, some collections did not survive. More or less complete variety collections exist for grapevine at IHVO and field crops at GIF.

The number of the varieties released at the end of the 1990-s was negligent and mostly included imported potato varieties, which were not registered officially eventually, as the issues of IPRs were not solved. In 2005, the Georgian Minister of Agriculture approved release of 4 Dutch vegetable, 7 local food legume, 1 Georgian tomato, 3 Georgian hybrid maize and 1 Georgian soybean varieties. The same year, National Center for Protection of Intellectual Property received applications for protection and release for 1 local variety of cabbage, 5 local varieties of mulberry and 3 Russian varieties of winter wheat. The next applications for protection and release were received in 2008 and included 5 hybrid varieties of maize. However, there have been decisions neither for protection nor for release of the varieties listed in the applications of the year of 2005 and 2008.

Actually, numerous varieties are grown in Georgia without going through the official procedure of the release. This concerns first all imported varieties of potato, wheat, maize, berries, kiwi and many others. These varieties are not registered and monitored by government bodies.

1.4 Diversity of Landraces/farmers' Varieties

Diversity of landraces/farmer varieties has been declining for more than 50-70 years, since the establishment of big specialized farms (collectivization) in Georgia during in the middle of 20th century. This trend continues nowadays as reliance on imported germplasm is dominating. The share of farmer varieties in field crops is negligent. Numerous Georgian wheat landraces remain only in collections. The share of farmer varieties in fruit crops should be sizeable as local varieties of apple, pear, plum, and especially of grape can be found in farmer gardens.

1.5 Factors Influencing to State of the Plant Genetic Diversity

The first change in relative importance of the local crops was observed in the 17th century, when maize, tomato, tobacco, potato and some others were brought to Georgia. Maize became staple food in West Georgia and replaced Italian millet almost completely. Food legumes such as chickpea and lentils yielded their place in the local diets to the American vegetables. During the Soviet era, Georgia became a very big producer of fruits, wine and vegetables. It became also an exclusive supplier of tea and citruses and one of the largest suppliers of wine, fruits and vegetables to the former soviet

republics. Furthermore, Georgia had to cease production of some crops, which were supplied by the central government from other Soviet republics. The Soviet era coincided with modernization and scaling up of agricultural production, which was associated with introduction of modern breeder varieties, which expelled many local landraces and varieties from the production fields.

After disintegration of the Soviet Union, the post Soviet area became open for international suppliers and the Georgian commodities had to compete with them. The major reductions in export commodities were observed in tea and citruses. Furthermore there were internal needs for crops, which were not addressed due to discontinued centralized supplies. The recent political developments resulted in banning Georgian imports to Russia, and urged the Georgian producers to seek for new markets (such as EU), which turned to be very competitive but provided with new marketing opportunities. The internal market needs and international market opportunities became a strong driving force pushing the Georgian agriculture to diversification. As far as the local PGR management and use system is weak, the Georgian producers switched to externally developed varieties and there is influx foreign germplasm to Georgia.

Besides the economic pressure and political issues, deforestation and overgrazing has been an issue since the early 1990-s. During the humanitarian crisis, as well as in the consequent years before the legal framework improved recently, the population, as well as big enterprises cut forests without any control resulting in disappearance of many important species and destroying natural habitats. Overgrazing remains an issue as there is no any control on that. Deforestation and overgrazing promotes land degradation and eventually destruction of habitats.

The phyto-quarantine quarantine measures are weak and can not exclude invasion and proliferation of new pathogens and diseases. The recent epidemics of American white fly are an example. It is known that potato and other clonally propagated crops suffer from viruses but there is no capacity to check the imported material adequately.

1.6 Future Needs and Priorities

Since 2005, Georgia has had an approved biodiversity national strategy and a plan of action, which has not been actively used and is being modified at present. The country has several relevant research institutes, but doesn't have a coordinated research agenda. If compared with the late 1980-ies, its research capacity has remarkably declined. The current government's effort to transform Chavchavadze State University into a center of scientific excellence for biodiversity studies and education is very promising.

The future needs include more targeted collection and research of biodiversity including existing crops and their varieties both for conservation and future use. There is also a need for capacity to better assess the state of diversity, as well as degree of genetic erosion, which requires qualified scientists one hand and research institutions with appropriate laboratories, land and facilities on the other hand to respond better to the threat.

Such research efforts, especially if they are done on regular bases, require national coordination with clear understanding of the roles and responsibilities of the involved stakeholders and sufficient funding from the government. This can not be achieved without public awareness of economic, social, cultural and ecological values of PGRFA. The government participation is also needed to facilitate international cooperation, involvement of Georgia in global programs and frameworks for technology transfer.

CHAPTER 2

THE STATE OF THE *IN SITU* MANAGEMENT

One of the ways of conserving PGR is to preserve them *in situ*, i.e. to protect areas or particular ecosystems, where the plant species occur naturally. This would be the best way of protecting wild relatives of the crop plants and of wild species that are directly used for food or other purposes. As far as it is concerned the landraces and farmer varieties, the best way of their preservation is their sustainable production at farms (i.e. on-farm conservation).

2.1 Inventories, Surveys & Priority Setting

There have been numerous taxonomic and floristical studies conducted by the Georgian and international scientist. A multi-volume edition of Flora of Georgia has been published and revised at least three times. Flora of Georgia has been included as a part of Flora of USSR and Flora of the Caucasus. Georgia has published the Red Book, according to which there 50 critically endangered species, while 300 are classified as rare, and 140 species have undergone significant decline in Georgia.

A network of PA is considered as the major element of *in situ* management of PGR in Georgia. According to the Georgian Law of the System of Protected Areas, the following types of PA could be used for *in situ* protection of PGR: state nature reserve, national park, monument of nature, sanctuary, protected landscape, multiple use territory and biosphere reserve. There are 12 state reserved areas, 7 national parks 8 sanctuaries, 3 monuments of nature and 1 protected landscape in Georgia. The status of multiple use territory and biosphere reserve has not been applied so far. The modern *in situ* management system was introduced largely through support of WWF, WB, IUCN and other international organizations. The priority setting process and identification of areas for protection has been also facilitated by the international organizations.

State reserved areas represent the strictest level of protection and are established only for conservation, monitoring and research of natural processes and genetic resources. National parks are managed to combine protection of major ecosystems with recreation, education and research opportunities. The total area of the state reserves and national parks in 2005 was 322 988 ha, which was about 4.4% of the country territory (Statistics Department, 2005) and it has expanded significantly since that.

The history of nature conservation in Georgia starts with establishment of Lagodekhi State Nature Reserve in 1912. It is situated in the east of Georgia, on the southern slope of the Greater Caucasus stretching from 450 to 3 500 m asl. At present its area is about 22 200 ha, while the adjacent 1990-ha area has status of a sanctuary. As many as 1 320 plants, including 37 rare ones, have been registered in the reserve.

Establishment of the Vashlovani State Nature Reserve was announced in 1935 with the purpose of conservation of the rare arid plant communities. At present it is a complex PA consisting of Vashlovani State Reserve itself (10 142 ha), Vashlovani National Park (24 598 ha) and three monuments of nature. It is located in the lowland area of the eastern part of Georgia, near Dedoplistskaro. More than 590 species, including 35 rare plants have been recorded in the area.

PAs of Tusheti (southern slope of the northern branch of the Greater Caucasus) include Tusheti State Nature Reserve, Tusheti National Park and Tusheti Protected Landscape. The total area is 118 319 ha, out which 76 000 ha is occupied by Tusheti National Park. It was established in 2003. The Tusheti area conserves more than 1 000 plant species and is characterized by very high endemism; as many as 11 species are endemic to Georgia.

There are two state nature reserves near Akhmeta in East Georgia on the southern slope of the Greater Caucasus: Babaneuri and Batsara, which occupy 770 and 3 000 ha, respectively. Babaneury Reserve was established with the purpose of conservation of relict woods of zelkova (*Z. carpinifolia*), while Batsara protects wood of yew (*Taxus bacata*) - the largest yew-tree woodland in the Europe. As many as 1 200 plant species are known to occur on that area.

Kazbegi National Park (former state reserve) was established in 1976 to protect specifically high mountain vegetation of the Central part of the Greater Caucasus. It occupies about 8 700 ha and conserves as many as 800 plant species including 10 rare plants.

Saguramo State Reserve is located near Tbilisi, where it was establish in 1957 on more than 5 300 ha to protect relict plants of the tertiary period Colchic flora in East Georgia. Its floral composition accounts for at least 580 plants.

Borjomi-Kharagauli National Park was established in 1995 to protect biodiversity of the Lesser Caucasus. Its area is almost 76 000 ha, which is more than 1% of the Georgian territory. It includes Borjomi State Nature Reserve and Nedzvi sanctuary.

Algeti State Nature Reserve is found on the Trialeti mountain range in the Tetritskaro district, which is located in South Georgia. It was established in 1965 with the purpose of protection of oriental spruce (*Picea orientalis*) and Caucasian fir (*Abies nordmanniana*). Its area is about 7 000 ha. It was transformed to the National Park in 2007. The Georgian PA system also includes Liakhvi State Reserve in the breakaway South Oseti.

In West Georgia, Sataplia State Reserve is located near Tskaltubo. It covers 350 ha and protects mostly geological, speleological and paleontological monuments. Kolkheti National Park was established in 1995 to conserve ecosystem of the Colchis Lowland, and covers both terrain and sea areas: 29 700 and 15 740 ha, respectively. Kintrishi State Nature Reserve was founded in 1959 to conserve the relict Colchis flora of the tertiary period. Its area is more than 7 100 ha and it protects as many as 1 045 species including 25 rare plants. Mtirala National Park is located in Adjara, where it was established in 2006. It occupies 15 800 ha and protects Colchis woods composing of more than 280 plant species. There are three protected areas in breakaway Abkhazeti : Gumista, Bichvinta-Miuseri and Ritsa State Reserves.

Six sanctuaries stand alone and are not adjacent to other protected areas: Ilto, Katsoberi, Gardabani, Chachuna, Iori and Ajameti.

The *in situ* conservation management of wild plants, including native crop plants and wild crop relatives is greatly facilitated through preparation of inventories and surveys. This is done by TBGIB and National Museum and their documented findings are stored in herbaria. Both institutions are active in research and characterization of genetic resources including those having importance for food and agriculture. There are some efforts to start molecular research of crop wild relatives at IBB. Chavchavadze State University has acquired molecular lab equipment and is starting molecular research of the wild flora of Georgia.

2.2 On-farm Management & Improvement of PGRFA

There has been continuous erosion of the local varieties and land races for the last 50 or more years, since the Georgia became specialized on supplying the former Soviet Union with few commodities, including tea, citruses, wine and vegetables. Georgia's diverse endemic cultural species of wheat and land races of bread wheat, barley, maize and food legumes have been abandoned by farmers and can be found only in collections. The situation with permanent corps is better as numerous traditional varieties of grape and fruits are still grown. The threat of erosion has even increased since achieving independence in 1991, as influx of new and improved imported varieties has increased.

The on-farm conservation of PGRFA is not an easy task, as farmers require economic incentives to produce land races. The need to conserve agrobiodiversity is mentioned in the Georgian Biodiversity Strategy and Action Plan. This is addressed through the GEF-funded and UNDP-managed project (Recovery, Conservation and Sustainable Use of Georgia's Agrobiodiversity), which supported multiplication of traditional varieties that were distributed to farmers. The project included marketing and public awareness components, which facilitated promotion of the products produced from the local varieties. There have been implementing an SDC-funded agro-tourism project that supports conservation of agrobiodiversity through promotion of local food and local agricultural practices.

However, the coordination of on-farm management of PGR and involvement of rural communities in formulation of strategy is very week. The government doesn't have a special program to support on-farm conservation in the country.

2.3 Restoring Agricultural Systems after Disasters

Georgia experienced drought in 2000, which was so strong that winter grain crop yielded less than 1/3 of what was obtained in average during the last decade. Many farmers could not manage to save seed and there was lack of seeds by the next planting season. This led to agricultural disaster as the Georgian economy was in stagnation and most of the farmers did not have resources to buy new seeds. The disaster was addressed by international donors mostly. Several donor-supported emergency projects (FAO, USAID etc.) were implemented to alleviate this problem.

At present, Ministry of Agriculture has developed capacity of managing critical situations and responds to emergencies such as shortages of food by internally displaced and socially-vulnerable people, overproduction of grapes, epidemics

of disease, pest invasions, seed and sapling material shortages etc. There is also an unofficial response mechanism for foreign donors to support the efforts of the ministry, which is facilitated by UNDP.

2.4 Crop Wild Relatives and Wild Plants for Food Production

CWRs are an important source of genetic variation for improving domesticated species. Wild plants give unique opportunities to diversify agricultural production and generate farmer incomes. The actions to improve their conservation first of all include survey and monitoring of their natural populations. Such efforts were conducted by TBGIB on a routine basis and considerable data was accumulated and analyzed from thirties till nineties of the 20th century. Similar efforts were made by GSAU, GIF and IHVO. The research was rather intensive and covered relatives grain crops, legumes, seed fruits, grapevine etc. The table below shows the numbers of CWR by families and genera.

TABLE 1
Wild crops relative species in Georgia

Family	Genera	Taxa	Genera with numbers of species
Poaceae	19	135	*Aegilops* (7) *Agropyron* (2), *Agrostis* (7), *Alopecurus* (6), *Arrhenaterum* (1), *Avena* (8), *Bromus* (15), *Dactylis* (1), *Echinochloa* (3), *Festuca* (21), *Hordeum* (5), *Koeleria* (4), *Lolium* (7), *Panicum* (5), *Phleum* (6), *Poa* (19), *Secale* (5), *Setaria* (6), *Trisetum* (7)
Fabaceae	8	110	*Trifolium* (29), *Vicia* (23), *Onobrychis* (19), *Cicer* (2), *Medicago* (21), *Pisum* (1), *Lotus* (5), *Trigonella* (10)
Rosaceae	11	53	*Fragaria* (1), *Malus* (1), *Pyrus* (13), *Rubus* (25), *Mespilus* (1), *Sorbus* (10), *Amigdalys* (1)
Brassicaceae	6	21	*Brassica* (4), *Sinapis* (2), *Rorippa* (4), *Lepidium* (8), *Raphanus* (2), *Spinacia* (1)
Apiaceae	6	22	*Apium* (2), *Anthriscus* (8), *Petroselinum* (1), *Carum* (5), *Daucus* (1), *Pastinaca* (5)
Liliaceae	2	28	*Allium* (25), *Asparagus* (3)
Lamiaceae	2	7	*Satureja* (3), *Mentha* (4)
Grossulariaceae	1	3	*Ribes* (3)
Asteraceae	3	16	*Cichorium* (1), *Lactuca* (7), *Scorzonera* (8)
Valerianaceae	2	21	*Valeriana* (11), *Valerianella* (10)
Linaceae	1	12	*Linum* (12)
Chenopodiaceae	1	2	*Beta* (2)
Polygonaceae	1	2	*Fagopyrum* (2)
Cannabaceae	1	1	*Humulus* (1)
Vitaceae	1	1	*Vitis* (1)
Totals	**54**	**304**	

Considerable work in the direction is being carried out by the GEF/UNDP project Recovery, Conservation and Sustainable Use of Georgia's Agrobiodiversity, which covers one of the most floristically diverse areas of Georgia. Within the project, the researchers surveyed the natural populations of CWR, assessed their status through different parameters and mapped. Based on this data, they are developing recommendations on establishment of protected areas for the CWR species. The same project promoted awareness of importance of wild crop relatives through organizing trainings on CWR research, management and policy issues at MEPNR by N. Maxted from University of Birmingham.

2.5 Improvement of *In Situ* Management, Priorities and Needs

One of the priorities *in situ* management is to include in the system of protected areas territories, where natural populations of CWR occur. Most of the present PAs cover native forests (though which some wild relatives of tree crops are protected) and subalpine and alpine vegetation, while wild relatives of field crops are usually found in the lowlands, closer to agricultural areas.

One of the priorities in improving the *in situ* management is establishment of a national program that would promote involvement of communities in on-farm multiplication of local land races and in formulation of strategies and designing of action plans.

Overwhelming majority of land races is stored in the collections and their seed is not available in quantities adequate for production. There is a need to multiply their seed at wider scale to promote their on-farm conservation.

The knowledge associated with the production and use of land-races has declined and is becoming an obstacle in reviving of community-based conservation of land races. There is a need to collect and disseminate this knowledge among the local population together with seeds.

There are also numerous research needs such as a) exploration for better inventories and characterization of land races and CWRs, b) ethnobotanical and socio-economic studies to better understand the mechanisms of introducing the land races in on-farm production, c) improvement of land races through simple breeding techniques such as mass selection, d) assessment of adaptability of the land races to organic systems and e) strategy planning at the national level.

CHAPTER 3

THE STATE OF THE *EX SITU* MANAGEMENT

3.1 Sustaining and Expanding *Ex situ* Collections

Ex situ conservation is especially important for protection of agrobiodiversity as *in situ* conservation can not guarantee survival of the plants. Besides, the *ex situ* conservation, if properly organized, provides scientists with easier access to agrobiodiversity.

3.1.1 Main *ex situ* Collections

Most of the plant research centers maintain *ex situ* germplasm collections Georgia. In total, about 7 000 accessions are stored in different research centers not including live collections of several arboretums. The largest collections of PGRFA have been concentrated at GIF (Genebank), IHVO and ITSCTI (live collections). TBGIB and BBG are the largest centers of wild plant *ex situ* conservation.

Name of Institute	Location	# of accessions in bank	Species in live collections	Accessions of *in vitro* collection	Major plants
RI of Farming	Mtskheta	3 057	-	-	Field crops, vegetables
Institute of Horticulture, Viticulture, and Oenology	Tbilisi	1 519	-	-	Grape, Pipe and seed fruits, nuts, berries
Institute of Forestry	Tbilisi	99	-	-	Trees
RI of Plant Immunity	Kobuleti	343	6	-	-
RI of Tea, Subtropical Crops and Tea Industry	Ozurgeti	-	155	-	Citruses, tea, fruit trees
Biotechnology Center	Tbilisi	-		75	Potato
Batumi Botanical Garden	Batumi	-	2037	-	Various
Tbilisi Botanical Garden/ Institute of Botany	Tbilisi	520	about 2 300	-	Various
Georgia State Agriculture University	Tbilisi	748	10	-	Grapevine, food legumes
Agro Cartu	Tbilisi		475	-	Grapevine

3.1.2 Gene Banks

There is only one genebank for PGRFA in Georgia, which was established in 2004 at GIF through support of ICARDA. The purpose of the genebank is to conserve genetic resources of field and vegetables crops. It became fully functional in 2006. It is a short-term storage facility, where temperature is maintained at the level of 0-+40C. It has simple equipment for moisture content measurement, drying samples (drying room) and conducting seed viability tests. The genebank collected the samples from local breeders, foreign genebanks and through field collecting missions.

The genebank characterizes and evaluates its material based on ICARDA and IPGRI descriptors and regenerates it. The data is managed through FoxPro based software developed by ICARDA. As of August of 2008, the Genebank contained 3 057 accessions. The numbers of accessions by crops/species are given in Annex 1. Out of the stored accessions, 2108 accessions have already been regenerated and studied for various agricultural and morphological traits. The major research emphasis is on field, especially grain and food legume crops. The research to characterize and evaluate the vegetables and tobacco accessions has not started yet. The safety duplications of the genebank are stored at ICARDA

Genetic Research Unit and NCGRP, Fort Collins, Colorado, USA.

In vitro conservation is more reliable for conservation of genetically heterogeneous clonally propagated plants. There is no a centralized depository for clonally propagated crops in Georgia. *In vitro* collection of potato is maintained at Biotechnology Institute. Potato tissue-culture is being revived at GIF through support of the Greek Government grant and technical assistance of CIP. The latter provided the institute with 15 and 6 potato clones in 2003 and 2008, respectively. IHVO, IS (GSAU), ITSCTI, TBGIB and few more biological research centers have extensive experience of *in vitro* research and maintain working *in vitro* collections of clonally propagated crops.

A modest collection of seeds of tree plants is maintained by the IF. A collection of seeds of rare wild plants is stored at TBGIB, which has been established through international cooperation.

3.1.3 Field Collections & Botanical Gardens

Field collections are maintained at most of the biodiversity and agricultural research centers. In case of permanent crops, live collection is the major method of their conservation in Georgia. The largest field live-collections PGRFA are maintained by IHVO and ITSCTI, as well as GSAU.

IHVO has the most complete live collection of local and imported grapevine varieties. Its Vashlijvari grapevine collection was established and managed by the financial support of Bioversity International's project "Conservation and sustainable use of grapevine genetic resources in the Caucasus and Northern Black Sea area". The total number of accessions exceeds 650. However, the Institute was deprived of the land in Vashlijvari and the collection is being replanted in a new location in East Georgia. The Institute has also a live collection of seed and stone fruit trees.

ITSCTI used to maintain a collection of subtropical fruits, citruses and tea that included as many as 155 species. During the recent years, the institute was deprived most of the land it used for research and collections and the institute staff had to transplant many plants to private gardens to rescue the collection.

There are two major botanical gardens in the country: TBGIB and BBG. Their major responsibility is conservation of endangered plants and maintenance of live collections of biodiversity, which are largely used for research and education. They conduct research on introduction of foreign plants with different use. Beyond wild biodiversity, their collections include CWRs and crop plants. BBG collection used to be comprised of as many as 5000 species, while Tbilisi Botanical Garden collection included up to 4 300 tree, shrub and herb species.

3.1.4 Documentation System of the *Ex Situ* Collections

The PGR documentation in Georgia is mostly computerized. Through the ICARDA's support, GIF has established a database, which includes all information and passport data availably for its more than 2 000 accessions of field crops. There have been no catalogues published for PGRFA collection of the institute so far.

IHVO has made database of local grapevine varieties, preserved in the collections of Georgia in the framework of the IPGRI's project "Conservation and sustainable use of grapevine genetic resources in the Caucasus and Northern Black Sea area".

3.1.5 Improvement and Expansion of the *Ex Situ* Conservation: Needs and Priorities

There is a need to improve public awareness of importance of *ex situ* PGRFA conservation. The government of Georgia needs to consider it as an important priority and provide support through allocation of necessary land and facilities for agricultural research centers involved in germplasm research. At present, neither field crop genebank nor live collections of the permanent crops have sufficient land and equipment, as well as funding to carry out *ex situ* conservation at the modern level. Storage of the *in situ* collections should be improved through upgrading the present storage of the field crop genebank facilities

So far, most of the efforts on capacity building in the field of PGRFA came from the international community. The necessary equipment was provided through projects and genebank staff was trained through numerous courses. However, more training is required. There is need to include the PGR research and management related courses in the curricula of agricultural education.

There is a need to fill the gaps in the collections through field missions and international exchange. International PGR centers, such as VIR, Gatersleben University and USDA, possibly store more Georgian accessions than the local genebank (See Annex 2). It is necessary to continue effort to get together the Georgian accessions for further evaluation and use.

3.1.6. Genetic Erosion in the *Ex Situ* Collections

Regeneration activities promote genetic erosion and there is a need to maintain and monitor integrity of the PGR collections. Unfortunately, there have not been any special efforts to assess integrity of the collections or introduce special measure to exclude genetic erosion of the accessions.

3.2 Planned & Targeted Collecting

3.2.1 Collecting Activities over the Past 10 Years

Most of the collecting activities during the last decade were associated with international cooperation.

In 2001, a joint expedition of GIF, TBGIB, ICARDA, IPGRI, IPK, VIR, AWCC and ACIAR was organized, which surveyed East Georgia and collected 152 seed samples of different crops. In 2003, TBGIB and USDA organized a legume crop seed collecting mission in Shida Cartli, and collected 108 samples.

In 2005, ACIAR sponsored a joint field mission of GIF, TBGIB, and CLIMA in Shida Kartli, which collected 85 samples of legume and cereal varieties.

Through support of ICARDA and GNSF, an expedition was conducted by GIF and TBGIB in 2007, which covered Svaneti, Racha, Samegrelo, Kakheti, Shida Kartli and collected 375 samples of old varieties and crop wild relatives.

3.2.2 Major Gaps in Plant Genetic Resources Collections, Ways of Their Identification and Measures to Fill Gaps

The gaps in the Georgian seed collections of PGRFA are significant considering heavy emphasis of the genebank of GIF on such big crops as wheat and legumes. There are very few accessions of other crops such as maize, forage crops, vegetables. There are very few samples of traditional Georgian crops and land races such as sorghum, millets, flax etc. The collection of the grapevine of IHVO is relatively complete. IHVO still needs to make considerable effort to improve its pip fruit collections. The recent research has showed that there is more diversity even within relatively well-studied wheat and grape and therefore further research is needed. Georgia needs to upgrade its facilities for working with tissue culture and there is need to establish a depository for storing meristem of clonally propagated crops.

3.2.3 Research Needs and Priorities in Relation to Enhancing Planned and Targeted Collecting

So far collection of PGR in Georgia has been carried out only with the purpose of enrichment of the collections and comprising the existing taxonomic and varietal diversity. However, the PGR collecting should be carried out for other purposes as well. The most important purposes are collecting for specific agro-ecological and breeding needs and mitigation of genetic erosion. As a result of such collecting missions the maximum of genetic diversity is collected for target species or populations.

To achieve the above-mentioned, there is an urgent need to conduct research to assess conserved diversity within varieties and taxa, assess the rate of genetic erosion in the conserved samples, introduce appropriate methods of sampling to improve collection and improve communication with crop breeders to identify required traits.

3.3 Assessment of Major *Ex situ* Needs

In Georgia, research institutes are mandated to protect and research PGR. However, the government doesn't have a national strategy on *ex situ* management of PGR and its support to the institutes is insufficient. The overall research capacity of the institutes to preserve PGR is low both at facility and researchers level and requires its strengthening.

As it has been mentioned above, during the recent decade, most of the collecting and establishment/enhancing of capacity of *ex situ* conservation have been carried out though international cooperation. The importance of international cooperation is even higher for improving storage facilities and techniques, rationalization of the collections and characterization of accession. Support to international cooperation in the PGR field should become a component of the government strategy.

There is need to improve management of the collections. Very little is done in assessing of health of plant material in the existing collections. There is a need to pathogen tested and pathogen-free collections.

One of the major challenges is better link the genebanks with the crop breeding programs. It is necessary to improve characterization and documentation of the existing collections through better methods including biotechnology to improve breeder's access to desired traits.

CHAPTER 4

THE STATE OF USE

4.1 Sharing Plant Genetic Resources

Georgia has not established an official mechanism to record the distribution of the samples of conserved plant genetic resources by August of 2008. The present legal framework doesn't require any official registration of imported or exported (transferred) samples of genetic resources. Usually, the collection holders distribute available material based on requests both aboard and in the country and keep records of distributed samples. Registration of imported samples is carried out directly by the recipients.

4.2 Utilization and Enhancing the Use of Plant Genetic Resources

Although importance of utilization of plant genetic resources for broadening genetic base and improving adaptation are widely understood and there is at least some well characterized germplasm collections inherited from the former times, there have been very few examples of using plan genetic resources in breeding during the recent decade.

4.2.1 Actions Taken to Improve the Use of Plant Genetic Resources

Nowadays, in Georgia, crop production is largely based on imported seed of foreign varieties. In many crops, high generation seed is imported to produce reproduction seed. Imported varieties dominate in wheat, potato, vegetables, fodder crops, etc. The same trend is observed in permanent crops, where the demand for imported varieties and planting material is justified by not only scarcity of its local production, but also market requirements, which emphasize the need for new crops and specific varieties to fill the emerging niches in the local market and address market opportunities abroad.

At present, there are no full-scale plant breeding programs that would involve pre-breeding, crosses and segregation populations. The efforts to utilize local genetic resources in breeding are almost non-existent. Most of the programs are concentrated on testing of imported materials for further multiplication of the selected lines and varieties. This work is done not only by breeders of the research centers but also by private farms. There were numerous examples of recent improvements of crop production, which were associated with introduction of new varieties. The most striking is progress in production of potato, vegetables and berries, where numerous new varieties contributed to higher yields and quality and increased farm incomes. Similar examples can be found in wheat, maize, and permanent crops.

It is obvious that the Georgian economy has benefited from externally produced genetic resources. However the Georgian agriculture is put at risk without utilization of its own genetic resources. Use of local PGR through breeding contributes in better adaptation to local conditions and higher diversity of the crop varieties.

One of the main constraints of utilization of conserved PGR is the very weak research sector in Georgia. NARS, which was represented by GAAS, an umbrella organization for 14 agricultural research centers, used to be the major producer of seed and planting material in Georgia and maintained large-scale plant breeding programs for most of the major crops in the country. However, during the reformation of the research sector, NARS was deprived of the land and facilities, which had been used in production of seed and planting material and new legal entities were established by the government to replace the institutes. The new legal entities inherited only movable estate from the old institutes, while most of the land and facilities were sold on auctions and passed to private ownership. Seed and planting material production moved almost entirely to the private sector, while the public plant breeding programs were curtailed remarkably. There is lack of qualified personnel, facilities, policy and strategy for integration of conservation and utilization for all major and minor crops.

The status of some of the breeding programs has improved since the launch of GNSF, which provides research funds on competition basis, but the research priority setting process is not in place. The funding is short-term and very few

plant breeding proposals have been funded. The institutes (new legal entities) are directly subordinated to MES, while their research agenda is not coordinated at the national level.

4.2.2 Characterization and Evaluation

Characterization and evaluation of accessions of the collections of genetic resources have been carried out by GIF, IHVO, ITSCTI, GSAU (including former IS) and GIPI.

At the end of the nineties and beginning of the 2000-ies, the efforts on characterization and evaluation of the germplasm were very limited. GIF together with its former Mtskheta Breeding Station carried out studies of their own working collections of wheat, barley, legumes, maize, and potato and to a lesser degree of accessions of the vegetables crops. The studies were of limited scope and concentrated mostly on morphological and agronomic characteristics. Starting from the end of the nineties, the CGIAR centers began supplying GIF with improved germplasm, which was jointly evaluated by local and researchers from ICARDA, CIMMYT and CIP. GIPI, which used to be a major screening site for the Moscow Plant Pathology RI in 1970-80-ies, maintained its program of evaluation of wheat germplasm and cooperated with the Georgian field crop breeding centers in evaluation of disease reaction of imported and local wheat lines. In early 2000-ies, the Genebank of field crops at the GIF began a regeneration program for its collections, which was accompanied by evaluation of the material according to Bioversity International descriptors. The latter program was supported by a GNSF grant during 2006-2008, which allowed for testing as much as 1 000 accessions annually.

IHVO became a participant/recipient of a reformation component of the WB-funded project, which significantly strengthened its capacity through provision of scientific equipment (including molecular lab) and training. The Institute benefited from several projects such as "Conservation of Grapevine Genetic Resources in the Caucasus and the North of Black Sea Area" (Bioversity International) and Hortivar (FAO). Its cooperation with Milan University allowed for better characterization and evaluation of the local grape genetic resources. Characterization of PGR of seed and stone fruits of the temperate zone was also conducted but at a lesser scale.

IS maintained collections of their mulberry varieties and continued their evaluation and characterization. Later, it became a research unit of GSAU. During the recent years, their efforts were supported through GNSF grants.

ITSCTI carried out evaluation and characterization of their collections that included citruses, tea, persimmon, kiwifruit, etc. This work was also supported through a grant from GNSF, which allowed for broadening their activities, especially in the crops that showed good market potential, such as kiwifruit. Similar activities but at even lesser scale were carried out at BSU and BBG.

4.2.3 Utilization of Genetic Resources in Breeding Programmes

Pre-breeding, in the sense of development of parental lines for further crosses, is not carried out. Typically, accessions, identified during their evaluation as valuable for different purposes are directly used in crosses to develop new varieties. Number of parental combinations in self-pollinated crops were reported to be very low from 5 -50 during the last decade at GIF and its station. These crosses were not made regularly - they were done by graduate students for their thesis work. Actually, development of new varieties of crops such as wheat and barley, as well as food legumes were heavily based on selection of pure lines from imported nurseries, which were supplied by CGIAR centers. Relatively large number of crosses was performed by the maize breeding program at GIF, which assessed combining ability of the CIMMYT introductions with the local material and identified promising combinations for producing hybrid varieties.

In case of perennial crops, crossing of 10-20 parental combinations annually were reported ITSCTI (tea, citruses) and IHVO (grapevine, pipe and fruits) and IS, in which accessions of the collections were used. The purpose of the crosses was to develop F1 populations out of which the best lines were selected and further multiplied clonally. The crossing program declined and mainly introductions were used for selecting improved varieties in the beginning of 2000-ies.

The breeding programs of cereal and legume crops were largely supported through the CGIAR Collaborative Research Program for Sustainable Agricultural Development in Central Asia and the Caucasus. Some wheat breeding efforts were supported through CIMMYT/WSU/USDA program International Cooperation in Agricultural Research. GNSF funded a project of breeding of improved mulberry varieties, in which genetic resistance to micro-plasmid diseases was deployed.

Although there have been some breeding efforts with the purpose of utilization of the conserved PGR, it resulted in development of very few varieties that would impact on agricultural production. Most of the successes of use of new varieties were associated with introduction of new crops and imported varieties, which provided new marketing opportunities for farmers and raise their incomes. The best examples would be varieties of actinidia as kiwifruit is

becoming a big crop in Georgia. Varieties of berries provided farmers with opportunities to access market of EU. All potato varieties are foreign in Georgia and there is remarkable improvement of potato supplies in the local market.

The analyses of the present situation suggests that the local agricultural market develops fast providing farmers with new opportunities, and, respectively, promoting demand for new and improved germplasm. For this, a very efficient PGR sector is required, which would be able to supply required crop varieties. While the public plant breeding is lagging behind and doesn't have appropriate capacity due to low public investment, absence of the national policy for use and management of PGRFA and shortage of qualified personnel. The private sector had to undertake some functions of the research sector and conducts research itself to respond raised market opportunities.

4.2.4 Reducing Genetic Weakness in Agriculture System

Although numerous new varieties have been introduced by the private sector, their performance is not monitored and there is no reliable data. Some observations provided by researchers suggest that at least some of the imported varieties are not well-adapted to local conditions and farmers face losses due to their susceptibility to biotic and abiotic stresses. Most of the wheat varieties that originated from KRIA (Russia) suffer from yellow rust. Many imported potato varieties are susceptible to local races of phytophtora blight. Imported maize varieties usually can be grown only in the irrigated lowlands of East as are susceptible to helmintosporium in West Georgia.

There is some collaboration between plant pathologists and breeders that contributes in developing of disease and pest resistant varieties. This collaboration is facilitated at the regional level through germplasm exchange networks run by CGIAR centers and their local partners. There is also a good example of involvement of plant pathologists with the purpose of developing resistant varieties in wheat and maize. This cooperation has been established between the GIPI and GIF. The breeders of the latter institute send their advanced material to Kobuleti, where it is screened under natural disease pressure or artificial inoculation regularly.

4.3 Seed production System and Sale Markets

Before the mid nineties, seeds of only officially released varieties had been multiplied and sold to producers. The seed production system was organized at state farms in several stages, which consisted of production of super-elite seed (at research centers), elite (elite farms) and 3-4 generations of certified (reproduction) seed (at seed multiplication farms). Observance of production rules and quality standards was controlled by a special agency, which issued quality certificates. During the land privatization reform, which started in 1992, all seed production farms were privatized, while Seed and Planting Material Quality Agency, Georgian Center of Varieties ("Saqjishcentri") and Variety Release Commission almost suspended their activities and were eventually abolished in 2005. Instead, a UPOV-compliant system was introduced, which is based on three agencies: MA, NIPC and NAC. NIPC is responsible for intellectual protection of plant breeding achievements. MA is responsible for recommending of varieties for production based on 'agricultural usability' and developing standards for farms conducting DUS tests and yield trials, while NAC is in charge of accrediting respective entities (farms). No standards have been developed by MA and therefore the variety system is not functional at present. In general, there is an agreement that seed quality control has to be a responsibility of the private sector but there is no any policy about it.

There is no systematic monitoring of plant variety introductions. Imported and locally improved varieties should be evaluated both at stations and on farmers' conditions in each of the agricultural zones of the country. Variety adaptation trials are extremely valuable for detecting pests and diseases. Introduction of a susceptible variety can have disastrous impact on farmers and certainly negatively impacts the credibility of the organization that imports a variety doomed to failure. Presently such research programs are of limited scope in Georgia and are leaded by the private sector with some participation of researchers from the public institutions.

4.3.1 Seed Production and Its Distribution

In the nineties and early 2000-ies farmers did no pay premium for high generation seed and planted any seed that could get for the cheapest price and almost never inquired about a quality certificate. Most of the seed farms planted seed of very low quality, often of unknown origin or even badly mixed.

With the revival of the economy in the 2000-ies, the demand for quality seed increased. The government allocated a low-cost credit for private seed farms in 2006. The winners of the credit, two farmer groups began large scale importation of high generation seed from abroad for further multiplication and sale. The company conducts trials itself to select the best varieties. Foreign varieties are tested through yield trials, which are often planted without observance of simple requirements, such as randomization and replication and their experiment error is usually high. Demonstration trials are rare and are not well-organized. There are other farms, such as Lomtagora, that produce locally developed/selected varieties and have better links with local breeding centers.

Research organizations such as GIF continued primary seed production (super-elite and elite), which was used mostly for production of reproduction seed for direct sales to grain producers. However seed production at research organizations is declining rapidly due to accelerated privatization of research land.

Grain producers purchase seed from the seed farms directly or from distributors. Distribution networks developed and seed is delivered to the rural locations. The distribution networks usually carry large amounts of imported seed, which is often preferred by local farmers as they don't have reliable information on locally produced seed and they trust multinationals.

There is relatively large-scale potato planting material production in the mountain areas of South Georgia, which is completely concentrated in the private sector. IADA, in cooperation with Merci Corps, through financial support of EU and technical support of CIP, produces reproduction seed of imported German potato varieties, which are further distributed to the farmers of the Akhalkalaki area in South Georgia.

Vegetable seed production is just reviving and there are examples of successful private investments in production of tomato seedlings in Marneuli area. Multiplication of planting material of grapevine has been the target of a private investment, as well as a grant from GNSF recently, which was awarded to IHVO. GNSF supported initiation of testing and production of kiwi and mulberry planting material through research grants to ITSCTI and GSAU (IS).

A large private investment has been made by Cartu Group that launched production of grapevine saplings, vegetable seeds and potato planting material. The project is in the process of acquiring necessary assets (land and facilities), establishing collections and training staff. The project has recently established field collection of grapevine (475 plants - base material from certified clones) and fruits (65 plants).

ELKANA, an association of biofarmers, multiplies seed and planting material of traditional varieties and land-races and distributed them to numerous local farmers. These efforts are fund through GEF/UNDP project on on-farm conservation of local agrobiodiversity. The project is also making some efforts to develop market niches for the old varieties.

4.3.2 Sale Markets, Needs and Priorities

As far as there is no system of quality and standard compliance control, the seed producers don't observe strictly the standards. Promotion of quality control is one of the priorities of the seed sector, as the seed and planting material producers can not prove quality of their product. Without a well-established seed and planting material quality control system producers can not convince buyers about such important characteristics as seed generation, seed germination percentage, absence of mixtures, weeds and pests or, as in case of clonally propagated crops, the absence of viruses, which limits investment in high quality seed production.

The malfunctioning variety release system is another constraint as it shifts the costs of its testing to the producers thus reducing their competitiveness. The variety testing, which is done by private companies is methodologically inconsistent and never includes enough locations/years/reps to provide sufficient information for making good variety choices by farmers.

Usually, local seed producers, especially those that multiply foreign varieties don't have sufficient data to advise farmers on management practices required by different varieties as respective research is carried by neither seed producers nor research centers.

There have been efforts by seed producers to organize a network of their authorized dealers in different areas of Georgia to promote the varieties through planting demonstration trials and dispersal of printed information. These efforts are in the initial stage and it is not clear if the local seed producers can eventually bear these costs versus the high competitiveness of seed importers that rely on brands of their foreign suppliers.

The local seed industry is heavily concentrated on big crops and modern varieties, while the emerging agro and eco-tourism is based on local foods and plant varieties. There is need to increase and diversify supplies of traditional landraces and varieties.

Generally, Georgia is a small market for most of the seeds and seed producers could supply seed to other countries in future. However, there are many barriers, among which is quality control, harmonization of seed laws, and introduction of standards compliant with the international requirements. As far as Georgia's crop sector is based on imported varieties, it should have a well-developed IPR system for crop varieties to facilitate their flow to the country.

There is a clear trend that big seed producers find it very costly (time- and labor-consuming) application of special methods for production of high generation seed to maintain purity. Seed/planting material producers consider regular importation of seed and sapling material from abroad for multiplication to be a very high cost and therefore will be willing to look for local sources of material for multiplication.

4.4 Crop Improvement Programmes and Food Security

Georgia doesn't have any formal crop improvement strategy. The public-sector plant breeding centers mainly breed improved varieties of grain crops (wheat and maize) and major fruit crops and grape. However, the public-sector crop breeding programs are either inefficient or based on imported material and often have pure links with seed and planting material producers. This suggests that the local breeding programs do not have large influence on production and contribute little in food security.

Georgia's food security has strengthened through use of external plan genetic resources. However, it is obvious that after first initial growth of seed production and overall development of the agricultural sector, there will be need for more competitive varieties and the government will have to promote local plant breeding to increase use of the local genetic resources and lighten the burden of selecting varieties, which at present almost totally lies on the private sector's shoulders. To do so, the government will have to develop strategy, provided the local research centers with necessary land and facilities, update skills of breeders and provide access to modern equipment and new methods.

There were some cases of using biochemical (in tea and citrus breeding) and molecular (mulberry) markers in breeding in late 1980-ies. Nowadays the local breeding programs rely on conventional breeding methods. Only very recently IHVO, as well as GIPI have been equipped by molecular labs through WB-funded program and ISTC grants, respectively. The same programs provided them with training necessary to operate the labs. Molecular labs capable of running DNA-level markers are also available at IMB and IBB. Hopefully these labs will be used in breeding in the near future. There is a need to coordinate efforts in the molecular research and make these facilities available for degree research and other research needs and researchers.

CHAPTER 5

THE STATE OF THE NATIONAL PROGRAMMES, TRAINING & LEGISLATION

5.1 National Programme

As it was shown in the previous chapters, there are many stakeholders in the PGR sector of Georgia: collection holders (research centers), private sector, non-governmental organizations and the government itself. However, the national coordination of their activities is week. In general, agriculture is recognized as one the most important and traditional sectors of the Georgia economy. However the importance of PGR in meeting national needs is only understood in the scientific community, while the government doesn't have a formal program for the sector. The functions are split among the three major ministries and several agencies that do not cooperate closely among each other.

MA is in charge of developing agricultural policy. It enforces (in-country) part of the phyto-quarantine system in the country through NSFSVPP and is supposed to participate in the variety release system through developing standards for variety testing, reviewing trial results and recommending varieties. The ministry has an agricultural strategy, which is very general and doesn't include specific provisions on PGR, but emphasizes the need to increase crop yields in the country.

The PGR collection holders and all public breeding centers are subordinated to MES, which funds them with help of direct provision of basic funds and competitive grants through GNSF. MES doesn't interfere in research agenda of the institutes directly, and, as it is formulated by researchers independently. GNSF is supposed to announce priorities and solicit proposal according to them. The priorities are to set by NAS and approved by the country president. However, the priority setting process has not taken place yet and there are no approved priorities. Nevertheless, priority level of the proposals is scored arbitrarily based judgments of the reviewers. MA and GAAS are presented in the board of GNSF and participate in discussion of approvals of the proposals.

MEPNR represents Georgia in CBD and has developed a strategy, which is being modified at present. It contains a chapter on agrobiodiversity. MEPNR is developing a legal framework for the access and benefit sharing system. There is no formal coordination at the national level and even government bodies do not cooperate regularly on this issue.

GAAS used to be in charge of PGRFA research coordination and continues to do so informally emphasizing international cooperation aspects. The issues of intellectual property are managed by NIPC.

There is no any national institution that would coordinate PGR activities in the country, while cooperation among the government bodies is not sufficient. There is no any formal mechanism for participation of the private and non-government sector in the formulation of PGR policy. However, informal mechanisms have emerged as the agricultural sector develops. E.g. big farmers, private agricultural investors and importers of seed and planting material interact informally with MA and lob for their interests at both government and parliament level, which partly could explain the low interest of the government in the public crop breeding.

Reliance on imported seed and panting material is sometimes considered as compliant with the government's strategy of promoting the private sector. However, in such case, most of the crop breeding efforts are shifted to the private sector including those that can not generate income and should be responsibly of the public sector. One of the approaches of the government is to minimize regulations to simplify and ease doing business. However, seed markets can not function well without quality control, phyto-quarantine, variety release system, agricultural extension, seed standards etc.

In 2008, FAO and ICARDA conducted assessment of the PGRFA sector in Georgia and developed recommendations on designing integrated national strategy on management and use of PGRFA in Georgia, which was been submitted to the Government. The recommendations were outlined in the form of elements that should constitute an integrated PGR strategy and included recommendations on establishment of national institutions, developing national program and establishing appropriate capacity at both policy and implementation levels.

5.2 Networks

Networks are important for exchange of data and experience, and technology transfers. When the PGR research, as well as the whole agricultural research was coordinated by GAAS, the plant germplasm RIs and collection holders represented one network, which was fastened not only scientifically, but also administratively. There were implemented numerous activities to promote cooperation among them and to link the institutes the international networks.

At present, all research institutions are independent. They participate in the international and regional networks directly. There very few efforts on strengthening local networks. These efforts are mostly concentrated in the research field. GAAS has established a center for coordination of PGR research in Georgia. Recently, the major institutes of the germplasm research began participating in information exchange mechanism established through FAO project and provided data for the present report. There is a need to establish crop networks, as an important source for linking PGR researchers, breeders, producers and users, which could facilitate development of strategies and improve impact of PGR on the agricultural production and food security.

5.3 Education and Training

All education centers (universities) of Georgia compete on equal bases for students and it is their responsibility to attract them through modern curricula, better quality courses, opportunities for research and future employment opportunities. Students are involved based on their national test scores. The tuition of the registered students is paid either through the government scholarships or by students themselves. MES monitors the numbers of the students at state education centers and adjusts the state funding and the numbers of teaching, administrative and technical staff necessary for the optimal functioning of the universities. In general, it should be mentioned that the agricultural education centers attract pretty significant number of students. However, their future employment is not certain. The government emphasizes that the unemployment observed in Georgia is partly structural, as job applicants often don't have skills, which are required by emerging businesses. There is a need for highly qualified specialists in agriculture as well.

GSAU is the biggest and the most traditional agricultural education center, which provides bachelor, magistrate and doctoral level training in all major fields of agriculture. It has 8 departments (agro-technology, agro-engineering, agricultural economics/humanities, animal sciences, veterinary medicine, food processing, forestry and agribusiness) and 2 centers: (foreign languages and training). In total, about 5 000 students are enrolled in the different programs of the university. The old, soviet-style 'aspirantura' was abolished in the end of 2005 and research institutes are not involved directly in training of students anymore. The University is experiencing difficulties in conducting degree research as it has little research land, field facilities and stations and is trying to establish cooperation with the research institutes.

GSAU has done assessment of national needs in agricultural education and striving to address them through internationally cooperation. It has established partnership with Kassel University (Germany) and Vienna Institute of Soil Science. Several GSAU graduates prepared their thesis at European Universities (Ghent, Peruja). The university is being assisted in modernizing its curriculum by USDA through MSU. The University has established cooperation with ICARDA and the CGIAR program in Central Asia and the Caucasus in the field of agricultural research.

Despite the recent improvements in the student curricula and establishment of PhD program in plant breeding and seed production at GSAU, there is a need for courses that would provide better background in biochemistry and molecular biology to allow for better understanding of modern methods of plant breeding and increase chances of the Georgian students to continue their studies in western universities. The existing courses are not integrated with courses addressing biodiversity. GSAU doesn't offer courses that would provide background in such PGR-related fields as curator of different taxa, seed physiology, biodiversity protection, genebank management, PGR conservation and use policy etc.

Bachelor and master/doctoral degrees in agriculture are also offered at Batumi State University and Kutaisi Subtropical Agriculture Institute. There have been some efforts of reviving agricultural community colleagues (pre-degree training sectors) and integrating their education program with that of GSAU. Three colleges (Tsinamdzghvriantkari, Senaki and Akhaltsilkhe) and an Agricultural Professional Education Centers (Kachreti) have been provided with assistance by USDA, KSU and WSU in cooperation with GIPA's GRDP. GTZ has also provided assistance to several colleagues in different areas of Georgia to strengthen their extension function. The colleges and centers provide training and plant trials to demonstrate improved crop management practices. GRDP also comprises several public schools in rural areas, which also receive seed and sapling material and plant demonstration trials.

Georgian agricultural scientists and professors participated in numerous trainings in various agricultural disciplines, including management of genebanks, characterization/evaluation of accessions, storage techniques, plant breeding, seed production, provided by CGIAR, FAO, NATO, ISTC, etc.

5.4 State Legislation

The importance of protection and use of PGRFA has been reflected in the Georgia legislature since the 1960-s. The necessity of protection of some of the farmer varieties (Colchis flax and Georgian wheats: zanduri, makha and dolis puri) was mentioned in the government order of 1965. The Georgian Red Book includes some landraces. By the order of #59 in 1997, the President of Georgia emphasized conservation of PGRFA as a major responsibility of the agricultural research centers. The Georgian Law on Grapevine and Wine of 1998 recognizes the PGR of grape as a major treasure of Georgia and commissions the government to support activities necessary for its conservation and use.

Law of Georgia on the Approval of Spreading the Agricultural Cultivar Variety, Quality Seeds and Sapling Materials (Georgian Parliament, June 25, 1999; revised December 28, 2005) and Georgian Law on Protection of New Plant Varieties (Georgian Parliament, December 29, 2006) are the major laws providing legal framework for use and management of PGRFA.

The first law describes the procedures necessary to go through for variety release and briefly mentions in Article 25 that "conservation and protection of cultural plant genetic resources is responsibility of research centers of appropriate specialization". It doesn't list any organization there and doesn't mention any policy role for MA in conservation of PGR. It mentions though the policy role of MA in clearing release of new varieties and entry of seed and planting material to the local market. MA is also obliged to establish a national council for provision of optimization and publicity in the field of seed production. The national council is supposed to elaborate recommendations on a) plant varieties to be disseminated in the country, b) plant varieties to be included in production and c) on development of the seed sector, which are approved by the minister. The council has not started working yet.

The Law on Protection of New Plant Varieties establishes framework for protection of intellectual rights of plant breeders and is compliant with the UPOV requirements. Applications for intellectual protection are accepted by NIPC. Unfortunately, its requirement for DUS testing can not be fulfilled locally as the testing entities must be accredited. However the standard for the testing entities has not been registered yet and there no entities that can carry out variety testing legally.

The legal framework for protection of plant from pests and diseases, as well as application of fertilizers is established through Law of Georgia on the Protection of Plants from Harmful Organisms (Georgian Parliament, October 12, 1994) and Law of Georgia on Pesticides and Agrochemicals (Georgian Parliament, November 25, 1998). Agricultural quarantine is regulated through Law of Georgia on Agricultural Quarantine (Georgian Parliament, May 15, 1997; revised December 28, 2005), which obliges two entities NSFSVPP and the Georgian Customs to enforce control of movement of plant material across the border.

The above-mentioned laws reflect the economic strategy of the Georgian government, which is directed at liberalization and support to development of the private sector. The more specific agricultural strategy, developed by the Ministry of Agriculture, talks about developing export-oriented production and support to import-substitution, which reflects necessity to overcome trade deficit, which is pretty large due to low level of local production.

In 2005, The Georgian government adopted the National Biodiversity Strategy and Action Plan, which emphasized importance of conservation of agro-biodiversity. It also emphasizes the need of developing a concept for protection and sustainable use of agrobiodiversity. However this document is being revised at present.

5.5 Information Systems

With the development of agricultural production, the role communications increases very fast. Easy access to information can facilitate of growth of agriculture. During the recent years, several agricultural information on-line database systems have been established in Georgia, such as Agro-market by GIPA (http://www.agromarket.ge) and Agroinfo by USAID/ACDI-VOCA (www.agroinfo.ge). The first site is more extension-oriented, while the latter emphasizes market information.

An information management system to support efforts to sustainable use, develop and conserve PGR has been introduced through support of the ICARDA project "Development of International Database for genetic resources, their documentation and coordination based on international descriptors". It is based on MS Visual Fox Pro and is available on

English and Russian languages. Most of the field and vegetables crop accessions have been entered in the database.

Hortivar, a FAO developed database, which is a tool to manage data of horticulture cultivar performance under deferent environments/locations has been introduced at IHVO.

The national information exchange mechanism on implementation of GPA on PGRFA has been introduced and the research institutes have begun using it for data management and its exchange.

5.6 Public Awareness

Generally, the public was aware of the role and value of PGR due to large-scale PGR research conduced in Georgia during the Soviet period. Georgia is widely recognized as a country of ancient agriculture and as a part of the area, where many crops were domesticated (as well as a diversity center). Georgia has always been a country, which was proud of its agricultural heritage. The work of plant breeders was highly respected in the society and relatively well paid.

After gaining independence, Georgia the public investment in agricultural science declined manifold. At present, mostly research community is well informed about the importance of PGR and there is need to integrate that awareness in other fields of political and economic activities such as agricultural production and biodiversity protection. This improved relatively during the recent years of economic growth, but still the Government policy emphasized mostly establishment of favorable environment for private sector growth. The government investments in agricultural sector and, specifically, in agricultural research did not increase proportionally to those in the high-priority sectors. Not-surprisingly, there has not been developed any official program to raise public awareness of importance of PGR.

However, local NGOs and international organizations make some efforts to raise public awareness, which can not pass unnoticed. ELKANA, through the GEF/UNDP funded project on sustainable use of agrobiodiversity promotes public awareness of PGRFA. FAO and ICARDA translated and distributed explanatory materials regarding the ITPGRFA. Information of importance of biodiversity in general has been made available to public through numerous projects on biodiversity conservation conducted through support of WB, WFF, GEF, Bioversity International etc. However, it's not sufficient and still needs considerable efforts as the importance of PGR is still not very well is understood at the policy level and is not incorporated in the agricultural strategy. There is a need to raise awareness among the other stakeholders including end users of PGR – farmers.

CHAPTER 6

THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION

6.1 International Networks and Programs

Georgia is singed up to the 7th phase (2004-2008) of "European Cooperative Programme for Crop Genetic Resources Networks - ECP/GR". Two Georgian organizations officially cooperate with ECP/GR: GAAS and GSAU. Georgian breeders and genebank curators are involved in working groups of wheat, barley, forages, vegetables, potato, grape, prunus, malus/pirus etc. IHVO hosted a meeting of the malus/pirus working group in Tbilisi in October of 2006.

As many as 15 PGR-related organizations of Georgia have been registered in the WIEWS and are supposed to monitor and research PGRFA and exchange information cases of erosion. However it is not done efficiently and there is a need to build capacity through international cooperation.

Major germplasm institutes (such as GIF and IHVO) participate of the Regional PGR Network for Central Asia and South Caucasus, which was established by ICARDA, IPGRI and GCDT. The Georgian network members exchange information and experience in PGR research with other members of the network. The participation of the Georgian centers in the international cooperation was particularly beneficial in terms of building capacity of PGRFA conservation and characterization. There is a need to build capacity in use of PGRFA so that the conserved PGRFA could have impact on the food security.

The Georgian agricultural research institutions participate in CACAARI, which is the Central Asia and Caucasus Association of agricultural research institutes established to improve information and communication management in the agricultural research centers and facilitate information exchange among them and supported by ICARDA.

The Georgian agricultural institutions participated in development of the Regional Strategy for the Conservation and Use of Crop Diversity in Central Asia and Caucasus, which has been compiled through integrated efforts of CGIAR centers (Bioversity International, ICARDA, CIMMYT, etc.), VIR and the scientist of the region.

6.2 International Agreements

Georgia signed the international CBD in 1994 but has not decided on joining the Cartagena Protocol yet. Georgia is a member of the Commission on PGRFA and was among the countries that approved the GPA for Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture and the Leipzig Declaration in 1996. Georgia was accepted to UPOV and it has developed UPOV-compliant legal framework for protection of plant varieties and variety release. Georgia is a member of WTO.

Georgia is not party of ITPGRFA. Although the Georgian government has been contacted by the ITPGRFA secretariat and provided with necessary information, the process of consideration has not started yet. The absence of a national institution/mechanism of coordination of the PGRFA-related issues complicates and hampers the understanding importance of PGRFA at the national level. The management and use of PGR are largely cross-sectoral issues and, therefore requires cooperation of many agencies and at least three ministries for full comprehension. International cooperation is the best way to promote awareness in the field of PGRFA and involve Georgia in full-scale participation in the international efforts on improving conservation and use of PGR.

CHAPTER 7

ACCESS TO PGRFA AND BENEFITS SHARING ARISING OUT OF THEIR USE, AND FARMERS' RIGHTS

7.1 Access to Plant Genetic Resources

By joining CBD, Georgia undertook obligation to "create conditions to facilitate access to genetic resources for environmentally sound uses by other Contracting Parties". Actually, there are no specific regulations on PGRFA so that there are no regulations restricting access or requiring registration of samples of any genetic resources, which are collected or exchanged in Georgia.

The Georgian agricultural centers and collection holders participating in the international cooperation on PGR freely exchange germplasm with their counterparts. Several joint field collection missions (USDA, ICARDA, Bioversity International and VIR) were organized during the last decade and collected material enriched the local collections and was exported by foreign participants.

The Georgian PGR collections, such as field crops genebank of GIF and grapevine collection of IHVO are characterized and their databases are available internationally, therefore are accessible by both international and local community of agricultural researchers.

As it was mentioned in Chapter 2, a very significant portion of conserved PGRFA of Georgia is stored at VIR and access of the Georgian scientists to those collections is very limited due to political tensions between these two countries, which have particularly severed since 2006.

7.2 Fair & Equitable Sharing of the Benefits of the Use of PGRFA

Equitable benefit sharing of biological resources is a very important component of CBD, which has not been addressed by the Georgian legal framework so far. However, the first steps have already been made. A consultant has been hired to by the MEPNR, who is supposed to review the existing biodiversity strategy and elaborate basis for the legal framework using the Bonn Guidelines.

7.3 Implementation of Farmers' Rights

According to the Georgian Law on Protection of New Plant Varieties (Georgian Parliament, December 29, 2006), the breeders' rights are not extended to the cases, when a new variety is not used commercially (Article 34). The same article authorizes MA to restrict breeder's rights on any variety and allow farmers its multiplication if the seed of the protected variety is produced by the farmer on its own land. However there is no any policy on on-farm conservation of agrobiodiversity and there is no any mechanism for farmers to influence on policy formulation in the field of genetic resources and seed production.

CHAPTER 8

CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

The importance of landraces and CWR has been widely recognized and their contribution in breeding of improved varieties valued in Georgia. It is understood that major increases in wheat productivity in the sixties and seventies were associated with release of semi-dwarf ("intensive type") varieties, which did not lodge at the higher rates of nitrogen application and irrigation. Numerous local varieties of grapevine facilitated development of wine-making in Georgia and the country became famous for its unique local wine, which was highly appreciated and demanded in the former Soviet Union countries. After introduction of tea and citruses, Georgia became almost an exclusive supplier of the commodities in the Soviet Union. As result of this Georgia was one of the most prosperous republics within the USSR.

The need for disease resistant and stress tolerant varieties are widely appreciated as the crops often suffer from biotic and abiotic stresses and there is definitely room for genetic improvement. There are no good assessments of damage incurred due to environmental factors. However, it is widely known that drought is observed in Georgia from time to time, which sometimes results in extremely low yields causing even emergency situations such as in 2000, when farmers had to use seeds for food and there was no seed for the next planting season.

Efficient PGRFA management is becoming even more crucial with the recent revival of the economy. Georgia doesn't have advantages in commodity markets in terms of economies of scale and former "big" crops such as citruses and tea may not be able to compete on international markets. Marketing and income-generation opportunities more often are provided by smaller or newer crops as new niches emerge and a very efficient system is needed to address these new opportunities. This concerns both imported and local germplasm. Georgia, which has very suitable environment for fine wine production, could succeed much faster at international markets through use of foreign varieties, while promotion of local varieties will take time and considerable resources. The local varieties remain exclusively important in the local market due to local taste preferences and, especially, development of agro-tourism, as Georgia attracts tourists due to spectacular nature, and ancient and diverse agricultural traditions.

Agriculture remains the most important part of the Georgian economy providing employment opportunity to more than 50% of population and the impact of improved management and use of PGRFA on overall level of poverty in the country will be remarkable.

ANNEX 1

THE COMPOSITION OF THE PGR COLLECTION OF THE GENEBANK AT GIF

#	Crops	Accessions
1	*Aegilops*	20
2	*Alfalfa*	228
3	*Anthylis*	3
4	*Asparagus*	2
5	*Astragalus*	3
6	Barley	43
7	Basil	5
8	Bean	155
9	Beet	7
10	Cabbage	12
11	Carrot	7
12	Celery	9
13	Chickpea	41
14	Clover	37
15	Coriander	11
16	Corn	251
17	*Coronilla*	8
18	Cotton	2
19	Cowpea	65
20	Cress	8
21	Cucumber	16
22	*Cystus*	2
23	*Lotus*	5
24	*Dill*	11
25	Eggplant	7
26	Fescue	2
27	Garlic	1
28	Georgian Millet	11
29	Horse Bean	92
30	Lentil	56
31	*Allium* porrum	5
32	*Linum*	1
33	Melilot	8
34	Melon	15
35	Millet	26
36	Oat	5
37	Onion	12
38	Dactylis	4
39	Parsley	8
40	Pea	126

#	Crops	Accessions
41	Pepper	20
42	Pumpkin	48
43	Radish	13
44	Rye	7
45	Rye grass	9
46	Sainfoin	37
47	Sorghum	98
48	Soybean	21
49	Spinach	2
50	*Trigonella coerulea*	4
51	Tomato	38
52	*Canabbis sativa*	1
53	Vetch	79
54	Vetchling	88
55	Watermelon	8
56	Wheat	803
57	*Agropyrum*	2
58	*Stipa*	1
59	*Lactuca sativa*	5
60	*Cuminum cuminum*	1
61	Medicinal and aromatic plants	55
62	Tobacco	375
63	*Phleum pratense*	5
64	*Brassica sinapistrum*	2
65	*Brassica oleracea*	3
66	*Triticale*	2
	Total	**3 057**

ANNEX 2

ACCESSIONS FROM CENTRAL ASIA AND THE CAUCASUS HELD BY VIR, USDA, ICARDA AND GENEBANK AT GATERSLEBEN (GERMANY)[1]

Crop/plant type	VIR (Russia)	Gatersleben (Germany)	USDA (USA)	ICARDA (Syria)
Cereals	9 590	1 279	1 093	2 378
Legumes	847	105	117	1 510
Forage crops	3 706	851	25	615
Vegetables	4 488	190	0	0
Horticultural crops	1 603	652	326	0
Industrial crops	1 358	106	108	0
Medicinal and aromatic plants	373	175	114	0
Total number of accessions	**21 965**	**3 358**	**1 783**	**4 503**

Source: Regional CAC PGR Strategy (CGIAR, Tashkent, Uzbekistan).

[1] The authors could not find data by countries. The same source mentions that VIR holds as much as 2150, accessions from Georgia.

ANNEX 3

LIST OF THE PARTICIPANTS OF THE WORKSHOP

Establishment of the National Information Sharing Mechanism on the Implementation of the Global Plan of Action and Preparation of the National Report of the State of PGRFA 25 January 2007, Tbilisi, Georgia

#	Name	Organization	Position	Address, Phone, Fax
1	Mamuka Meskhi	FAO	Assistant Representative in Georgia	41, Kostava Str., Tbilisi, Georgia 0179 Tel/Fax99532 333112 Email:FAO-GE2fao.org
2	Ana Rukhadze	Ministry of Environment Protection and Natural Resources of Georgia	Head of Biodiversity department	Georgia, 0114 Tbilisi, G. Gulua st. #6 275700 275720 biodepbio@moe.gov.ge
3	Guram Aleksidze	Academy of Agriculture of Science	Vice President PGR National Coordinator	D.Agmashenebli alley 13km 0131, Tbilisi, Georgia 995 32 59 56 96 995 93 200 793 E-mail guram_aleksidze@yahoo.com
4	Stephano Diulgheroff	FAO, AGPS	Agricultural Officer	Email: stefano.diulgheroff@fao.org
5	Zaal Gamtsemlidze	N.Ketskhoveli Institute of Botany	Director	Kodjori road #1 0105 Tbilisi, Georgia Tel: +(995 32) 99 7746; 98-88-09
6	George Nakhutsrishvili	N.Ketskhoveli Institute of Botany	Corr member of the Georgian Academy of Science	Kodjori road #1 0105 Tbilisi, Georgia +(995 32) 99 7746; 98-88-09; Email:botaninst@yahoo.com
7	Maia Tavartqiladze	N.Ketskhoveli Institute of Botany	Deputy Director	Kodjori road #1 0105 Tbilisi, Georgia. Tel: +(995 32) 99 7746;
8	David Bedoshvili	ICARDA/CIMMYT	ICARDA/CIMMYT Sub-regional office in the Caucasus	#2, Gelovani Street, Tbilisi 0159, Georgia +995 32 38 06 69 d.bedoshvili@cgiar.org
9	Tamar Jinjikhadze	N.Ketskhoveli Institute of Botany	Cultural flora department Head of PGR documentation in Georgia	Kodjori road #1 0105 Tbilisi, Georgia 995 32 99 7746; 98-88-09; 995 32 22 73 26 995 93 25 62 67 Email tamrikoj@yahoo.com
11	Maia Akhalkatsi	N. Ketskhoveli Institute of Botany	Head of Plant Reproduction Department	Kodjori road #1 0105 Tbilisi, Georgia +(995 32) 99 7746; 98-88-09; (Mob:) +(995 99) 193529 Email: orchisge@yahoo.com
13	Tina Barblishvili	N.Ketskhoveli Institute of Botany	N.Ketskhoveli Institute of Botany Physiology Department	Kodjori road #1 Phone:+(995 32) 528875 995 99 93 32 95 Email:tinabar7@yahoo.com
14	Ana Gulbani	N.Lomouri Institute of Farming PGR Genebank	Gene bank Manger	Tserovani, Mtskheta Phone: 995 99967071 99532 571484 Email: agulbni@yahoo.com
15	Ana Devidze	N.Lomouri Institute of Farming PGR Genebank	Legume Curator PGR documentation assistant	Tserovani, Mtskheta Phone: 99593 20 62 94 Email:adevidze@yahoo.com
16	Nana Chkhutiashvili	N. Lomouri Institute of Farming	Genetic and Breeding department	Tserovani, Mtskheta
17	Manana Elbaqidze	Tbilisi Central Botanical Garden	Director	#1, Botanikuri Str.Tbilisi, Georgia, 0105, Tel/Fax: (995 32) 72-34-09, 72-11-85. E-mail: tbg_370@yahoo.com

#	Name	Organization	Position	Address, Phone, Fax
18	Marine Mosulishvili	Georgia National Museum Herbairum collection		Tel:995 99 55 50 89 mosulish@posta.ge Tbilisi, Georgia
19	Tariel Berishvili	Biological Farming Association (NGO)	PGR department	16 Nakveti, 3rd Delisi str. 0177, Tbilisi Georgia 995 32 660721; 995 99 54 87 50; Email : crop@dika.org.ge
20	Eka Abashidze	Institute of Horticulture Viticulture and Oenology	PGR department	Address : Marshal Gelovani ave # 6 Phone: 995 99 720992 Email ekalini@yahoo.com
21	Irina Tvauri	V.Gulisashvili Institute of Mountain Forestry		