ARMENIA:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCES

(Leipzig,1996)

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Ministry of Agriculture

Yerevan, June 1995

Note by FAO

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CHAPTER 1
Introduction to the Republic of Armenia and its Agricultural Sector

Geographically, the territory of the Republic of Armenia is a part of a spacious region, conventionally called "the Armenian Upland" [Abikh., 1899; 1902]. In the past Armenia, the place of origin of the ancient Armenian nation, encompassed the whole upland. This area received its name after Arim-Armens, one of the most archaic tribes that populated the Armenian Upland. This territory is situated in the northern part of the Western Asia and stretches from 37.8° to 41.8° N. Lat. and from 38.8° to 47.8° E. Lon. Greenwich. The Armenian Upland is kind of wedged between the Iranian and the Minor-Asiatic mountainous structures, heaving above these highlands by almost 500 m. That is why the Upland is also called "the Mountain Island". Its area makes more than 300,000 sq.km with the mean altitude of 1,700 m above sea level.

Armenia occupies a smaller north-eastern part of the vast Armenian Upland. It is located in the southern part of Transcaucasia between 38.850° and 41.818° N. Lat., and 43.821° and 46.837° E. Lon. The country's territory is 29,740 sq. km (nearly 10% of the former historic Armenian realm). However, almost all of Transcaucasian's natural environments, relief and climate features as well as plant and animal diversity are replicated within the country. The span between its borders and the Black Sea is 145 km, while the distance to the Caspian Sea is 175 km. Despite such remoteness, these seas extend noticeable influence on the climate formation process in Armenia.

The territory of Armenia stretches from the North-West to the South-East covering 360 km, and from the West to the East covering 200 km. The country borders on Georgia in the North, Azerbaijan in the East and South-West, Turkey in the West and Iran in the South. Its altitudes vary from 400 m to 4,095 m above sea level. The relief of the country is a combination of highlands, plateaux and hollows, over which huge mountainous ridges, volcanic massifs and peaks are hoisted. 70% of the country's total area are situated at the altitudes of 1,600-3,000 m above sea level, and only 0.3% do not exceed 500 m. Considerable deviations in the altitude and surface characteristics, complex geomorphological conditions and hydrothermal features have led not only to the development of multifarious climate and vegetation, but also to the formation of variegated topsoil.

The territory of the Armenian Republic is a classical example of distinct vertical zonality. On a relatively small area it is possible to observe all transitions between the natural zones from semi-deserts to eternal snows. Armenia is notable for an exceptional abundance of solar irradiation: the reported duration of sunshine vary from 1,900 to 2,800 hours per year, while the annual number of days when the sun does not shine is from 18 to 64. The tension of solar radiation is also high. Within Armenia several genetical soil types have been formed.

In the desert/semi-desert zone at the altitude of 1,250-2,500 m there are brown semi-desert soils (5.1%), brown meadow watered soils (cultivated irrigated soils - 1.8%) and meadow alkaline and saline soils (1.0%). In the mountain-steppe zone at the altitude of 1,250-2,500 m there are chestnut (8.2%), black (24.1%), meadow-steppe (9.5%) and meadow-black soils (0.4%). In the mountain-forest zone at the altitude of 800-2,000 m there are brown forest (4.5%) and cinnamon-coloured forest (0.5%) soils. In the mountain-meadow zone at the altitude from 2,300-2,500 m to 3,500-4,000 m there are mountain-meadow soils (11.6%). Besides there are also floodplain-terrace soils (1.6%) and grounds of Sevan Lake (0.7%). The remaining area (12.1%) is occupied by bedrock outcrops under water, roads and constructions.

Due to favourable botanical and geographical distribution and diversity of floristic provinces and subprovinces as well as natural and historic conditions, the vegetation in Armenia has become extremely rich and diverse (ca. 3,200 spp. of vascular plants out of approximately 6,000 spp. occurring in the Caucasus and 21,119 spp. in the whole territory of the C.I.S.). About 400 plant species have been described in Armenia. 275 of them were found sometime in the past in the adjacent Turkey, Iran, Azerbaijan and Georgia, while the other 125 are endemic and occur only in Armenia.

The current situation with the plant species growing in Armenia is rather distressing. Almost half of the Armenian plant species need protection. However, only 387 spp. are included in the national Red Book (which correspond to 12% of the Armenian flora).

Vegetation of Armenia is as diverse as its geography, climate and soils. Widely diversified physical geographical conditions, preconditioned mainly by the mountainous relief, have provided for the formation of the vegetation cover highly variable in composition and differentiated by vertical zones: the lowest level is occupied by deserts, while the highest places are under Alpine vegetation. In between there are semi-deserts, mountainous steppe areas, meadows, woods and thin forests.

Different scientists in Armenia have described the following types of vegetation: desert, semi-desert, highland-xerophilic and xerophilic thin forests; thick forests; sub-Alpine and Alpine meadows.

1.1 MAJOR TYPES OF FORESTS

Major types of forests in Armenia are: oak-groves (represented in the country by 5 species) which combine 6 basic types with 19 sub-types; beech-groves with 3 basic types and 4 sub-types; and hornbeam woods with 3 basic types. Mixed deciduous forests have formed three types with oak as a dominating species; birch groves with one basic type have made sub-Alpine thin forests. Coniferous species: pine and juniper woods with two basic types each, and yew tree-stands making one type in fresh composite beech and oak forests. Under the anthropogenic effect the country's woods obviously suffer reduction of the areas occupied by natural afforestation, decrease of the forest density, transgression of natural reforestation conditions and nature protection functions. During this century the areas of oak groves have diminished surrendering space to the formations of Oriental hornbeam *(Carpinus orientalis*), European hornbeam (*Carpinus betulus*) and, on the northern bearing of the mountains, of beech (*Fagus orientalis*). Destruction of sub-Alpine twisted forests has led to abrupt eduction of birch forest areas. Frequent woodcutting and pasturing are followed by diminishing of thin juniper forests. Besides, the areas under European and Oriental hornbeam formations are tending to expand.

1.2 AGRICULTURAL SECTOR

The population of the Republic of Armenia presently amount to 3,740,000 people, including nearly 400,000 refugees. Of the total population of Armenia 32.5% or so are involved in agricultural production (1,207,4000).

Basic agricultural production spheres are viticulture and horticulture with well-developed cereal growing and livestock production. Cereal production is based mainly on spring and winter bread wheat and spring barley. Annual harvest of these crops in the country presently makes approximately 280-320 thousand tons of grain. 65-70% of this amount is wheat, while 30-35% are barley and other cereals. The amount of grain produced can satisfy only 25-30% of the population's demand and is used only within the country.

Cultivation of potato, horticultural and forage crops is carried on to an extent sufficient to meet the demand of population for such products. However, fruit, grape and tobacco production may potentially be increased to a higher level allowing the producers not only satisfy domestic demands, but also export the products.

Armenian agriculture currently exist in three forms: (a) private individual peasant farms numbering 303,377 plots and covering the total land area of 383,200 hectares (without pastures); (b) collective peasant farms numbering 1,628 and covering 47,300 ha (without pastures); and (c) 100 state-owned farms occupying in total 54,700 ha (without reserve lands).

Seed production is currently performed mainly by state farms. Basic activities of these farms are steered to grow seed of cereals, forage crops, vegetables, potato and tobacco. The outputs of domestic seed production in some crops are not enough to satisfy the country's demands to the fullest extent.

Reproduced seed materials of cereals fulfil only 50% of total requirements, vegetables - 80%, and potato 70%.

The remaining amount of seed materials required are imported from abroad. A number of institutions in foreign countries render certain assistance in acquisition of seeds.

A new trend in national agricultural production is soy bean cultivation. The key motivation for introducing this crop on commercial scale is great demand of the population for protein-containing products. Enhancement of commercial soy bean production will doubtlessly help to relieve the existing deficiency in animal proteins and fats.

In our opinion, very important is to renew sugarbeet production in the area of approximately 6,000 ha. Large-scale cultivation of this crop would allow agricultural producers to meet the demand of the population for sugar.

Scanty harvests of the crops grown in the country result mainly from the shortage of fertilizers, toxic chemicals, power resources, irrigation and adequate equipment.

Losses in crop yields of cereals ensuing only from droughts in some years reached 20%, while 35% losses were due to the absence of fertilizers and 25% to the lack of chemicals.

The population of Armenia still preserve numerous old varieties and landraces of cultivated plants (see Chapter 4).

CHAPTER 2
Indigenous Plant Genetic Resources

As indicated in Chapter 1, geographically the Armenian Upland is an integral part of the Western Asiatic region which is widely known as one of the primary foci of civilized culture. The man has been living here since the early Stone (lower Palaeolithic) Age. This land attracted the man not only by favourable environments of physical and geographical nature (such as climate, suitability for settlement, etc.) but also by the general character and specific features of the country's vegetation. There is much evidence that primitive communities populated predominantly the areas rich in various plant species including wide diversity of edible plants.

Larger part of the Armenian Upland is incorporated in the floristic area of the Armeno-Iranian Province, which is characterized according to A.L. Takhtajyan "by rich and unique flora with very high generic and specific endemism" [1978:129].

2.1 FOREST GENETIC RESOURCES

Within the small territory of the Republic dendritic vegetation consists of 522 species, 220 of which participate in the formation of natural forest stands, including 7 coniferous species: Caucasian pine (*Pinus caucasica*), juniper (*Juniperus spp.*) and English yew (*Taxusbaccata*). Deciduous trees are represented mainly by the species of Tertiary origin: oak (5 *Quercus spp.*), beech (7 *Fagus spp.*), maple (7 *Acer spp.*), elm (3 *Ulmus spp.*), hackberry (2 *Celtis spp.*), linden (2 *Tilia spp.*), birch (2 *Betula spp.*) and ash (*2 Fraxinus spp.*). Among fruit trees there are 32 forms of Persian walnut (*Uglana regia*) differing in shell thickness, chemical composition of fruit and other parameters, 17 species of pear (*Pyrus*), apple (*Malus*), forest cherry(*Cerasus*), myrobalan plum (*Prunus*), hazel (*Corylus avelana*), Turkish filbert (*Corylus colurna*), and others. Undergrowth is formed of dogwood (*Cornus*), medlar (*Mespilus*), various species of wild rose (*Rosa*), currant (*Ribes*), raspberry (*Rubus*), European dewberry (*Rubuscaesius*), bloody dogwood (*Thelycrania*) and other representatives of arboreal diversity in Armenia.

The forests in Armenia are few: only 10% of the country's territory is covered with forests, but the distribution of them is extremely uneven: 62% of forests

are concentrated in the north-west, 36% in the south-eastern part, whereas in the vast central area of the Republic, that incorporates Sevan Lake and Shirak Plateau with adjacent lands, only 2% of forests are situated. In many administrative districts wooded areas do not exceed 1%, while in 7 districts forests are totally absent.

Armenian forests are basically formed of valuable deciduous species of major economic importance for the national economy. Beech and oakstands which occupy over 2/3 of the wooded areas accumulate 87% of the country's stock of wood.

The primary socio-economic role of the forests in Armenia is environmentalistic. Over 70% of forests grow on mountain slopes (above 208) and perform such important functions as hydroclimatic control, sanitation, water and soil protection. In this respect, an especial niche is filled by arid thin juniper forests (3,500 ha) growing on dry stony hill slopes within 550-2,700 m above sea level. The composition of arid tree stands often involves such relict species as hackberry (*Celtis caucasica, C. glaubrata*), maple (*Acer iberica*), almond (*Amygdalus fensliana, A. nairia*), buckthorn (*Rhamnus catharica*), tragacanth (*Astragalus microcephalus, A. macrocephalus*), other xerophilous species undemanding of soil conditions.

In the socio-economic aspect the most important species are *beech (Fagus orientalis*), oak (*Quercus macranthera, Q. araxina*), *hornbeam (Carpinus betulus*), ash (*Fraxinus excelsior, Foxicarpa*), maple (*Acercampestre, A. platanoides, A. trautvetteri*), elm (*Ulmus foleacea, U. scabra, U. densa*), linden (*Tilia caucasica, T. cordata*), etc.

All forestry activities of the past 50 years (excluding the last 3 years of blockade) have been aimed at increasing self-sufficiency of pure and mixed beech and oak tree stands by supporting natural seed reproduction of the above-mentioned valuable species.

In order to preserve the rich diversity of forest plant genetic resources natural reserves were organized in three historic regions of Armenia: Dilizhan (north-eastern forestry district), Khosrov (central forestry district) and Mtandzor (south-eastern forestry district) with the total area of about 64,000 hectares.

With a purpose of saving separate arboreal species and groups of species 16 protected local zones have been established. Some of them encompass the whole territories of forest districts, as, for instance, Gyulakarak zone organized to protect the largest pine wood in Armenia (*Pinus caucasica/Hamata*). Other zones include a part of Gorissky district (preserving oak groves in the ravine of Vorotan), sub-Alpine twisted birch-tree forests of Dzhermuk forest district, thin juniper forests spread over the whole country,

and groups of separate species: stands with dominating English yew trees (96 ha), Turkish filbert (40 ha), oriental plane trees (60 ha), etc. (In Armenia there are the largest natural groves of the latter two species in the whole C.I.S.)

Beginning from 1958 the status of a protected zone was assigned to wild arboreal species of Persian walnut, pear, apple and other fruit plant throughout the whole forest areas of Armenia. All measures regarding the above-mentioned species have been targeted at preservation and regeneration by applying both forest management and silviculture methods. The species or groups of species that are under the threat of extinction in Armenian forests, in addition to such widely known relict plants as English yew, Turkish filbert and oriental plane tree which have been protected by the state since 1926, should include juniper (*Juniperus sabina, J. polycarpos, J. foctidissima*), hackberry (*Celtis caucasica, C. glaubrata*), maple (*Aceriberica*) and oak (*Quercus oblonga*) which have survived just as smallgroves or isolated trees along the rivers of Vokhchi, Debed, Astef and Akhum; birch-tree (*Betula litwinowii, B. verrucosa*) that remained only on small sites (total of 1,000 ha) in Pambak, Tsakhkunyan, Areguni and Sevan Ridges. The same status may be attributed to Persian walnut, natural groves of which are thinning gradually, though the areas under artificial afforestation of this tree are expanding from year to year.

Other wild species and wild relatives of cereal grasses. Not only cultivated varieties, but also crop prototypes and donors have been preserved in Armenia. They are characterized by wide specific and intraspecific polymorphism. Many progenitors and closely related forms of these plants were involved in the development of cultivated species. Others are taxonomically close to the cultivated forms and may be/are used in crosses in order to obtain new hybrids or varieties and in phytogenetic studies.

The diversity of wild crop relatives existing in Armenia may be grouped as follows: (1) cereals; (2) grain legumes; (3) forage grasses; (4) fruits and berries; (5) vegetables and melons; and (6) wild edible plants.

2.2 CEREALS

Among wild cereal plants, wild wheats are becoming more and more important from theoretical and practical points of view. Out of the four presently known wild wheat species, three occur in Armenia: *Triticum*

boeoticum Boiss; T. urartu Thum. et Gandil. and *T. araraticum Jakubz.* The latter two had been unknown until they were discovered in Armenia.

Wild einkorn wheat (*T. boeoticum*) occurring in Armenia has wide intraspecific polymorphism. There are about 90 varietal forms [Gandilyan, 1975]. This species is reported to have been a donor of the *T. timopheevii* wheat group. Up to now only 6 varietal forms of *T. urartu* have been identified. Most researchers assume that it was Urartu wheat that acted as the donor of the first genome (A genome) of widely distributed tetraploid and hexaploid wheats. Dr. B.S. Johnson, an American geneticist, stated (1975) that this species was the donor of B genome of bread and durum wheat. At present, the interest towards studying this wheat is increasing, so the need to protect this species becomes a burning priority.

The area of distribution of emmer wheat (*T. araraticum*) in Armenia overlaps with the area of *T. boeoticum*, which is a CMS source. In Armenia 10 varieties of this species have been identified as well as a number of diverse forms.

The above-mentioned wild wheat species existing in Armenia are of value for breeding practice and have been used mostly in crosses with cultivated wheat species. Wild species are also interesting for fundamental science and need to be safely preserved.

All-round studying of and increased interest to gen. Aegilops L. have lately been connected with the cytogenetic evidence concerning its role in the origin of tetraploid and hexaploid wheats. In view of this, theoretical and practical significance of this genus for plant breeding and genetics is raising. Consequently, the country has encountered the problem of preserving the species and great intraspecific diversity of gen. Aegilops. The territory of Armenia coincides with the centre of the area of distribution of this genus. Aegilops plants are especially frequent in the area of occurrence of wild wheat. The following species grow in Armenia: *Ae. tauschii Coss., Ae. cylindrica Host., Ae. triuncialis L., Ae. umbelulata Zhuk., Ae. trivialis [Zhuk.] Mig.* and *Ae. mutica Boiss.*

Cultivated rye (*Secale*) presently occupies small areas in Armenia, though a striking diversity of wild annual (*S. vavilovii Crossh.*) and *perennial (S. montanum Guss.*) rye species has been reported. The number of variants in wild annual rye is 26, being more than 10 in wild perennial one. Both belong to the group of plant species that have yet been insufficiently studied and utilized in national economy.

Wild species of barley (*Hordeum*) are basically used in Armenia for forage purposes. There are attempts to utilize them in breeding practice with

cultivated species of *Triticeae*. In Armenia there are such species as *H. glaucum Steud., H. murinum L., H. hrasdanicum Gandil., H. marinum Huds., H. geniculatum All., H. violaceum Boiss., H. bulbosum L.,* and *H. spontaneum C. Koch.*

Of special interest for practical breeding is *Hordeum bulbosum* and *H. spontaneum*. Among the forms of the latter that are distributed in Armenia, there are typical winter-hardy forms, which is very important due to the fact that breeding of typical winter-hardy winter barley cultivars has major economic significance.

2.3 GRAIN LEGUMES

In Armenia, numerous indigenous forms of cultivated legumes have been identified (Phaseolus beans, chickpea, pea, horsebeans, etc.), though there are also wild forms, such as *Cicer minutum Boiss. et Hohen, Cicer anatolicum Alef.; Lens ervoides Grande, L. orientalis (Boiss.) hand.; Pisum siriacum Lehm., Pisum elaticus Bieb.* and *P. formosum Boiss.*

2.4 FORAGE GRASSES

Major forage grasses cultivated in Armenia are leguminous and, after them, cereal grasses. There are numerous ecotypes and local varietal populations of forage grasses. Such gene pools serve as sources for breeding new varieties with higher yield. There also many wild species of these crops.

Of alfalfa (*Medicago*), 10 species occur in Armenia; of sainfoin (*Onobrychis Adans.*) - 6 spp.; of clover (*Trifolium*) - 30 spp. (majorones being *T. pratense L., T. hybridum L., T. repens L., T. ambigum Bieb.* etc.; of vetch (*Vicia*) - about 36 spp.

Among the forage crops grown in Armenia leguminous grasses hold the first place and are followed by cereal grasses. There are numerous ecotypes and local populations of forage grasses which serve as an initial stock for breeding new varieties with higher yield. There are also a lot of wild species of these plants.

Alfalfa (*Medicago*) is represented by 10 spp., sainfoin (*Onobrychis*) by 6 spp., and clover (*Trifolium*) by 30 spp., among which more important are

T. pratense L., T. hybridum L., T. repens L., T. ambigum Bieb.,etc. 30 species of vetch (*Vicia*) occur within Armenia. Two of them are worth mentioning here since they require protection and further studying most desperately. Hairy vetch (*V. villosa Koth.*) is a highly polymorphic species. M.G. Tumanyan has identified an aftermath form which belongs to this species and has great economic value (being suitable for two harvests in a year). Another species is bitter vetchor French lentil (*V. ervilia Willd.*) which occurs as a wild plant, as a weed in the planted fields, but in some places is valued as a cultivated crop. Its seeds are rich in protein-containing substances,and it was formerly used for feeding domestic animals. It is also characterized by wide intraspecific polymorphism. The above-mentioned forage grasses belong to the family of Fabaceae. However, there are numerous valuable forage plants of *Poaceae*, for example, various species, forms and ecotypes of such genera as *Agropyron Gaert., Arrhenatherum Beauw., Dactylis L., Festuca L., Lolium L., Phleum L., Poa L., Zerna Panz.*, etc. One of the burning tasks is to collect the genetic diversity of forage grasses and establish collections in botanical gardens.

2.5 FRUIT AND BERRY PLANTS

The territory of Armenia, situated within the boundaries of the Ancient Mediterranean floristic province, is rich in the plant species that the population have been using since remote ages. Numerous morphological and biological forms of these plants have survived up to the present. Wild fruit plant diversity is first of all interesting for inventorying, introduction into cultivation and utilization inbreeding practice. As there is no opportunity for detailed reviewing of specific and intraspecific variability of fruit and berry plants, separate genera will be mentioned here, especially those which need protection.

Wild apple-trees (*Malus*) grow in almost all forests of Armenia. Wild spp. *M. orientalis* and *M. pumila Mill.* are polymorphic. Pear (*Pyrus*) is one of the most widely occurring fruit plants in Armenian woods.There are over 17 wild species and numerous forms. Mountain ash (*Sorbus L.*) is represented by 10 spp., hawthorn (*Crataegus L.)* by 11 spp., plum (*Prunus L.)* by 4 spp. and almond (*Amygdalus L.*) by 4 spp. In Armenia there exist numerous wild and run-wild forms of quince (*Cydonia*), medlar (*Mespilus*), apricot (*Armeniaca*), sweet and sour cherry (*Cerasus*), filbert (*Corylus*), walnut (*Juglans*), pistachio (*Pistacia*), persimmon (*Diospyros*), pomegranate (*Punica*), oleaster (*Elaeagnus*), fig (*Ficus*), strawberry (*Fragaria*), raspberry (*Rubus*), currant (*Ribes*), etc.

Besides many varieties of cultivated grapes (*Vitis vinifera L.*), there is one wild species in Armenia (*V. sylvestris Gleum*).

2.6 VEGETABLES AND MELONS

Of certain interest are wild species of beet (*Beta*), such as *B.marorrhisa Stov., B. corolliflora Zoss., B. lomatogon F. et M.*. Among other vegetable plants, worth mentioning are four-stamina spinach (*Spinacea tetrandra Stev.),* diverse forms of carrot (*Daucus carotaL.*), coriander (*Coriandrum L.*), savory (*Satureja L.*), asparagus (*Asparagus L.),* onion (*Allium L.)* and others. There is information on the existence of wild melon (*Melo Adans*) and watermelon (*Citrullus L.*) forms.

2.7 WILD EDIBLE PLANTS

From prehistoric times the population of Armenia have been making use of various edible wild plants. The attached list is far from being a complete inventory of plant species suitable for eating and cooking or used as spicy and aromatic relish.

This enumeration of plants exposing rich genetic sources of plant products is by no means exhausting. There are plenty of other species and forms which are interesting from the point of view of their preservation and utilization. For example, it seems appropriate to mention a group of wild oil-bearing plants, including different species and forms of flax (*Linum L.*), hemp (*Cannabis L.*), false flax (*Camelina Cranz.*), wild cabbage (*Brassica campestris L.*), rape (*Brassica napus L.*), mustard (*Sinapis L.*), lallemantia (*Lallemantia Fisch.*), safflower (*Carthamus L.*), poppy (*Papaver*), etc.

Armenia is rich in honey-yielding plants as well. The above-mentioned and far from being complete list witnesses that Armenia possesses a unique genetic diversity of plant species important both for science and economy. Further research on the diversity of cultivated plants and their wild relatives, their preservation and reproduction becomes an urgent necessity with the development of modern biological and agricultural sciences. In order to obtain new advanced crop cultivars it will be necessary to enrich the gene pools of plants available. This process would require not only searching and

discovering various primitive and cultivated forms, but also managing and opening up the enormous stock of genetic resources which are available or which will be disclosed in wild crop relatives, as they are still concealing rich reserves of useful genes.

It is regretful to acknowledge that due to a number of reasons especially in the recent years genetic diversity of "primitive" cultivated and wild species has grown scantier and scantier. As an example, 13 species and over 300 botanical varieties of cultivated and wild wheats have been identified in Armenia (Gandilyan, 1975). Local wheat varieties have been and are a valuable source of the best cultivars of wheat. But the present-day wheat plantings are observed to lack former variability. Many advantageous variants are vanishing with the removal of old landraces from production, though they could have made a contribution to further breeding work. This circumstance entails necessity of undertaking appropriate measures to avert premature disappearance of valuable genetic resources and to replenish their diversity by searching for new plant forms.

Protected should be not only cultivated, but also "primitive" and wild plant forms. Commercial reclamation of new, previously uncultivated lands, especially as regards the procedure of land privatization, may result in complete extinction of most interesting species of wild relatives of cultivated plants. But this process is already going forth. Due to various reasons (forest reclamation works, land privatization, thoughtless ploughing, etc.) the habitat of a number of wild wheat forms has completely vanished.

It is reported in publications that in 1930-1940's in Armenia a number of weedy melons grew in the fields of cotton and cultivated melon crops, and were even more abundant in long-abandoned arable lands. At present, most obviously due to the application of herbicides, they cannot be found. For information about the old (traditional) varieties of agricultural crops, please refer to Chapter 4.

As a result of blockade and sheer absence of fuel and power resources, and because of the entailing heedless and uncontrollable cutting of trees, forest massifs suffered heavy losses in Taush, Noemberyan, Kapan, Idzhevan and Gugark districts, and in the vicinities of Yerevan, Gyumri, Vahadzor, etc.

CHAPTER 3
National Efforts in Plant Genetic Resources Conservation

For preservation of plant genetic resources the Government authorities of Armenia have undertaken certain measures.

3.1 *IN SITU* PRESERVATION

In this sphere a very important role is assigned to natural reserves and local protected zones of wild nature. The following natural reserves have been established in Armenia:

a) Khosrov (Garni or Urtz) National Reserve: This reserve has an interesting history. Khosrov Reserve was factually founded as long ago as in 330 A.D. by Khosrov, King of Armenia. In the Armenian historic tradition King Khosrov has the reputation of being weak and irresolute in warfare and politics, but enterprising in building issues. Movses Khorenatsi, a historian of the 5th century A.D., gave the following characteristics of King Khosrov II: "... neglecting feats and blessed memory (of himself) he indulged in amusements, bird trapping and other kinds of hunting: it was for this purpose that he planted a forest near Azat River - the forest which bears his name until this day". More details about the Khosrov Reserve were narrated by another historian of the same century, Favstos Byuzand. He described the events that preceded the establishment of the Khosrov Forest (reserve) and setting of its boundaries: "And the King ordered his captain to rouse many people over the country to bring wild oak from the woods and plant the trees in Airarat District, beginning from the King's impregnable fortress of Garni and as far as the Field of Metsamor, upto the hill which is called Dvin and situated in the northerly part of the large city of Artashat. And so, the forest was planted down by the river, down to the Palace of Tiknuni ("Queen's Halls"). He named this forest Tachar ("Temple") of the Tree. Another forest did he plant to the south of the first one along the reed grove, where the whole field was covered with oak seedlings, and named this Khosrovakert ("Created by Khosrov"). Both forests were encircled with fences, but the girdle was not closed leaving a passage through. Then the King ordered to gather every kind of bird and beast, and let them fill the girdled land, so that it would be the place of the King's hunts and amusements". Thus, it comes

obvious from these data that King Khosrov founded a real national park with its plant and animal worlds, which has borne his name not only in the times of Khorenatsi and Byuzand, but it our time as well.

In 1972 the world community celebrated the 100th anniversary of national parks (natural reserves). One of the first ones is considered Yellowstone National Park in the U.S., which dates back to 1872. Although the national reserve status was assigned to the Khosrov Forest in 1958, in reality it was founded approximately 1,630 years before that year. Thus, the Khosrov Reserve (or Park) is 1,540 years older than the officially acknowledged Yellowstone.

At present, this reserve is consisted of 8 separate sites with the aggregate total area of 29,196 hectares. There are about 1,800 plant species growing in it. There one can find mountainous and xerophilous vegetation with elements of broad-leaved grass cover, tragacanth steppes, thin juniper forests with thickets of evergreen xerophytic shrubs , and woods of large-anther oak with dispersed thickets of wildpear species. In the territory of the reserve there are small spots of halophilous and hypsophilous desert as well as a sagebrush-ephemersemi-desert.

b) Dilizhan National Reserve (31,000 ha): It is situated at the slopes of Pambak, Khalab and Murguz mountain chains between 1,200 and 2,900 m above sea level. Besides broad-leaved beech, oak and hornbeam forests,in its territory there are unique coniferous woods consisted of yew and pine trees, groves of Turkish filbert, sub-Alpine meadows and high grasses.

c) Shikakhakh (Bartas) National Reserve (ca. 10,000 ha): It is located in the south east of Armenia within the range of altitudes from 700 to 2,500 m above sea level. It was organized in 1959, reorganized into a local protected area in 1963, and received back the status of a national reserve in 1975. This reserve was established to preserve and reproduce characteristic forest formations of Zangezur. Widely represented there are pure elite hornbeam and oak forests. There is the only in Zangezur small beech grove in this reserve. One can meet there also a number of rare plants: English yew, common chestnut and gall oak.

d) Erebuni National Reserve: It covers a small area, not more than 100 hectares. However, this small natural reserve is unique. There are many national parks in the world, 150 reserves in the C.I.S. and only 4 in Armenia. Erebuni was established later than the other three, but its purpose made it the unique one not only in this country, but in the whole world, since it was organized for in situ preservation of the progenitors of cultivated wheat and other cereals. As far ago as in 1930's, after studying vegetation of this place, Nikolai Vavilov supposed publicly that this area was one of the most interesting places in the

world. Several times did he come later to this locality proposing to transform this place into a national reserve. However, his wish came into reality only 51 years later, and in 1982 the natural reserve was established.

The following wild species occur in this reserve: of wheat - *Triticum boeoticum Boiss., T. urartu Thum ex Gandil., T. araraticum Jakubz.*; of barley - *Hordeum spontaneum C.Koch., H. bulbosum L., H. glaucum Steud., H. murinum L., H. maritimum Huds., H. geniculatum All., H. hrasdanicum Gandil.*; of rye - *Secale vavilovii Grossh., S. montanum Coss.; of Aegilops - Ae. tauschii Cosson., Ae. cylindrica Host., Ae. triuncialis L., Ae. columnaris Zhuk., Ae. trivialis Zhuk., Ae. mutica Boiss (Amblyopyrum muticum Eig.).*

All these species, and wild wheats in particular, are characterized by wide intraspecific polymorphism and are of high breeding and genetical value. Since everywhere a tendency towards reduction (sometimes in catastrophic dimensions) of habitats of wild relatives of cultivated plants, great hopes for saving the diversity of wild wheats and other cereals (Aegilops, rye, barley, wheatgrass, etc.) are placed with the Erebuni Natural Reserve.

A thorough study of eco-biological peculiarities of plants in their habitats and after introduction will prepare a basis for devising measures for protection, re-introduction and introduction into cultivation of valuable representatives of the wild flora. New wheat types have been produced employing wheat and Aegilops forms collected in the natural reserve, and it has enriched the genepool.

e) Sevlichsky Natural Reserve: It is an intergovernmental natural reserve organized in 1987 on the border between Armenia (Gorissky Province) and Azerbaijan (Lachinsky Region). The total area of the reserve is 240 ha; it includes the Sevlich Lake (176 ha) and a 100m-wide strip around the shore (total of 64 ha). A 1km-wide buffer belt surrounds the reserve. The reserve's flora numbers 102 species of vascular plants, including such rare and endemic plants as woad (*Isatis takhtadjanii*), eyebright (*Euphrasia Juzepczukii*), purple-flowered cinquefoil, etc.

f) Sevan National Park: It was organized in 1978. Its territory covers 150,100 ha in Vardenis Reg., Sevan Reg., Kamo Reg., and Martuni Reg. Under protection are the Sevan Lake and a strip of the shore varying in width from several meters up to 10 km. Artificial plantations of pine, sea buckthorn, etc. in the Vardenis, Martuni and Noraduz Regions acquired the status of protected zones in 1952.

Besides natural reserves, the following protected zones have been set up in Armenia:

- Plane-tree Grove (ca. 160 ha, 1958) is the largest one in the Caucasus. It stretches along the Tsav River in Armenia and Bashut River in Azerbaijan.
- Gyuneisky Protected Zone (3,312 ha, 1958) is a massif of juniper thin forest in the Sevan Lake basin (alt.ca. 2,000 m a.s.l.). The zone features large-fruited juniper, mountainous steppes with tragacanth (*Astragalus gen.*), and sainfoin (*Onobrychis cornuta*).
- Gyulagaraksky Protected Zone (2,576 ha, 1958) is located on the northern slope of the Bazumsky Ridge. The area is covered with Koch's pine and redbud maple.
- Dzhermuksky Protected Zone (7,900 ha, 1958). Oak forests along the upper Arpa River consist mostly of Quercus macranthera, a number of endemic pear species and several cowparsnip species.
- A Jack-Pine Grove (4 ha, 1958) is a protected zone in the Marmarie Canyon on the right bank of the river near a monastery.
- Gergersky Protected Zone (6,139 ha, 1958) is in the Vaiksky Region (Daralageze). The area represents by itself mountainous steppes with massifs of tragacanth (*Astragalus gen.*), and juniper thin forests. Rare and endemic pear species occur here. A number of historical monuments are located on the territory.
- Sevan Bottom Ground (20,000 ha, 1958). It is a unique natural territory that once used to be the bottom of Sevan Lake. Currently it makes a perfect illustration of the natural development of mountainous steppe vegetation.
- Akhnabad Yew Grove (25 ha, 1958) is on the territory of the Dilizhansky natural reserve.
- Turkish Filbert Grove (40 ha, 1958) is located in the Idzhevansky Region in the Voskepar River canyon. Trees there reach 1m in girth.
- Gorovansky Sands (200 ha, 1958) are situated along the left bank of the Vedi River. The area is characterized by specific psammophyte vegetation. Thickets of *calligonum, Astragalus paradoxus, Rhinopetalum, Leontice*, etc.
- Yekhegnadzor Protected Zone (4,200 ha, 1972) is located in the Yekhegnadzor Region near Agavnadzor (alt. ca. 1,500 m a.s.l.). A wide diversity of wild wheat forms, as well as a series of interesting semi-desert and steppe plants are under protection here.
- Arzakan-Megradzor Protected Zone (14,500 ha, 1972) is in the Razdansky Region (alt. ca. 2,000 m a.s.l.). A natural complex of trees and shrubs is protected in the zone.

- Flood-plain forest of Populus euphratica and thickets of such rare species as *Tamarix hohenackeri* and *T.araratica* (5 ha) are protected in the Megrinsky Region near Agarak Station along the left bank of the Araks River.
- Semi-desert vegetation on Tertiary red clays in Yerevan (10 ha) is a protected zone on the excavation site of the ancient Erebuni city. A complex of rare and vanishing desert and semi-desert plants is under protection here.
- Alpine carpet and meadows (100 ha) near the Kari Lake at an altitude of 3,200 m a.s.l. is another protected zone in the upper part of the Aragats mountain.
- Salty marshes in the vicinity of Ararat Settlement are located near hot mineral springs and cover 100 ha. It is a unique natural monument where such rare species as *Microcnemum coralloides, Thesium compressum, Hinum barsegianii, Sonchus araraticus, etc.* are concentrated.

3.2 *EX SITU* COLLECTIONS

PGR collections in Armenia are concentrated at research institutes and higher education institutions, of which the following ones should be noted:

i) Botanical Institute and Botanical Gardens of the National Academy of Sciences of Armenia (CBG ASA)

The herbarium at the Institute stores over 200,000 specimens higher plants. This collection with the international code ERE is famous both in the country and abroad. It is subdivided in two parts, one of which is the herbarium of Armenian indigenous flora (130,000 sheets) and the other one is the general herbarium (70,000 sheets).

New materials are constantly added to the general herbarium thanks to exchange with the main herbaria at botanical institutions in CIS countries and many foreign countries like Austria, England, Bulgaria, Hungary, Germany, Israel, Spain, Italy, Poland, Portugal, Rumania, USA, Finland, Czechia and Slovakia, and Scotland.

The herbarium was founded in 1920 by A.B. Shelkovnikov, director of the museum at the Institute of Natural History (within the framework of the Peoples' Commissariat of Agriculture) and kept on growing thanks to the

efforts of several generations of botanists. For instance, a rich herbarium of mosses numbering 7,000 packets has been collected.

CBG ASA maintains a live collection of Armenian aboriginal flora with around 950 species in it (incl. 126 arboreal and shrub species) thus representing nearly 1/3 of the floristic riches of the republic. It is one of the most representative live plant collections in the Transcaucasus. Before 1990, 1,240 species have been accumulated in the greenhouses of the Botanical Gardens. By now, 95% of them have died. CBG ASA, its branches and arboretums of the republic preserve a rich collection of trees and shrubs numbering 1,650 accessions belonging to 207 genera of 75 families. Out of them, 1,070 species are concentrated at the Botanical Gardens in Yerevan, 590 spp. at the Vanadzor Branch, and 443 spp. at the Sevan Branch.

CBG ASA possesses a rich exchange seed stock for 1,200 species of Armenian aboriginal flora. Besides, the Botanical Gardens in Yerevan stores a seed collection of wild plants from the Armenian flora (ca. 1,700 species of 99 families), and another one of the global wild and cultivated flora (2,600 species, 112 families). The herbarium of type specimens contains 3,800 sheets.

The Seed Laboratory maintains contacts with 101 botanical institution in 82 cities in CIS countries, and with 45 foreign countries (322 botanical institutions in 229 cities). Exchange with materials involves annually from 8 to 10 thousand accessions.

ii) Specialized Research Laboratory for Cultivated and Wild PGR (SRLCW PGR)

This Laboratory was set up following Acad. Vavilov's intentions. He was delighted with the Armenian plant diversity. From this point of view, he regarded Armenia as "one of the most interesting countries", "one of the global foci of cultivated plants", and "one of the most interesting places in the whole world" as regards the wild wheats. Therefore, the great scientist persistently raised the issue of setting up a genebank in Armenia.

Following the Resolution No. 268 issued on 22 July 1981 by the State Committee for Science and Technology of the USSR, a Task Group for Research on the cultivated PGR and their wild relatives was set up, and later, in compliance with the Order No.12 of 5 January 1989 issued by the State Agroindustrial Committee, transformed into the Specialized Laboratory of the Armenian Agricultural Institute (at present - Armenian Agricultural Academy).

Since its founding, the major objectives of the Laboratory have been as follows: a thorough study of cultivated plants and their wild relatives, their protection and utilization for developing new plant forms and breeding new varieties and hybrids. As a result of investigations, an inventory of wheat, Aegilops, rye and barley has been made and their specific and intraspecific composition specified. The work on collecting and specifying the diversity of wild forages, fruits, vegetables, etc. has been started. The number of collected and taxonomically described accessions is 600 for wheat, 500 for rye, 500 for Aegilops, and 350 for barley. Besides, samples of such wild vegetables as beet, carrot, spinach, coriander, and of fruit-bearing plants have been collected. 8 new groups of variants have been determined and over 70 new variants of wheat, rye, barley and Aegilops identified. For the first time, the Amblyopyrum genus has been discovered and its 8 variants described for the flora of the USSR. The following new species have been discovered and described: of wild barley - *Hordeum hrasdanicum Gandil.*, and of wheatgrass - *Agropyrum semiaristatum Gandil.* For the first time, the new species of Aegilops (*Ae.trivialis* and *Ae.umbellulata*), of barley (*H.spontaneum, H.marinum, H.bulbosum f.segetalis*) and of wheatgrass (*Agropyrum desertorum*) have been discovered in the Armenian flora. 15 new hybrid amphidiploid and autotetraploid species have been synthesized.

Some measures have been undertaken to provide PGR protection. Setting up of the Erebuniisky natural reserve was the most significant accomplishment in this respect.

Rich genepools of cultivated plants and their wild relatives have been accumulated at research institutions of the Ministry of Agriculture of the Republic of Armenia, namely at the Research Institute of Vine, Wine and Horticulture, at the Research Laboratory of the Armenian Academy of Agricultural Sciences, at the Department of Breeding and Plant Resources of the Agricultural Research Institute, at the Research Institute of Vegetable Growing, at the Experiment Station for Research on Tobacco, etc.

3.3 DOCUMENTATION

The most complete documenting of PGR is carried out at the Botanical Institute of the Armenian Academy of Sciences. The "Regional Flora of Armenia", a result of over 100 years of inventorying the republican flora, is the only and most complete manual for the botanists. For each species mentioned in the Flora there is a herbarium material stored at the Botanical Institute of AAS, and at counterpart institutes in St.Petersburg, Tbilisi and other cities.

Floras of a part of natural reserves has also been documented.

At the Specialized Laboratory there exists a Catalogue of collected samples and bred varieties. Other research institutions keep registers of their own. Evaluation and characterization of genetic resources are carried out by each institution with consequent publication of the data obtained.

Also, research institutions provide for the regeneration of plant resources.

CHAPTER 4
In-Country Uses of Plant Genetic Resources

Detailed study of the Armenian cultivated flora and determination of plants' breeding value were launched in the 1920's. Acad. Vavilov and his associates carried out voluminous work on exploring, collecting and selecting valuable plant forms. It is quite natural that Vavilov could not underestimate the value of wild and cultivated genetic resources of Armenia. Under the influence of Vavilov's teaching, the Armenian experts have been actively exploring the wild and cultivated floras. In course of these activities, it was established in the 1940's that Armenia is one of the regions of concentration of initial species and varietal diversity for many important cultivated plants, one of the foci of origin of a number of cultivated plants in Western Asia. Quite many scientific works have been devoted to this matter. New plant species have been discovered and described. Acad. M.G. Tumanyan, one of the Vavilov's followers, has identified the following new taxa: *Triticum araraticum, T.urartu, T.jerevani, T.vavilovii*, and *Secale daralagesi*. Numerous variants of the known wheat, rye and barley species have also been identified. Besides, *Triticum spelta L.* has been discovered in the flora of the Soviet Union.

New plant species and dozens of their variants are being studied by Armenian scientists and their foreign colleagues.

Collecting and studying of indigenous fruit crops were started in 1927 by the Research Station for Fruit and Vegetable Crops of the Armenian Canning Trust. In 1956, this Station served as a basis for setting up the Armenian Research Institute of Vine, Wine and Horticulture. The Institute carries out extensive research on the indigenous genetic resources of apricot, peach, plum, sweet cherry, sour cherry, apple, pear, quince, and maintains these materials in collection nurseries. Much attention is paid to genetic resources of grapes. In 1960, collecting and studying of local varieties of fig, pomegranate, oriental persimmon, oleaster, etc. was initiated.

Similar work has been carried out with other groups of cultivated plants, for instance forages, vegetables and melon crops. Continuous research on the cultivated genetic resources in Armenia has resulted in improving local varieties, breeding new ones and raising their yielding ability.

Until 1940's, over 25 local varietal populations of wheat have been cultivated in Armenia. Through mass selection, 15 varieties have been improved, and some of them are cultivated even nowadays. Using landraces, Armenian scientists have bred such wheat varieties as Armyanka, Artashati 42, Yegvardi 4, Leninakani 3, Lernain 22, Leninakani 216, Norkundik, Almargarit, Vardenik 9, Erythroleukon 12, Erinaceum 36, etc.

In recent years, indigenous germplasm has been used in breeding new commercial varieties of wheat, namely Armyanka 60, Akhtamar, Shiraki 1, Shiraki 2, Voskeask (an Aegilops was involved in breeding this winter wheat variety), of barley - Kaler, Ararati 7, Mush, and one triticale variety - Sis 1.

Armenia is one of the most ancient regions of viticulture. In course of the evolution, there emerged quite a diversity of wild and cultivated grape forms differing by flower type, fruit quality, vegetation period length, etc. The most detailed study and efficient utilization of grape genetic resources have been carried out at the Armenian Research Institute of Vine, Wine and Horticulture (ARIVWH) by Prof. S.A. Pogosyan and at the Laboratory of Grape Breeding of the Armenian AAS by Prof. P.K. Aivazyan. An ampelographic collection has been compiled and kept growing each year thanks to new varieties and elite forms were included into it thanks to collecting missions and breeding work. In 1989, ARIVWH alone possessed a collection numbering around 900 varieties, clones and elite forms. Breeding programmes gave birth to 110 grape varieties of various application, out of which 22 varieties have been commercialized in Armenia, Moldavia, Kirghizia, Crimea, Hungary and Ukraine.

Besides, the Armenian AAS possesses a rich stock of hybrids numbering over 500 thousand seedlings. Over 500 elite hybrids have been selected. Over 20 new bred varieties are characterized by 3 to 5.5t/ha yielding ability, from 20 to 28% sugar content and from 6 to 9.5g/l acid content. Indigenous genetic resources of fruit crops are also extensively used by Armenian scientists.
50 apricot varieties, 300 varieties and forms of apricot, numerous varieties of plum, myrobalan plum, sweet cherry, sour cherry, apple, pear, etc. have been studied and used in breeding new varieties.

Good results have been achieved at the Research Institute of Vegetable and Melon Crops in breeding new varieties of tomato, pepper, eggplant, okra, pumpkin, cucumber, basil, etc. New tobacco varieties have been bred at the Experiment Station for Tobacco Research.

Indigenous genetic resources have been used for breeding new varieties of forage crops, for instance, Armyanskaya 1 and Urartu of alfalfa, Zangezursky 82 of sainfoin, Armyansky odnoletnii of clover, etc.

4.1 UTILIZATION OF FOREST GENETIC RESOURCES

Genetics of forest species was initiated in Armenia some 30 years ago. Major attention is paid to oak, beech, pine and walnut.

Walnut forms diversity has been studied and 32 promising forms selected for afforestation by using grafted seedlings with inherited quality characters.

Seeds of the arboreal species predominant in the forests are collected mostly from elite trees and stands. In recent years, there is a stepwise shift towards specialized farm plantations developed through grafting from elite trees.

At CBG ASA, a special department has been set up in order to collect and study rare, vanishing and endemic plant species, including the arboreal ones. Multiplication of the latter is done in a special nursery. These measures make a significant contribution to preserving the highly diverse PGR of Armenia.

A more efficient utilization of Armenian PGR acquires these days a special urgency; obviously, this germplasm will maintain its value in the future. However, as it was noted in Chapter 3, quite many species, varieties and forms are under the threat of extinction. Appropriate laws must be adopted and certain means provided in order to prevent these losses.

CHAPTER 5
National Goals, Policies, Programmes and Legislation

In 1992, the Government of Armenia adopted the "Concept of the Nature Protection Programme for Armenia" which attributes certain importance to PGR protection, regeneration and efficient utilization. Devising of the National Programme for nature protection has slowed down these days due the lack of necessary finances.

It has been mentioned in the Concept that PGR protection, regeneration and utilization may be improved provided a special law "On the protection and utilization of the flora of the Republic of Armenia" has been devised and adopted. The law is planned to envisage ways of genetic resources utilization and develop a system of licensing the procurement of plan raw materials. An aspect of importance is the study of eco-botanical peculiarities of rare, vanishing and useful plant species, as well as organization of their multiplication and reintroduction.

Biodiversity protection measures in Armenia are coordinated by the Ministry of Nature and Environment Protection (MNEP).

In 1992, Armenia signed the "Biodiversity Convention". In order to implement provisions of the Convention, a special joint committee has been set up at MNEP. Prominent scientists from various institutes in the network of the National Academy and higher education institutions have joined this committee. Pursuing the above objectives, the laws "On the Territories of Special Protection" and the "Armenian Legislation on Forestry" have been devised and adopted by the republican Parliament.

A draft law "On the Protection of PGR in Armenia, of Achievements in Breeding, and of Seed Production" has been developed and submitted to the Parliament for considering and adopting. It follows from the above that a National Programme on PGR in Armenia has not taken its final shape. Attempts are being made in order to accomplish the work, but many problems cannot be solved due to a prolonged siege and financial constraints. As a result, impoverishment of the national PGR is going on. Obviously, the interference of the international community is required to provide protection and proper utilization of the rich plant diversity of Armenia.

CHAPTER 6
International Collaboration

Since the Republic of Armenia had been part of the Soviet Union, international collaboration in all spheres, PGR included, was effected via the corresponding bodies of the Union. Closer ties existed only between republics of the former USSR. Many Armenian scientists involved in PGR studies and utilization were members of the All-Union Botanical Society (AUBS) and of the N.I.Vavilov All-Union Society of Geneticists and Breeders (AUSGB). They participated in conferences and symposia held in the Soviet Union. Counterpart research institutions and individual scientists exchanged with information, reports and materials. The closest links existed with the N.I. Vavilov All-Union Research Institute of Plant Industry (VIR). Also, collaboration was carried out with foreign (i.e., beyond the borders of CIS) research institutions and scientists. For example, Dr. E. Ts. Gabrielyan, Head, Dept. of Plant Geography and Taxonomy at the Botanical Institute of ASA, is a full member of the International Association on Plant Taxonomy. In 1974, she was elected member of the International Commission for PGR protection and phytotaxonomy in Mediterranean countries ("OPTIMA").

The ampelographic collection at ARIVWH comprises wild grape forms, varietal samples from 12 grape-producing regions of the former USSR and 19 foreign countries, as well as from the wild grapes habitats (Primorski Territory, Southern China, Hokkaido Island, Armenia, etc.). PGR collections preserved at the Dept. of Breeding and Plant Resources of the Agricultural Research Institute contains quite many accessions of foreign origin.

International collaboration by SRLCW PGR included the following aspects:

1. The Laboratory worked in compliance with the All-Union scientific and technical programme aimed at "collection, complex study and preservation of the global PGR of cultivated plants and their wild relatives with the purpose of their efficient utilization in national economy". This programme was coordinated by VIR (Leningrad/St. Petersburg), and annually the institute received reports and new plant accessions. Upon acquiring independence by Armenia in 1992, this collaboration was terminated and contacts with VIR became sporadic.

2. The Laboratory maintained scientific contacts with the Institute in Gatersleben (Germany). Prof. P.A. Gandilyan visited the institute in order to get acquainted with the collections held there. Quite a number of samples of Armenian cereals were sent to Gatersleben to enrich their collections. At present, the Laboratory is planning to revive its collaboration with IGK-Gatersleben.

3. SRLCW PGR maintains contacts and exchanges with information and plant materials with many foreign organizations and individual scientists in the USA, Italy, Israel, Japan, Poland, Czechia, Slovakia, CIS countries, etc.

4. In recent years, the Laboratory is developing close cooperation with GRU of ICARDA.

   a) In January 1991, Prof. P.A. Gandilyan was invited to ICARDA to exchange information and familiarize himself with the collections of GRU. A survey of these collections showed the presence in the Syrian flora of wild *Triticum urartu* and *T. araraticum* besides the previously discovered *T. boeoticum* and *T. dicoccoides*. Until then, the former two species have never been recorded there. Consequent collecting missions proved the presence of these interesting species in Syria.

   b) In summer that same year, a joint collecting mission with ICARDA explored Aegilopses in Central Asia. 129 germplasm samples (spikes and spikelets) and 36 herbarium samples were collected. These materials were shared by ICARDA and SRLCW PGR. (for details see Annual Report for 1991, GRU, ICARDA, pp.9-16).

   c) In summer 1992, another joint collecting mission explored wild cereals in Southern Syria and Armenia. (For details see Annual Report for 1992, GRU, ICARDA, pp.13-17).

   d) In summer 1994, Northern and North-Eastern Syria have been jointly explored. 10 wheat accessions, 20 of Aegilops, 15 of barely, and 15 of synthetic amphidiploids and autotetraploids have been sent to ICARDA in exchange for interesting wheat and aegilops accessions. This aspect of collaboration is being further developed.

5. In recent years, the Laboratory established collaboration with the Crop and Soil Science Dept., Oregon State University, and with the National Wheat Improvement Programme (CIMMYT and ICARDA), and has already received from these sources 200 and 160 samples of wheat varieties, respectively. These 360 samples joined the Laboratory's collection and are currently studied in the conditions of Armenia.

It is desirable to establish contacts with UNCED, FAO and other important foreign centres.

CHAPTER 7
National Needs and Opportunities

1. As shown in Chapter 1, Armenia occupies just a small North-Eastern part of the vast Armenian Upland,though possesses nearly all peculiarities of this greater territory, PGR diversity included. Due to various reasons, impoverishment of the local flora, extinction of individual species, forms and crop varieties take place. The loss of this unique reserve of valuable genes necessary for breeding purposes not only in Armenia, but also on the global scale, must be prevented.

2. Before becoming an independent republic in 1992, Armenia did not have a special genebank besides the small Specialized Laboratory (SRLCW PGR) at the Academy of Agricultural Sciences. VIR in St.Petersburg was regarded as the major genebank of the USSR, and its researchers collected materials together with their colleagues from various scientific institutions. Collections of fruits, seeds and clones preserved by various institutions, the Specialized Laboratory among them, cannot be regarded as the ones providing safety of the stored germplasm against moths, rodents and diverse fungous diseases.

   At present, creation of the national genebank which would meet modern scientific and technical standards is a matter of high importance. It is absolutely necessary to maintain accessions in live condition employing short-, medium-, and long-term storage. Obviously, all that requires qualified scientific staff and certain material means. Provided the financial aspect of the problem is solved, organization of training would be quite easy.

3. The Resolution of 27 May 1981 passed by the Government of Armenia on the Erebuni Natural Reserve has, among others, the following items: a) protection of the natural reserve shall be ensured; b) within 1981-1982, general expenses of the Committee shall include fencing of the Erebuniisky natural reserve, installation there of one "Finnish" cottage and setting up a laboratory for conducting stationary research, and provision of irrigation water and electricity supply". However, these works have not been carried out till now and can hardly be done without certain financial inputs from appropriate international organizations.

4. Efficiently implemented legislation is essential for PGR protection. Though a draft law "On the Protection of PGR in Armenia, of Achievements in Breeding, and of Seed Production" has been developed, it is still to be adopted.

   Adoption of a law is just one aspect of the issue, the other one is its strict implementation, it being a task hard to fulfil under present conditions. As it was mentioned in Chapter 5, in 1992 the Government of Armenia approved the "Concept of the Nature Protection Programme for Armenia", but still it cannot be implemented properly due to the shortage of finances. The laws "On the Territories of Special Protection" and the "Armenian Legislation on Forestry" are difficult to put into practice.

CHAPTER 8
Proposals for a Global Plan of Action

In respective chapters of the Report it has been stated that preservation of Armenian PGR is of high importance from the theoretical and practical points of view not only for Armenia, but also for the whole world. Here are some examples to support this thesis:

The world-famous botanist and geneticist N.I. Vavilov had devised a concept of origin of European and Russian winter wheat varieties from the Armenian mountainous prototypes. In his letter of 11 August 1937 to M.G. Tumanyan, an Armenian scientist, he wrote: "The type of awned winter Banatki, like "Ukrainka", "Kooperatorki", etc., which we presumed to originate from Hungary, are basically related to winter wheats from mountainous Armenia and mountainous Georgia, to which they are very close. All in all, you have the pro-Banatki there, and the Transcaucasus is the cornerstone regarding Banatki, too. No wonder that our "Kooperatorki" and "Ukrainki" feel quite good at your altitudes, as they've returned to their Motherland". In a letter of 2 January 1938 to B.M. Garasferyan, another triticologist, Vavilov was even more explicit: "I am inclined to believe, that the groups designated "Slfaat", "Gyulgyani" and "Gulisar" could give rise to the European Banatki in Hungary, and consequently to our (Russian) Banatki borrowed from Hungary via Poland". In the same letter he stresses "Armenia is a wonderful country, and therefore the composition of its cultivated plants is of interest not only for the Union, but for the world as well".

It is known that local forms from the Armenian Upland served as progenitors to a series of American wheat varieties. Also known are the works by A.I. Derzhavin (1938, 1960) devoted to developing a perennial hybrid of wheat and rye using wild perennial rye from Armenia.

Since the most ancient times, various countries have been introducing Armenian fruit crop species and varieties. Prof. N.E. Hansen, an American breeder, and others confirm the fact that a number of apricot, peach and apple varieties from Armenia had been brought to the USA, planted there and used in breeding.

Thus, plant genetic resources from Armenia had global importance in the past and maintain their value at present and for the future. In order to utilize Armenian PGR globally, the following measures are deemed necessary:

1. The Specialized Research Laboratory for Cultivated and Wild PGR of the Armenian Agricultural Academy shall serve as a basis for setting up a modern genebank in which all collections from various research institutions of Armenia will be accumulated. New materials shall be collected in Armenia, various species and intraspecific categories be saved from unrecoverable loss, and genepools enriched with new forms obtained through hybridization and polyploidization. The staff of the genebank may include both local and foreign scientists. All activities shall be carried out within the framework of international collaboration.

   Creation in Armenia of a genebank that would meet modern standards from the points of view of science and technology would require certain financial inputs.

2. Among Armenian natural reserves, a special place is occupied by the following ones:

   a) The Khosrov Natural Reserve - Historically, it's the first natural reserve in the world. As it was mentioned in Chapter 3, it was founded around the year 330. This natural reserve is a good source of interesting forest PGR. Besides, other interesting plants, like wild perennial rye, wild barleys, Aegilopses, etc. occur here.

   b) The Erebuni Natural Reserve - Great expectations regarding preservation of the diversity of wild wheats and other cereal grasses (Aegilops, barley, rye, wheatgrass) are connected with this natural reserve. There is a multitude natural reserves in the world, but in terms of its specialization, i.e., preservation of wild wheat species and other cereals, this reserve is the only one in the world. It may be called a live monument to wild wheats diversity. In 1934, N.I.Vavilov wrote about this area: "Undoubtedly, this is the most interesting place in the whole world. I would suggest the isolation of an area from 50 to 100 ha to take special care over it in order to preserve this document of global importance".

      Proceeding from the above, it would be reasonable to establish control of the international community (in the global system of FAO, UNCED) over these documents of global significance.

3. Taking into account the importance of Armenian PGR and the vivid interest to them, it is necessary for Armenia to participate in the international (UNCED, FAO, CGIAR) and regional (ECPGR, ITCA, etc.) programmes.