

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

TURKEY



**Second National Report of
TURKEY
on
Conservation and Sustainable Utilisation of Plant
Genetic Resources for Food and Agriculture**

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Note by FAO

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SECTION I

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Second Turkish National Report on Plant Genetic Resources (PGR) describes the current state of plant genetic resources in Turkey. Changes and developments since the first national PGR report in 1996 was issued are commented in particular.

Turkey is characterized by large climatic, eco-geographic, diversities and agricultural sector plays a major role in the economies and in the livelihoods of rural communities. Since population growth rate is high the population has increased to 67 803 927. The rate of agricultural population in total population is getting less as a result of economic development and urbanization. Arable land has decreased during the past decade.

State of diversity

Turkey encompasses areas major centers of crop diversity and center of origin for globally significant crops, fodder plants and forages. Landraces of many of these crops are still used within traditional farming systems and pasture the crop wild relatives and endemic species are found in their natural habitats in the rangelands and forest areas which occupy different ecosystems. Flora of Turkey consists of high endemism about 3 000 out of the 9 000 plant species. Turkey is described as microcenters for many crops also. The importance of the protection of existing plant diversity is highly recognized and various conservation programs exist. The National Plant Genetic Resources and Plant Diversity Program (NPGRDP) operate under the coordination of Aegean Agricultural Research Institute (AARI) of Ministry of Agriculture and Rural Affairs (MARA) involves *ex situ* (since beginning of 1960s) as well as *in situ* conservation, including on-farm conservation (since 1990s).

State of *in situ* management

Turkey actively promotes *in situ*/on-farm conservation of agrobiodiversity as well as various protection activities of nature. The availability of funding from GEF, other donors and the ministries of MARA and Ministry of environment and Forestry (MEF) have support to enhance activities on biodiversity (*in situ*) conservation and on-farm conservation which were able to assess the status and threats to plant species and crops in selected eco-systems. The reserves in different status are designated to protect the biodiversity. The various NGOs are also take actions for this effort. The projects were rewarding in developing "National Plan for *in situ* Conservation" as well as "National Biodiversity Strategies and Action Plans" and the approaches for promoting *in situ*/on-farm conservation and ecosystem conservation and managements.

State of *ex situ* management

Turkey is one of the pioneering countries started to maintain the genetic resources and has considerable experiences on *ex situ* conservation since 1960s. Within the frame work of national program, the *ex situ* conservation is implemented both for generative and vegetative collections which are preserved in seed gene bank and field gene banks respectively. The national collection in the National Gene bank with international standard at AARI, contain the landraces, wild and weedy relatives, other wild species which are especially economically important (medicinal, aromatic, ornamentals etc.) and endemic plant species. The total number of accessions of national collection (seed and vegetative collection) is about 70 000 with about 2 700 species. The vegetatively propagated material, mainly fruit genetic resources are kept in field gene banks at 16 institutes (including AARI). The in country safety duplicates of national collection were arranged. The cryo-conservation facilities also exist for conservation of some difficult species. All information about the national program activities are computerized by Central Database of National Program. The Geographic Information System (GIS) is available to evaluate the quantitative and spatial data gathered from National program activities. Regeneration of the collection is recognized and conducted when necessary.



State of utilization

The characterization activities, both agromorphological and molecular and evaluation for identifying sources of resistance to pests and tolerance to abiotic stresses are coordinated by national program and conducted in cooperation with the National Plant Breeding Programs. The characterization and/or evaluation are done mainly for field crops (including, industrial crops and cereals), forages, legumes, fruit trees, medicinal and aromatic plants, vegetables and even ornamental plants. The participatory breeding program with farmers to improve the landraces is recently started for some crops. The informal seed production system to maintain the landraces is predominant in some remote and marginal areas. Material is freely available for breeding programs and for domestic and foreign plant scientists. Exchange of plant genetic resources depends on the availability of accessions for distribution. According to Material Transfer Agreement (MTA), feedback information is requested for the accessions, either dispatched from the Turkish gene bank, or collected jointly. Various improved varieties released and registered from the use of national collection.

State of national program, training and legislation

Turkey establish national PGRFA/Biodiversity program (NPGRDP) and committees to harmonize and coordinate the activities of conservation among the multitude of institutions and programs of formal and informal sector (MARA, MEF, universities, NGOs etc.) involved in the conservation efforts, since 1970s. But in fact the program needed in term of capacity building in the areas of management of gene banks, best practices for conservation, characterization, evaluation, documentation and utilization and on the scientific basis for *in situ/on-farm* conservation approaches. So, AARI operates the training for the National program staff in each year. AARI has also organizes the international courses jointly with international organizations and international centers. The public awareness programs also conducted jointly with other relevant institution within the framework of national program. The National plant genetic resources collections protected by legislation. The Regulation on "Collection Conservation and Utilization of Plant Genetic Resources" has been in force since 1992. The renewal of this regulation is now under process in accordance with new agreements and new legislations. There are various legislations for the protection of nature. Turkey has aimed at to participate actively and to take in control the trade and conservation of natural and biological resources by signing international agreements. Turkey had signed and ratified by the law 5414 the "International Treaty for Plant Genetic Resources for Food and Agriculture".

Regional and international collaboration

Turkey is member of the international organizations, which are either funding sources or actively involved to advocate or to carry out the conservation of world natural resources. Turkey has also close cooperation with centers of Consultative Group on Agricultural Research (CGIAR) in the region. As being bridge between Europe and Asia, Turkey collaborates with both regional (Europe and CWANA) institutions and Networks (European Cooperative Program for plant Genetic Resources- ECPGR).

Access and benefit sharing and farmers' rights

Access to the national material is regulated with legislation related to Collection Conservation and Utilization of Plant Genetic Resources. Since Turkey is party to "International Treaty for Plant Genetic Resources for Food and Agriculture" the PGR regulation and MTA is started to renew. Turkey has also ratified the UPOV Convention. The related legislative arrangement had been developed. Turkey has started to develop the required policies and legislations for farmers' rights and benefit sharing, related to the registration for the landraces. Last decade total 11 228 seed sample were distributed to domestic and foreign users. Cereals, oil seed Crop, food legumes, forage and vegetable programs are frequent users of the material.

Contribution to food security

Turkey, while performing the agricultural development project to assure its own food security, also contributes to the achievement of food security in her region and eventually, to the global food security by being the exporter many of the agricultural products and main crops, vegetables and fruits. The greatest diversity of Turkey contributes for the improvements of new varieties and new crops for the livelihood of farmers. So, for the agricultural sustainability, food security, economic development Turkey has take preventive measures on natural resources (water, soil and biodiversity etc.) conservation and sustainable use. In this concept, Turkey has made important policy and legislative progress (including the risk management) under the coverage of European Union harmonization programs and awareness actions for better understand the roles and the economic social, cultural and ecological values of biodiversity in general and agrobiodiversity in particular including plant genetic resources for food and agriculture.

SECTION II

INTRODUCTION TO THE COUNTRY AND THE AGRICULTURAL SECTOR



INTRODUCTION TO THE COUNTRY AND THE AGRICULTURAL SECTOR

Turkey is located in the subtropics zone in between 36°- 42° latitudes North and 26°- 45° longitude east. The total area is 77 945 000 hectares (Area 779 452 km², Anatolia 755 688 km², Thrace 24 888 km²). The surface area of Turkey is divided by the Dardanelles, the Sea of Marmara and the Bosphorus in the west and it is surrounded by Black Sea in the north; Aegean Sea in the west; Mediterranean Sea in the south. Turkey has boundaries with Greece and Bulgaria in the west, Georgia, Armenia, Azerbaijan, Iran in the East; Iraq and Syria in the south. Geographically Turkey is a land bridge between Europe and Asia. Total length of land borders 2 627 km.

1. Topography

The topography of Turkey exhibits significant variety where ecological factors change greatly over very short distance. The European section (Thrace) of Turkey is a fertile hilly land. The Asian part (Anatolia) of Turkey consists of an inner high plateau with mountain ranges along the north and south coasts. The plateau extends from west to Aegean coast, with many river valleys. Most part of Anatolia consists of a plateau, rising steadily towards the east and bounded on the north and south by steep mountain ranges which are part of the Alpine-Himalayan System.

2. Climate

In contrast to the rest of Turkey, the most striking climatic feature of North Anatolia is the heavy rainfall, which particularly in the North-east, continues all the year around. The coastal climate is mild. Throughout North West of this region there is sufficient summer drought near the coast west of cape Sinop cold winds bring lower winter temperatures. Precipitation in the area often believed increases with altitude. West and South Anatolia have typical Mediterranean climate near the coast- mild, wet winters, and long, hot, add summers with almost constant drought from May to September. Although summer precipitation is negligible, humidity is not so low as it is on the Central Plateau. Rainfall in the Mediterranean belt of Turkey, however, varies considerably from one year to another, throughout much of the area snow lies in winter above 1 000 m. Temperatures tend to be higher in South Anatolia than west, where in South West of Marmara Sea the Mediterranean climate is modified by the lower temperatures and higher rainfall of North Anatolia.

3. Population

The population growth rate is high in Turkey. The present population of Turkey is over 60 million (67 803 927 - Census 2000) Urban population is 44 006 274 (64.9 % of total) and Rural population is 23 797 653 (35.1 % of total). However, there is a substantial migration from rural to urban.

The rate of agricultural population in total population is getting less as a result of economic development and urbanization. According to 2004 Household Work Force survey results, 34 % of economically active population work in agriculture. Industry employs 18.3 % of the working population. The service sector employs 46.3% of the working population.

4. Agriculture

Turkey's main ecological regions from the agricultural point of view are Mediterranean, Aegean, Black Sea Coastal Regions, Thrace and Marmara, Central Anatolia, Southeastern Anatolia, Eastern Anatolia and the Transition Regions (Northwestern Transition, Western Transition, Northeastern Transition, Eastern Transition, and Southeastern Transition). This zoning system, based on main climatic features such as rainfall and temperature, covers agricultural product diversity



and the regional and phenological characteristics of agriculture. The Central, Eastern and Southeastern Anatolia Regions are dominated by the hard continental climate, and their agricultural product characteristics carry the influences of these ecological regions. The transition regions are agricultural regions differing more or less from each other in terms of both climatic factors and overall agricultural characters, each covering several provinces in the transitions from the middle of Central Anatolia to other regions.

The total amount of arable land and land under permanent crops is about 23 million hectares. The main farming systems are dry and irrigated farming. Irrigable land is 12.5 million hectares arable land. Since the water derivation is not possible through the basins, the only 8.5 million hectares of land can be irrigated economically. The total irrigated area is about 4.5 million hectares. In any given year, about two-thirds of arable land is under crops, and one-third is fallow. Little uncultivated arable land remains. The average holding is not more than four or five hectares (10–12 acres). Dry grain farming—in which half the land must lie fallow each year— offers little more than a subsistence standard of living (TUİK,2008: <http://www.tuik.gov.tr/>). Table 1 shows the statistics of agricultural land and forest areas by years.

Grasslands and meadows constitute about 14.6 million hectares. They may be divided into two groups: “Coastal Meadows” and “Steppe Meadows”. The coastal meadows include the grazing areas in the Black Sea, Marmara, Aegean, Mediterranean and Thracian regions. About 25 - 30 % of the country’s meadows area coastal meadows, where annual rainfall varies between 600 and 2 800 mm and the herbaceous plant cover, show forms of transition to the steppe character as rainfall decreases. As a result of higher rainfall and better soil conditions, more fertile pasture vegetation has formed in the coastal meadows. The grazing areas in arid and semi-arid zones, where total annual rainfall varies between 200 and 700 mm, are called steppe meadows, which are divided into two as “mountain steppe meadows” and “plain steppe meadows” in terms of altitude and topography. Since altitude and rainfall are relatively higher in mountain steppes, more valuable fodder plants can be grown there.

One of the most important problems in Turkish agriculture is about size of parcels and their holdings. The size of parcels is usually in small size. This small size may not so important problem for the Mediterranean side of Turkey, because of climate conditions and thus, production in greenhouses.

The rate of agricultural population in total population is getting less as a result of economic development and urbanization. The ratio of agricultural population (villages and towns) was 56.1 % in 1980, 41% in 1990, 35.1% in 2000, 33.9% in 2003 and 34.0 % in 2004. In terms of employment capacity, agriculture is the main sector. According to 2004 Household Work Force survey results, 34% of economically active population work in agriculture. While industry and services rates are 18.3% and 47.8% respectively (<http://www.ilo.org/public/english/employment/strat/kilm/>). As of 2004, the share of agriculture in GNP is 11.6% (http://www.agr.hr/jcea/issues/jcea7-3/pdf/jcea73-19_proc_p_05.pdf).

According to the results of the Crop Production Survey (<http://www.turkstat.gov.tr/>), wheat and barley sown areas are the utmost crop areas out of the total sown field area with the rates 48.9% and 19.9% respectively. In terms of sown field area, ratios of the other important crops are sunflower with 4.3%, maize with 4.2%, cotton (raw) with 4% and sugar beet with 2.2%. These crops areas constitute 83.5% of the total sown field area. Wheat production takes the first place within cereals production with the rate 29.8%. Wheat, barley and maize are the utmost sown crops out of the total cereals area with ratios 64.8%, 26.4% and 5.6% respectively. When distribution of production gained by total cereals area is examined, it can be seen that wheat production with rate 58.1%, barley production with rate 21.2% and maize production with rate 17.1% compose of 96.4% of the total cereals production. Tomatoes have the highest production value within vegetables with rate 27.3%. Out of the selected crops that utmost sown and constitutes 56.6% of the total vegetable area, dry onion and watermelon make up predominant production with rate 11.6% of each. These three vegetables constitute 50.5% of the total vegetable production. According to the results of the survey, grapes for table constitute 54.2% of the total vineyard area and constitute 50.3% of the total grape production. Citrus have the highest production value with rate 24.1% within the total fruit areas. Out of the selected important crops from crops constitutes 74.5% of the total fruit area, olives and apples have predominant production with rates 13.9% and 12.4% respectively. These three crops compose of 50.4% of the total fruit production. Turkey is pursuing the policy of modernization of agriculture with more irrigated lands and greater transition to privatization in the sector. To ensure the food security, development of well adjusted production techniques with climatic change is necessary. So, for the food security Turkey has take preventive measures on natural resources (water, soil and biodiversity etc.) conservation and sustainability. In this concept, Turkey has made important policy and legislative progress including the risk management under the coverage of European Union harmonization programs. Agricultural risk management system with public-private sector partnership also exists since 2005. More and more companies that were originally active in other areas are investing in agriculture. The main areas of investment are farm modernization, organic farming, food safety, etc. Moreover, we see more new farms being equipped with modern farm machinery, tools, etc. Mechanization is getting increasingly popular all over Turkey, especially in the western parts of Turkey, where farmers are wealthier and farms are bigger.

TABLE 1
Agricultural land and forest area (TUIK,2008: <http://www.tuik.gov.tr/>)
 (Thousand Hectare)

Year	Total utilized agricultural land	Total arable land and permanent crops	Cultivated field area			Land under permanent crops					Land under meadows and pastures	Forest area(2)
			Sown area	Fallow land	Area of vegetable gardens	Total land under permanent crops	Area of fruit trees	Area of vineyard	Area of olive trees			
1987	42 104	27 927	18 781	5 574	609	2 963	1 517	590	856	14 177	20 199	
1988	41 940	27 763	18 995	5 179	612	2 977	1 531	590	856	14 177	20 199	
1989	42 074	27 897	19 036	5 234	610	3 017	1 563	597	857	14 177	20 199	
1990	42 033	27 856	18 868	5 324	635	3 029	1 583	580	866	14 177	20 199	
1991	40 032	27 654	18 776	5 203	652	3 023	1 560	586	877	12 378	20 199	
1992	39 953	27 575	18 811	5 089	663	3 012	1 565	576	871	12 378	20 199	
1993	39 913	27 535	18 940	4 887	654	3 054	1 615	567	872	12 378	20 199	
1994	40 049	27 671	18 641	5 255	709	3 066	1 618	567	881	12 378	20 199	
1995 ⁽¹⁾	39 212	26 834	18 464	5 124	785	2 461	1 340	565	556	12 378	20 199	
1996	39 364	26 986	18 635	5 094	785	2 472	1 344	560	568	12 378	20 199	
1997	39 242	26 864	18 605	4 917	775	2 567	1 364	545	658	12 378	20 703	
1998	39 344	26 966	18 751	4 902	783	2 530	1 389	541	600	12 378	20 703	
1999	39 180	26 802	18 450	5 039	790	2 523	1 393	535	595	12 378	20 703	
2000	38 757	26 379	18 207	4 826	793	2 553	1 418	535	600	12 378	20 703	
2001	40 967	26 350	18 087	4 914	799	2 550	1 425	525	600	14 617	20 703	
2002	41 196	26 579	18 123	5 040	831	2 585	1 435	530	620	14 617	20 703	
2003	40 645	26 028	17 563	4 991	818	2 656	1 501	530	625	14 617	20 703	
2004	41 210	26 593	18 110	4 956	805	2 722	1 558	520	644	14 617	21 189	
2005	41 223	26 606	18 148	4 876	806	2 776	1 598	516	662	14 617	21 189	
2006	40 496	25 879	17 560*	4 691	779	2 849	1 623	514	712	14 617	21 189	

¹ Since 1995, only the closed area of fruit and olive trees was given the area of scattered trees was not included.

² Normal forest area having equals and more than 11 percent forest tree density and spoiled forest area having equens and less than 10 percent forest tree density are included. Provisional data.

Organic farming and organic products are getting more and more popular in Turkey in parallel with the growing importance and popularity of organic products in Europe. In addition to this, Turkey has a great advantage in the sense that there are still available lands in Turkey without any pollution which is perfect for organic production. Organic production of some vegetable and fruit varieties has been growing since it started in 1985. In 2002, around 90 different kinds of agricultural products were organically produced in Turkey. Due to growing demand from EU countries, great majority of the current production is exported to the EU. With a new law approved by the Parliament in December 2004, there are more strict regulations on production and labeling of organic products.

Due to favorable climatic conditions, greenhouses and flower production (cut and pot flowers) are other important areas for business opportunities. The fact that Turkey is dependent on imports of most varieties of vegetable-seeds (for some varieties up to 90% of the seeds are imported) and fruit-seeds accounts for potential business opportunities. Flower production in greenhouses is another area of growth in Turkey. The major export markets of cut flowers are UK, Japan, Russian Federation and Netherlands.

The government stimulates production through crop subsidies, low taxation, price supports, easy farm credit, research and education programs, and the establishment of model farms. The government also controls the conditions under which farm products can move into world markets. For some products, such as grain, the government is the sole exporter. Agricultural products trade has been taken important place in Turkish economy. Both of import and export are an increasing trend in Turkish economy (Table 2, 3). Despite the overall trade deficit, the agricultural trade balance is significantly positive. While fruits and vegetables and their manufactures are an important place in Turkish agricultural export, agricultural raw materials have an important place in Turkish agricultural import. Turkey's agricultural exports are diverse: hazelnuts, tobacco, lentils, chickpeas, citrus fruits, vegetables, pistachios, dried apricots, seedless raisins, and olive oil. Turkey also exports ready-to-eat and ready-to-cook products such as pasta, tomato paste, canned vegetables and fruits, margarine, candy, and confectionery products. Turkey's trade for wheat, barley, and sugar depends on production and stock levels. Turkey ranks number one in the world in apricot, cherry, fig and hazelnut production (FAO, 2004). Most of these products have exported EU countries. At present, Turkey is the largest producer and exporter of agricultural products in the Near East and North Africa.

TABLE 2

Exports of Turkey (FAO, <http://www.fao.org/>)

Commodity	Quantity (Mt)	Value (000 US\$)	Unit value (US\$)
Hazelnuts Shelled	134 557	737 370	5 480
Tobacco Leaves	114 774	399 804	3 483
Prepared Nuts (Excl.Grnuts)	78 638	370 782	4 715
Raisins	211 894	231 400	1 092
Pastry	162 403	213 677	1 316
Flour of Wheat	803 704	203 410	253
Food Prepared nes	140 943	198 158	1 406
Dry Apricots	81 292	197 704	2 432
Fruit Prepared nes	88 898	176 231	1 982
Chocolate Products nes	72 059	161 281	2 238
Sugar Confectionery	67 654	157 157	2 323
Tomato Paste	183 254	133 770	730
Oil of Olive	49 632	133 034	2 680
Vegetables Pr by Vinegar	174 069	122 956	706
Cherries	39 732	117 987	2 970
Tomatoes	235 364	109 563	466
Lemons and Limes	216 756	99 211	458
Tang., Mand., Clement., Satsma	216 102	95 559	442
Figs, Dried	49 074	85 597	1 744
Lentils	171 185	85 444	499



TABLE 3
Imports of Turkey (FAO, <http://www.fao.org/>)

Commodity	Quantity (Mt)	Value (000 US\$)	Unit value (US\$)
Cotton Lint	585 108	836 428	1 430
Skin With Wool Sheep	130 953	316 680	2 418
Soybeans	681 964	226 828	333
Wheat	1 065 389	221 868	208
Maize	1 049 744	190 477	181
Food Prepared nes	36 997	185 481	5 013
Oil of Palm	349 423	182 276	522
Tobacco Leaves	46 254	165 947	3 588
Sunflower Seed	481 703	157 376	327
Cocoa Beans	69 221	153 049	2 211
Rubber Natural Dry	110 779	151 208	1 365
Cake of Soya Beans	465 976	144 863	311
Bran of Wheat	831 054	97 001	117
Tobacco Products nes	19 907	73 323	3 683
Oil of Maize	90 026	67 427	749
Oil of Palm Kernels	89 316	59 718	669
Sesame Seed	79 190	59 037	746
Tallow	111 176	55 930	503
Wool Tops	8 419	55 798	6 628
Cake of Sunflower Seed	351 803	53 689	153

Turkey's closeness to the Europe, the Middle East and the North Africa; gives her the opportunity of accessing easily to large markets through the Black Sea on the north, the Aegean Sea on the west and the Mediterranean Sea on the south. Likewise, Turkey's internal market also experiences rapid growth in demand for more food of higher quality, due to the high rates of population growth and rising income. Thus, agriculture in Turkey holds the promise of making a major contribution to Turkey's economic development (EPC 2005). Due to the market size and the importance of agriculture, the agricultural machinery industry has grown over the years, not only to meet domestic demand but also to export its surplus. Major export markets are countries like: France, Morocco, Bulgaria, Greece and Syria. Turkey manufactures almost all kinds of agricultural machineries and equipments. Turkey's import from EU countries also depends on productions which have been fluctuated yearly. Turkey's main agricultural import products from EU are oils and fats; beverages and tobacco; coffee, tea and spices; animal feed; and dairy products.

In summary, the agricultural sector in Turkey has been growing for the last couple of years with more and more companies investing in the sector. Furthermore, new farms are being equipped with modern farm machinery, tools, etc. and mechanization is getting increasingly popular all over Turkey.

SECTION III

THE MAIN BODY OF THE COUNTRY REPORT

THE STATE OF DIVERSITY

Turkey is located in the eastern Mediterranean and a bridge between the continents of Europe and Asia (39°N and 35°E). The Turkish landscape encompasses a vast variety of diversity in geography (topography, climate), natural resources including biological resources and in culture. From a cross-section of east to west, one will encounter rugged snow-capped mountains with long and cold winters along long and cool summers in the east, barren bedrocks and endless wheat fields of dry steppes with rolling hills in central Turkey and fertile valleys between cultivated mountain-foot hills reaching lacelike shores of the Aegean with warm and friendly climate in the west. The north-south cross section begins with the lush, temperate zone of the Black Sea coast with mountain ranges facing coastal lines which are mostly cultivated with hazelnuts, corn and tea. The high elevation northern Anatolian Mountains include intact forest ecosystems and biodiversity rich high meadows, which are characteristics of the northern Turkey. To the south from the Black Sea, vast Konya plain in the central Anatolia and magnificent Toros (Taurus) Mountains covered with conifer forest followed by the field of cotton and banana plantation in the Mediterranean Region are present with nice the Mediterranean climate. Since Turkish landscape has the combined characteristics of three old continents (Europe, Africa and Asia), ecological and biological diversity surpass any other place along the 40°N latitude in the region. For example, at the large scale, there are three phytogeographic regions such as the Mediterranean, Euro-Siberian and Irano-Turanian phytogeographic regions which are the indication of diverse climate and topography of the country.

Turkey consists of three different biogeographic regions, each with its own endemic species and natural ecosystems. These are: the Caucasian mountain forests with the temperate deciduous forest, including alpine meadows; Central and Eastern Anatolian Steppe grasslands and the Mediterranean region, which includes the World's largest remaining Cypress forests. The steppe ecosystem is perhaps the most important of all from the point of view of economics, as a large number of food crops have been derived from their wild species native to Turkey. Wetland ecosystems provide suitable breeding, feeding environment and habitat, and are second to tropical forests regarding biodiversity levels. Wetlands are vitally important for many endangered and endemic species. Significant degradation exists in each of the mentioned ecosystems, and each of them has endemic, endangered, threatened, or extinct species. There are two main forests: Temperate Coniferous Forest and Temperate Deciduous Forest. Forest ecosystems include high-mountain and alluvial forests deciduous forests are prevalent in Turkey and coniferous forests are found at varying altitudes from sea level to timberline. Forests in Turkey include three distinct and different floristic regions. These ecosystems are very important for the habitats of wild relative of crop species, such as wild relative of cereals and legumes and also wild fruit species.

Since Turkey is located in a geographically and climatically favorable place which harbors diverse ecological regions. Thus, the country is rich both animal and plant biodiversity. Although many mammalian and possibly other animal species were extinct in the past, there are still a large diversity in insects, fish and reptiles. Ecological diversity was also reflected as the presence of three phytogeographical regions. Over 75 % of the 12 000 plant species that occur in Europe naturally occurs in Turkey over 9 000 taxa (Table 1.1). Turkish flora includes many wild relatives of important domestic species (e.g., wheat, barley, chick pea, lentil, cherry, pear, apricot, chestnut, pistachio, etc.) as well. Additionally, the Turkish flora also includes many economically important timber species, and medicinal, aromatic, industrial and ornamental plants. Turkey is also described as microcenters for *Amygdalus* spp., *Cucumis melo*, *C.sativus*, *Cucurbita moshata*, *C.pepo*, *Lens culinaris*, *Lupinus* spp., *Malus* spp., *Medicago sativa*, other annual *Medicago* spp., *Onobrychis viciifolia*, *Phaseolus vulgaris*, *Pistachio* spp., *Prunus* spp., *Pyrus* spp., *Trifolium* spp., *Vicia faba*, *Vitis vinifera* and *Zea mays*.

Turkey is also located in one of the three major flyways for millions of migratory birds, which move between the Western Palearctic and Africa each year and pass through Turkey. Since the country is predominantly semi-arid, Turkish wetlands are of crucial importance for many of these migrants, and also for many breeding species of water birds, including a significant proportion of the global populations of some species.

Turkey is one of significant country with its rich plant genetic resources/plant diversity. Two of the Vavilov's Center of Origin (i.e., Near Eastern and Mediterranean Centers) extends into Turkey. This, of course, indicates that Turkey is the one of the Center of Origin and/or Center of Diversity of several crop plants with wild weedy and cultivated forms and many plant species. Moreover, Turkey is also one of the domestication centers where ancient agriculture started. Turkey is endowed with a rich diversity of family, genera and species of plants (163 family, 1 225 genera, and 9 000 species).



3 000 plant taxa are endemic to the area out of 9 000 species. Species endemism is also high. So, Turkish flora includes many wild relatives of important domestic species (e.g., wheat, barley, chick pea, lentil, cherry, pear, apricot, chestnut, pistachio, etc.) as well. Additionally, the Turkish flora also includes many economically important timber species, and medicinal, aromatic, industrial and ornamental plants. This rich plant diversity (primitive land races, wild crop relatives and other wild plant species) of Turkey continue to provide new sources of important traits to improve agricultural production and introduce new source efficient world wide.

Turkey's wealth in plants is apparent in the fact that 3 000 out of the 9 000 plant species are endemic to the area. Endemics are scattered throughout the country, but few in Trace (Table 1.1). The largest number of endemics occurs in the Irano-Turanian Region and the Mediterranean region. Many genera (like *Alyssum*, *Asyneuma*, *Alkanna*, *Rhamnus*, *Salvia*, *Sideritis*, and *Verbascum*) contain closely related endemics that replace one another in different areas. A rather large number of endemics, however, are apparently confined to areas where adjacent regions meet or inter-grade a feature which deserves further study. The endemics show definite areas of concentration throughout the country, predominating in the mountainous parts of South and Southeast Anatolia. The distributions of the endemics to the regions are: Irano-Turanian (1 181), Mediterranean (1 946), Euro-Siberian (256). The distribution area of 1 689 taxa has not been determined. Within the framework of National Plant Genetic Resources Research Program, the collection and conservation of endemic species of Turkey is understudy. The genus with rich endemism are *Astragalus* (229 species), *Verbascum* (175 species), *Centaurea* (107 species). The genus represented with low number of species but high proportions of endemism are: *Alkanna*, *Sideritis*, *Acantholimon*, *Paronychia*, *Gypsophila*. All Ebenus species found in Turkey are endemic. The detailed information about Turkey's endemics will be resulted and of this program. IUCN categories of endemic and non endemic species are given in Table 1.2.

TABLE 1.1

Number of Species in Turkey. Red Data Book of Turkish plants (*Preridophyta* and *Spermatophyta*) 2000

Plants	Described Species	Endemic Species
<i>Ferns</i>	86	1
<i>Gymnospermae</i>	23	3
<i>Monocotyledons</i>	1 423	249
<i>Dicotyledons</i>	7 415	2 509

TABLE 1.2

IUCN Categories of Endemic and Non-endemic Plant Species. Red Data Book of Turkish Plants (*Preridophyta* and *Spermatophyta*) 2000

	EX	EW	CR	EN	VU	LR (lc)	LR (cd)	LR (nt)	DD	NE
Endemic	12	-	171	774	688	769	470	347	270	3
Non-endemic	1	-	10	69	769				244	3
Total	13	-	181	843	1 457	769	470	347	514	6

Turkey was the first country to complete a national inventory of Important Plant Areas (IPAs). The Important Plant Areas program in Turkey is a partnership combining the joint expertise of three conservation and scientific organisations: WWF-Turkey (known as The Foundation for the Conservation of Nature); Fauna and Flora International (FFI), based in UK; and the Department of Pharmaceutical Botany of Istanbul University (ISTE). The IPA project in Turkey, as a pioneer for IPA processes, inspired the development of Plant life International's European and Global IPA Program. The Important Plant Areas of Turkey were identified in cooperation with approximately 40 scientists from 20 universities along with many other researchers and institutions. The Turkish-language report *Important Plant Areas of Turkey* was published in 2004 with lists 122 Important Plant Areas (110 000 km², one eight of total surface area of Turkey) including botanical, geographical and geological characteristics, and describes their importance regarding nature conservation and threats (<http://www.plantlife.org.uk/international/plantlife-ipas-euro-turkey.htm>).



The wild relatives

Wild relatives and wild ancestors of cereals include those of wheat (wild einkorn, *Triticum boeoticum*; wild emmer, *T.dicoccoides*; goat grass (*Aegilops* spp), barley (*Hordeum spontaneum*, *H.bulbosum*, *H.marinum* and *H.murinum*), oats (*Avena* spp), and rye (*Secale* spp). Five wild species of lentil, *Lens orientalis*, *L.nigricans*, *L.ervoides*, *L.montbretii*, *L.odemensis*; the wild and weedy forms of *Pisum* (primary progenitor of pea, *P.humile*; *P.elatius*); wild progenitors of *Cicer* (*C.pinnatifidum*, *C.echinospermum*, *C.bijugum*, *C.reticulatum*) occur in Turkey. Extremely rich medicinal, aromatic and ornamental plant species are found in the flora of Turkey. Within the ornamental plants the great numbers of bulbous tuberous plants, woody and herbaceous perennials, biennials and annuals are found. Most of the ornamental species are grown in wild habitat among deciduous shrubs and under deciduous trees or scattered among bushes and/or rocks. The diversity of ornamental plant species are related to diverse topography and climate of Turkey. Medicinal and aromatic plants almost have same situation in Turkey. The rate of endemic is also high within those plant groups. The number of vegetable has their origin in Anatolia. The wild relative of *Brassica's B.cretica* is found in South Anatolia (In South Aegean and Mediterranean Belt). Wild *Raphanus raphanistrum* has also distribution in the West and South coastal part. Wild celery, *Apium graveolens*; wild beet *B.maritima* and other *Beta* spp., wild carrots, *Daucus* spp.; wild rockets *Eruca* spp. wild lettuce, *Lactuca* spp.; wild mustard, *Sinapis* spp. are some of the wild vegetables commonly used as vegetable or salad plants. Many other wild plant species are used as salad and vegetable plants, but still are not utilized in development. The indigenous fruit trees are also found in Turkey. Those woody plants are valuable genetic resources as food crops. Because their resistance to insect, disease and their natural ability to an array of sites, such species as chestnut (*Castanea sativa*), olive (*Olea europea*) and walnut (*Juglans regia*) are some valuable fruit genetic resources. Wild relatives of apple (*Malus* spp.) pear (*Pyrus* spp.) and plum (*Prunus* spp.) are also found in Turkey (Gönülşen, 1986). The wild pistachios; *P.terebinthus*, *P.lentiscus*; wild hazel nuts *Corylus* spp.; wild plums *Prunus spinosa*, *P.divericata*; wild cornel cherry *Cornus sanguinea*, wild pears *Pyrus elaeagrifolia* and other *Pyrus* species; wild almonds *Amygdalus* spp. are some of wild relatives of fruit trees found in Turkey. Sweet and sour cherries are also indigenous, various wild types are found especially in North Turkey. Most of those wild relatives of fruit trees are utilized as rootstock. There are also wild relatives of other fruits like wild strawberry, *Fragaria* spp.; wild blackberries *Rubus* spp. The wild relatives of forage grasses and legumes commonly occur in Turkey. The natural pastures and meadows show high genetic diversity. These caused to ecological populations of forages, which are superior to the current use can be released as commercial cultivars with a minimum of further selection and breeding. But most of them threatened with genetic erosion mainly due to over grazing.

Landraces and old cultivars

Landraces are found in the areas where crop species first arose through domestication. Turkey also lies within the broad region of domestication of crops. Therefore, there are highly variable domesticated crops as well as landraces with unique characteristics in Turkey. But Adoption of new crop cultivars, nitrogenous fertilizer, and increasing commercialization in agriculture has reduced the area of local crop production. While high yielding modern cultivars predominate, the local landraces are still cultivated in some of the regions. For instance modern wheat is concentrated mostly at the irrigated and valley bottom lands in W. Anatolia, but farmers still grow local bread and durum wheat cultivars for their home use. The diploid einkorn, and the tetraploid emmer wheat are grown by some farmers in NW. and E. Anatolia. The two-row barley land races, and six-row barley and races are also grown in Turkey. The cultivation of oat and rye landraces is now rare in Anatolia. The landraces of legumes maintain a high level of genetic heterogeneity. The lentil landraces are still widely grown by farmers. The forms of those landraces are very diverse as large seeded, small seeded and intermediates for both red and green lentils. Landraces of field and garden pea, fababean are still grown. Chickpea and beans are remarkable landraces of Turkey. Different forms of chickpea landraces are found. Small seeded forms grown mainly in SE and Central Anatolia, whereas large seeded types exist in transitional regions and W Anatolia. Beans are cultivated all over Turkey for dry and vegetable use. Because of better adaptation of bean into the various climatic regions, the most important variation are observed in fruiting characters, in pod and seed size with a remarkable range of testa color.

Some vegetables have micro gene centers in Turkey. Number of vegetables has their origin in Anatolia. As a result of the natural adaptation to different ecogeographical regions and the farmer selection, the vegetable landraces have considerable variation exhibited from one locality to another. The traditional agricultural system used in the backyard gardens to grow vegetables, especially in remote areas of Turkey, has been important in bringing together some species that have subsequently hybridized. Turkey is one of the possible centers of origin for Beet (*Beta*). Different races of beets for different use are found. The diverse forms and landraces of vegetable, table and fodder beets have been grown and used locally for generations in Anatolia. Some industrial crops like flax have ancient cultivation in Turkey. The fiber (flax) and oil (linseed) type of *Linum* landraces found with various in length and branching in habitus. Along Black Sea Coast of Turkey prostrate multistemmed types are cultivated since ancient times. *Papaver somniferum* has also different

form of landraces with different capsules, flower and seed colors. Turkey is the junction between primary and secondary center of diversity of sesame. Therefore, different forms are found. Although Turkey is not center of origin of tobacco, sunflower, and corn but those crops have also diverse landraces which are adapted to different ecological conditions. The various local types of fruits are found in Turkey. *Prunus* species are represented with different fruit types like almond, plum, cherries, apricot etc. Almond types may differ widely in vigor, yield, nut and kernel quality, and flowering time. Various plum types are found with very ancient cultivation and wide distribution. Different types of sweet cherry have also grown for centuries throughout Turkey. The spontaneous seedlings are occasionally allowed to develop into bearing trees, especially of apricot; almond and cherry plum (*P.ceracifera*), which increase the rate of existing diversity.

The land races which maintain a high level of genetic heterogeneity are still grown in transitional zones and mountain areas where the agricultural lands are small and the modern farming is not possible. Transitional zones appear to have retained traditional farming methods to higher degree than the intensively cultivated coastal region or Anatolian plateau. The farm population in the region is fully integrated into national economy and culture of Turkey. "Agricultural Development Programs" have been providing improved varieties through the seed corporation, which causes the landrace plantations to decline. Fragmentation of holding allows farmers to manage several fields and to cultivate land races in at least one field. Marginal agronomic conditions especially steep slopes and heterogeneous soils of mountainous lands make landraces competitive with improved varieties. Farmers keep local races in fields that are relatively margined and poorer soils, steeper slopes and higher altitudes. Economic isolation in the mountain part creates market imperfections and lessens the competitive commercial advantage of improved varieties. Cultural and traditional demands and preferences for diversity cause farmers to maintain land races. But in some of the other areas, some of the modern farmers also still prefer to grow the land races for their conceptions.

Neglected and underutilized species (NUS) are very adaptable to marginal environments, where the most fragile groups live, they represent a source of income of particular significance for those groups, in particular women and children, who can harvest these species from the wild, having land and labor access within the boundary of their community villages, often exploiting uncultivated areas. For this reason, the sustainable use of these species and their conservation is so important. Often, NUS are neglected and underutilized because traditional consumer patterns were lost with urbanization, where it is difficult to find the traditional food items. Promoting NUS may be easier where promotion can capitalize on traditional knowledge of uses, recipes and culture. Consequently, there is need to create demand for NUS by promoting their specific values, such as nutritive and health properties (e.g. balanced diet, specific medicinal uses), and also by appealing to the heritage of cultural values, stressing the contribution of the utilization of NUS to biodiversity conservation, to the livelihood especially of rural people and the sustainable use of natural resources. Recent years there are demand to NUS crops for various reasons, such as greater food security, healthy nutrition, cultural knowledge, income generation, poverty reduction, sustainable use of natural resources. Because many underutilized crops have important nutritional qualities and they are therefore a significant complement to the 'major' cereals and serve to prevent diet deficiencies. Underutilized species are also capable to offering new opportunities for income generation if their market potential is successfully recognized and developed. Some crop species and varieties fit easily into traditional sustainable farming systems geared towards maintaining or restoring soil fertility, like mixed cropping and agroforestry. NUS are important component of Turkish plant diversity. Therefore, various projects are ongoing on inventory of local species and reintroduction to farmers and consumers and also recultivation for the sustainable utilization and conservation on-farm.

This rich genetic diversity becomes important to plant breeding programs. Especially, the land races are utilized to improve the varieties. The wild crop relatives which are in the first gene pool of crops are also used easy in variety improvements. Many registered varieties are release from those plant genetic collections of Turkey. Especially most of the vegetables, industrial crops, fruits, and forage varieties have been released from the land race collections of Turkey. The registered varieties (1963-2008) are shown in Table 1.3. Most of the recently registered varieties are in market now.

TABLE 1.3
Number of registered varieties in the national List of Turkey (www.ttsm.gov.tr)

Crops	Years		Total
	1963-1998	1999-2008	
Cereals	145	334	479
Fodder crops	31	26	57
Turf Grass	-	22	22
Grapes	73	-	73
Grapevine root stock	21	-	21
Fruits	567	19	586
Fruits root stock	164	2	166
Industrial crops (including root crops)	164	275	439
Pulses	31	26	57
Medicinal and aromatic plants (herbs)	-	9	9
Vegetables	89	75	164
Total	1 285	788	2 073

In summary, the potential and the reasons for this richness can be described with below factors (1) meeting place of three phytogeographical regions, (2) Center of Origin and Center of Diversity of many crop/plant species, (3) domestication center for many crops, (4) high species endemism, (5) a bridge between Europe and Asia, and has apparently served as a migration route for the penetration of other elements. Therefore, Turkey has very rich and interesting flora with existing bio-diversity and/or genetic diversity. However, due to social, economical and environmental problems, natural resources including biological resources in Turkey like in many other parts of Turkey have been threatened and required to be conserved and managed for sustainability. Factors such as environmental destruction, over exploitation, replacement of traditional cultivars, and modernization of agriculture result the erosion of the genetic diversity. In some regions of Turkey are now undergoing some degree of changes in terms of trade, exports, urbanization and market driven farming. Despite the positive aspect of such changes, these have greatly contributed to decrease, even loss of the agrobiodiversity. Biodiversity conservation, *ex situ* and *in situ*, of plant diversity is conducted within the framework of "National Program on Conservation of Genetic Resource/Diversity" since 1960s. The Turkish Constitution, Laws and Regulations and international conventions in the field of nature conservation provide the legal framework for seeking the strategy for continuity of biodiversity/genetic diversity in Turkey.



THE STATE OF *IN SITU* MANAGEMENT

Protected areas are valuable reservoirs for crop wild relatives, medicinal and herbal plants as well as all other components of the ecosystem. This importance was considered conservation of the natural environment in the early years of republic. The designation of the first National Park in 1958, when environmental problems were not yet intensive in Turkey, reflects a well-established approach to nature conservation. In early 1970s, environmental conservation policies started to become institutional in Turkey. In early 1980 and 1990 legal bounding of the environmental protection were achieved and included in national programmes. The fact that Turkey is party to international conventions aimed at the protection of biological diversity is a reflection of its nature conservation policy. The subsequent Development Plans and Annual Programmes have included issues of biological diversity in the environmental and agricultural sectors, set forth policies for the protection and sustainable development of biological diversity and for the augmentation of its economic value, and specified the necessary measures. The Ninth Development Plan, covering the years 2007 to 2013, determines it as a priority to carry out activities for the protection and development of and the addition of economic value to the biological diversity that Turkey has.

National Environmental Strategies, Plans and Programs are listed below:

- National Plant Genetic Resources and Plant Diversity Conservation Program (1976)
- National Environmental Action Plan (1998)
- National Plan for *In situ* Protection of Plant Genetic Diversity (1998)
- National Biological diversity Strategy and Action Plan (2001 revised in 2007)
- National Agenda 21 Programme (2001)
- National Wetland Strategy (2003)
- Turkish National Forestry Programme (2004)
- National Science and Technology Policies 2003-2023 Strategy Document (2004)
- Turkish National Action Program Against Desertification (2005)
- National Environmental Strategy (2006)
- National Rural Development Strategy (2006)

In situ programs such as National Parks, Nature Conservation Areas, Nature Parks, Wild life Development Areas, Special Environmental Protection Zones, Natural Sites, Natural Assets and Gene Preservation and Management Areas have been conducted in Turkey since the 1950s (Table 2.1). The proportion of protected areas under various statuses to the country's total surface area increased from 4% to about 6% after 2000.

TABLE 2.1

***In Situ* Conservation Programs in Turkey (National Biological diversity Strategy and Action Plan (2007))**

Conservation Programs	Foundation Year	Responsible Institution	Number	Area (acres)
National Parks	1958	MEF	39	878 801.00
Nature Parks	1983	MEF	29	78 868.00
Nature Conservation Areas	1987	MEF	32	63 008.00
Nature Monuments	1988	MEF	105	5 541.60
Wildlife Improvement Areas	1966	MEF	80	1 205 599.00
Wildlife Breeding Stations	1966	MEF	22	4 551
Protection Forests	1950	MEF	57	394 853.00
Gene Conservation Forests	1994	MEF	193	27 735.60
Seed Stands	1969	MEF	338	46 086.04
Special Environment Protection Regions	1988	MEF	14	1 206 008.00
Ramsar Areas	1994	MEF	12	200 000.00
Natural Archaeological Protection Areas	1973	MTC	1 003	
Natural Assets	1973	MTC	2 370	
Gene Conservation and Management Areas	1993	MARA/MEF	3 Pilot study areas	

MARA: Ministry of Agriculture and Rural Affairs; **MEF:** Ministry of Environment and Forestry; **MTC:** Ministry of Tourism and Culture

Source: <http://www.cevreorman.gov.tr/belgeler6/NBSAP.pdf>

There are various important projects related to *in situ* conservation conducted at national level in cooperation with ministries of Agriculture and Rural Affairs (MARA) and Ministry of Environment and Forestry (MEF), NGOs and Universities (Box 2.1, 2.2, 2.3, 2.4, 2.5). The public awareness is the one of the main component of those projects.

BOX 2.1**Project for *In situ* Protection of Turkey's Plant Genetic Diversity (GEF 1 Project)**

The project was conducted between 1993 and 1998 jointly by the Ministry of the Environment and Forestry and the Ministry of Agriculture and Rural Affairs with GEF/World Bank grant support. Its objective was the *in situ* conservation of the wild relatives of plant and forest genetic resources. The possibilities of conservation in site the wild species of cereals (wheats and barley) food legumes (chickpea and lentil), fruits (plum and chestnut) and certain forest tree species (the Ida Mountain Fir, the black pine, the red pine, the Taurus cedar, the Taurus fir) and of determining and establishing their conservation areas/sites were investigated under the project. The study sites of the project were Kaz Mountains in Northern Aegean Region, the Bolkar and Aladag Mountains in Central and East Mediterranean Region and the Ceylanpinar State Farm in South East Anatolian Region. In those three areas, sites having rich genetic diversity and containing target species were designated as "Gene Protection and Management Areas (GPMA)". Under framework of the project, a Geographical Information System (GIS) and a Remote Sensing Centre were established at the Ministry of Agriculture and Rural Affairs. A "National Plan for the *In situ* Conservation of Plant Genetic Diversity of Turkey" was prepared to provide the basis for review of the project to date, facilitate the coordination and cooperation for the management of Gene Management Zones (GMZs) in to the GPMA and other nature preservation strategies in the country, and outline the implementation of the national plan. The "National plan for *in situ* Conservation" also provides a mechanism for the country to set priorities and present a plan of action that ensures the protection of wild crop relatives and forest genetic resources in their natural habitat beyond designated *in situ* reserves. This National Plan includes list of *in situ* conservation of wild crop relatives and their ecosystems and crops/plant species (priority list) for on-farm conservation of agro biodiversity. Beside National Plan the management plans and monitoring of GMZs of target species and their ecosystem and public awareness activities are the achievements of the Project.



BOX 2.2**Biological diversity and Natural Resource Management Project**

The project, supported by the World Bank-GEF fund, which became effective in 2000, and completed in December 2007. This project aims at efficient, intersectoral and participatory planning and sustainable management of nature conservation and natural resources in the application sites of İğneada, Camili, Koprulu Canyon and Sultansazlığı, representing the three important phytogeographical regions, and in 9 replication sites. The project components were: (1) strengthening the national framework for biodiversity conservation; (2) developing prototypes for effective protected area management; and (3) project management and monitoring. Project also aimed to incorporate the biodiversity conservation concept into the forest management plans of Turkey

The management plans with the participatory and ecosystem-based approach for protected areas prepared and regarded as an alternative to the conventional planning approach, the project gives attention to meeting the needs of the people living in or around the protected areas as well as the requirements of nature conservation and natural resource management.

The national biodiversity database called "Noah's Ark" and a Biological diversity Monitoring Unit have been created to monitor the current state and the progress of biological diversity in Turkey and to use the data concerning biological diversity more effectively in protection activities. In this context, gaps analysis work has also been used for the protected areas. Legal and institutional structure required for sustainable nature conservation and resource management has been reviewed and the "Draft Law for Nature Conservation" prepared. The Forest Management Regulation has been redrafted to ensure more effective protection of biological diversity in exploited forests. To ensure the participation of interest groups in protection activities in the 4 pilot areas determined, grant support has been provided for about 150 small-scale projects which may be considered biological diversity protection-friendly. Raising public awareness and training on biological diversity protection and natural resource management have also been implemented within the framework of the project. A new reserve ,The Camili Biosphere Reserve, has also been established under this project.

BOX 2.3**Anatolia Water Basins Rehabilitation Project**

The duration of the project is about 7 years starting from 2004 to 2011. The aims of the project are to achieve sustainable resource management and participatory planning in the Central Anatolia and Black Sea regions, to reduce pressure on natural resources, to adopt environment friendly agricultural and silvicultural practices, to enhance institutional capacity, to raise public awareness and to develop water and food management policies in the process of alignment with the EU. Also, in connection with the rehabilitation and income-raising activities, the project aims at identifying the Pollution of Agricultural Origin in the Kızılırmak and Yeşilirmak basins and eliminating or reducing the negative impacts of such pollution, with support from the GEF (Global Environmental Fund).

In the 28 micro basins determined under the project, a series of actions to develop natural resources will be implemented in cultivated areas, pastures and forest land, including the development of pasture management, the rehabilitation of pasture and forest areas, the enrichment of these areas in plant cover, the increased production of fodder crops, the reduction of agricultural areas left fallow, the adoption of environment-friendly farming techniques, the implementation of measures to increase animal feed and wood production and to promote soil conservation, and agricultural techniques to protect humidity.

BOX 2.4**Ecosystem Conservation and Management for Threatened Plant Species Project (Life Project)**

Project supported by EC LIFE programme was initiated for the purpose of determination of Important Plant Areas (IPAs) in Southern part of Central Anatolian Region and adjacent transitional zones in Turkey for conservation, management and sustainable use of selected ecosystems, which are already considered as rich in plant endemism, annexed to Bern Convention. The project has been designed around the following components: a) Site survey and inventories; b) Designation of IPAs; c) Community awareness and participation; d) Data management; e) Development of a Management Plan for each area; f) Provide the institutional strengthening within and between formal (MARA, MEF and universities) and informal (NGO's and local peoples) sectors. Goals of the project to achieve the overall objective are:

- Identification of IPAs in project area
- Data management
- Raising awareness and public participation
- Managing the designated IPAs for sustainable use
- Monitoring the area

Achieved Project outputs:

- The populations of 18 target species out of 25 found in the project area
- Total number of 15 core areas determined as a candidate IPAs in the Project area for target species
- Finally 5 IPAs designated including 9 core areas
- Target species *ex situ* conserved in AARI and CRIFC gene banks, herbarium materials added to national herbarium of AARI
- The database established for the IPAs, and IPAs mapped by using GIS facilities
- The local public and administrators informed about need to conserve IPAs and their support was taken in conservation efforts
- Adverse impacts on IPAs were analysed
- The management plans for IPAs prepared
- The decentralised management system to achieve sustainable use of natural resources in and around the IPAs formalized
- The monitoring system for IPAs designated as a part of management plans
- Institutional partnership and capacity building achieved during the project implementation.



BOX 2.5**Design, Testing and Evaluation of Best Practices for *in situ* Conservation of Economically Important Wild Species (UNEP/GEF Project EP/INT/204/GEF) Project (GEF3 Project)**

The conservation of wild plant species of economic importance required a subtly different approach. To develop an applicable and participatory *in situ* conservation program for economically important wild plants in the Middle East and Morocco, a new international project titled "Design, Testing and Evaluation of Best Practices for *in situ* Conservation of Economically Important Wild Species Project (UNEP/GEF Project EP/INT/204/GEF" was initiated by collaboration of Turkey, Egypt, Lebanon and Morocco and contributions of international organizations such as GEF, FAO, IPGRI (Biversity International), and DIVERSITAS. The project partner countries agreed that this new project should clearly demonstrate an effective *in situ* conservation of genetic resources of selected target species in each country as well as secure a sustainable use and trade of products from such species. The partner countries also aim to accomplish some practical outcomes in each country with the project. The objectives of the GEF-3 project for Turkey are: (1) to determine project target species and pilot sites with a participatory manner; (2) to develop an efficient and applicable *in situ* conservation programs for genetic resources of target species and expand such programs at the national level for other wild economically important plant species; (3) to have sustainable use of wild plant genetic resources and secure the *in situ* conservation of wild plant genetic resources, development of cultivation techniques for target species in turn to reduce pressure on wild genetic resources; (4) while *in situ* programs and cultivation techniques are developed, to have participatory review of current practices and challenges of wild and economically important plant species in Turkey.

The objective of the Important Plant Area (IPA) program in Turkey, same as global program, to identify and conserve Important Plant Areas, is in line with the aim of target 5 of the Global Strategy for Plant Conservation; "protection of 50% of the world's most important areas for plant diversity assured by 2010." Turkey was the first country to complete a national inventory of IPAs. The Important Plant Areas programme in Turkey is a partnership combining the joint expertise of three conservation and scientific organisations: WWF-Turkey (known as The Foundation for the Conservation of Nature); Fauna and Flora International (FFI), based in UK; and the Department of Pharmaceutical Botany of Istanbul University (ISTE). The IPA project in Turkey, as a pioneer for IPA processes, inspired the development of Plantlife International's European and Global IPA Programmes. The Important Plant Areas of Turkey were identified in cooperation with approximately 40 scientists from 20 universities along with many other researchers and institutions. The Turkish-language report Important Plant Areas of Turkey was published in 2004. The book (88 pp) plus CD (with detailed data sheets) lists 122 Important Plant Areas including botanical, geographical and geological characteristics, and describes their importance regarding nature conservation and threats. This will help for the further protection and conservation projects and efforts (<http://www.plantlife.org.uk/international/plantlife-ipas.html>).

The other effort for the conservation and determination of plant diversity is the publication of the "Red Data Book of Turkish Plants (Pteridophyta and Spermatophyta)" in 1980s. The first revision of this book was published in 2000. The revision of "National Red Data Books in Turkey" with the financial and technical support of IUCN Centre for Mediterranean Cooperation is under process (<http://cmsdata.iucn.org/>).

On-farm conservation

Traditional agricultural knowledge which is related to indigenous technologies and traditional farming and crop beliefs associated with different cycles of crop cultivation or utilisation such kind of species, is deteriorating faster than their biological/genetic diversity which are used by local farmers for different purposes of their consumption. Local people are often excellent resource managers when they are allowed to manage their own resources for their own benefit. Land races are the products of their selection and even multiplication over long periods of time. Therefore, their participation to the conservation of bio/agrobiodiversity is essential to identify how more complex traditional systems can be adapted to modern needs, while still retaining the bio/agrobiodiversity of both agroecosystem and its surroundings. Bio/agrobiodiversity conservation can not succeed unless farming/ rural communities receive a fair share of the benefit, and assume a greater role in managing their resources, and understanding/ measuring their impact to the local bio/agrobiodiversity.



Turkey was involved in to develop a new project for the *in situ* conservation of agrobiodiversity. In 1995, IPGRI together with National Programs in 9 countries formulated a global project to strengthen the scientific basis of *in situ* conservation of agricultural biodiversity. Nine countries involved in the project are: Burkino Faso, Ethiopia, Nepal, Vietnam, Peru, Mexico, Morocco, Turkey and Hungary. Within the framework of this program, “*In situ* Conservation of Agricultural Biodiversity” project (case study) was initiated in Turkey by AARI in cooperation with Local institutions of study site, universities and farmers associations by the support of national budgeted. The main objectives of the project have been:

1. to support the development of framework of knowledge on-farmer decision-making processes that influences *in situ* conservation of agricultural biodiversity,
2. strengthen links among the formal, informal sectors and farmers for the planning a new implementation of conservation for agricultural biodiversity,
3. to broaden the use of agricultural biodiversity and participation in its conservation by farming communities and other groups.

Because the traditional agroecosystem are a continuum of integrated farming units and the natural ecosystem where the plant use and crop production are actively practised Sustainable and effective conservation can be achieved when the formal, informal sectors, including community based organisations, extension services and farming communities, works together. During the development stage, even implementation stage, of the project the experiences on the extension and farming community participation can be adapted to this project from the Agricultural Extension and Applied Research Project (Recently revised and named as Agricultural Research Extension Training Koordination-TAYEK). This project can be characterised by research being done by national research institutes/ universities, the results of which are passed through extension to the farmers with on-farm trials/demonstrations to feedback.

The surveys results done by National Programme showed that farmers employ morphological, gastronomic, life habits, familiarity, functional selection criteria to discriminate among different cultivars The first two categories are most frequently used. Morphological criteria are most important than gastronomic criteria for subsistence farmers, while gastronomic criteria are more important for commercial farmers. Female farmers utilise a greater number criteria than male farmers for the local crop development. Decision making among farmers does not proceed through the sequential resolution of dyadic alternatives. The mixed cropping methods are practised in such a way that different local crop/plant species can be harvested in different periods of year to meet food requirements for domestic needs. In the farming communities of remote areas, traditional cultivars are preferred to modern varieties because of their adaptive performance without external inputs, and because of their taste and nutritional value.

The result of case study done showed that four factors effect the farmers, even modern farmers, to keep their traditional crop landraces:

- Fragmentation of land holdings allows farmers to manage several fields and to keep local landraces,
- Marginal agronomic conditions, especially steep slopes and heterogeneous soils of mountain agriculture, make local landraces competitive with improved cultivars, at least in part of the farming system,
- Economic isolation creates market imperfections and lessens the competitive advantages of improved cultivars,
- Cultural identity and preference for diversity lead farmers to keep local landraces.

Most households collect seeds from their own harvest, although exchange and gifts are also methods of obtaining seed. Seeds are collected from healthy plants with desired characteristics to farmers. In many cases, seeds of several species are mixed together for storage in containers such as bottles, etc. This practice may minimise pest infection. The home gardens are highly diverse in size and appearances, mostly small, in particular in the combinations of species and in their differing utilitarian.

Peasant agroecosystems are seen as a continuum of integrated farming units and natural ecosystems where plant gathering and local crop production are actively practised. These types of traditional ecosystems are still found throughout Turkey to constitute plant/crop species for the utilisation of use. These plant/crop species are evolved in part under the influence of farming practices shaped by particular traditions. Many examples can be given to the use of weeds and wild plants gathered from those agroecosystem. The maintenance of traditional farming systems and adjacent natural ecosystems is proposed as a sensible strategy for *in situ* conservation/preservation of crop and wild plant species. Conservation/preservation efforts should be linked to rural development programmes/projects that take account of the ethno-botanical knowledge of rural people and that emphasise both food self sufficiency and local resource conservation. Such efforts are likely to succeed as long as members of culture have their own reasons for maintaining their crop heritage and preserve in conducting the practices for nurturing these plants. The causes behind the abandon of neglected and under-utilised species have largely relied on their rusticity to grow in poor environments,

usually in marginal lands, and competitiveness with other crops in traditional agriculture.

The GEF/SGP has been functional in Turkey since 1993 (<http://sgp.undp.org/>). To date, the programme supported over 60 projects implemented by more than 40 local and national NGOs. This programme has generated a rich package of best practices, lessons learned and experiences in applying sustainable development with local peoples, and in real socio-economic circumstances. In addition it has managed to virtually create a unique "environmental community" comprised of more than 40 NGOs that have received support from this programme, and still expanding. The GEF/SGP Projects promote public awareness to environment. Some of the GEF/SGP Projects directly related to on-farm/home garden conservation are: "Networking and Participation for Conservation and sustainability of Traditional varieties", "Conservation of Land races in Kars by sustainable village", "Conservation of Agrobiodiversity of Kirazlı Village", "Mugla's Local Fruit Varieties: Cultural Heritage, Database and Preservation Project". All *in situ* conservation effort are complementary to *ex situ* conservation. So the species found at *in situ* sites are collected and conserved at National Gene Bank.

Documentation

The documentation of *in situ* conservation activities, have done through the Data Base Management System of National Program. The data management system for *in situ* conservation of wild species in Turkey has been integrated with *ex situ* databases and GIS was used for the documentation of spatial diversity. The database comprises digitized map sheets and drawings, linking to external databases, including *ex situ* databases, integrating tabular data and converting existing digital geographic data. Using this database a couple of different analysis for planning the *in situ* conservation of wild species has been carried out. The results of these analyses together with the underlying database, the spatially grouped maps of Gene management Zones (GMZs)/Important Plant Areas (IPAs) and the potential sites for GMZs/IPAs for designated priority species were produced and the "Project Atlases" have been produced and published. All data recorded on the standard fomats for easy and standard data gathering.

The National Biodiversity Database called "Noah's Ark" (<http://www.nuhungemisi.gov.tr/>), Turkish Flora data base called "TUBIVES" (<http://www.weski.tubitak.gov.tr/tubives/>) and Turkish Taxonomic Tpecies data dase (<http://bioces.tubitak.gov.tr/>) are benefit to National Plant Genetic Resources/Plant Diversity Program to receive more information on plant diversity. There are willingness and demand to link all those databases including National Data Base of Plant Genetic Resources/Plant Diversity.

THE STATE OF *EX SITU* MANAGEMENT

Ex situ and *in situ* approaches are followed to protect biological diversity. Both approaches are generally accepted programmes with their own applications. *Ex situ* protection is implemented through organizations such as gene banks, seed banks, zoological gardens, botanical gardens, etc. However, the process of evolution is halted in *ex situ* protection since the interaction between the species and the environment does not continue. On the other hand, damage that may result from natural processes which it is not possible to prevent at *in situ* protection sites makes it necessary to protect species also outside such sites. For this reason, *ex situ* and *in situ* protection activities are conducted as programmes that complement each other.

Ex situ conservation activities has been undertaken since 1964. It is still on process within the framework of the “National Program on Conservation of Plant Genetic Resources/Diversity”. The *ex situ* conservation is implemented both for generative and vegetative collections which are preserved in National Gene Bank and field gene banks respectively (Table 3.1 and 3.2.). Today, about 55 000 materials over about 2 700 species are kept in the National Gene Bank. Of those materials, about 20 000 belong to 2 221 wild species. The conservation facilities at Field Crop Research Institute are available to keep the safe duplicates of National collections as well as 8 405 accessions of field crop species. So, total accessions are about 63 000 at both genebank. About 7 000 vegetatively propagated genetic resources material, mainly fruit genetic resources are kept in national field gene banks at 15 institutes (including AARI). Garlic, some medicinal and aromatic plants and ornamental collections are also kept as field collection at AARI. The field gene bank collections of vegetatively propogated species consist of over 100 species. The national collection contain the landraces, local types, wild and weedy relatives, other wild species which are especially economically important plant and endemic species (totally 70 000 accessions of seed and vegetative collections). The main users of the material are the plant breeders and researchers both from Turkey and abroad. There are some research activities on the *in vitro* storage techniques of some vegetatively propagated plant species. Certain species peculiar to Southwest Asia and a small part of wheat and barley varieties in the world are also included in the collection. The security backups of the some proportion of base collection are preserved at the Field Crops Central Research Institute.

TABLE 3.1

Number of species and number of accessions at National Gene Bank at AARI

Plant Groups	Number of species	Number of accessions
Cereals	169	19 325
Industrial crops	58	4 388
Vegetables	92	7 357
Ornamental plants	127	1 216
Forages and fodder plants	398	7 656
Food legumes	34	6 633
Medicinal and aromatic plants	198	1 546
Endemic species	874	5 297
Other species (including species utilized as vegetables)	735	1 105
Total	2 692	54 523



TABLE 3.1
Number of accessions at Field Gene Banks

Vejetatif Materyal	Number of accessions
Olive	204
Grapes	1 494
Apple	724
Pear	622
Cherry	251
Cornelian cherry	38
Sour cherry	214
Peach and nectarine	70
Walnut	101
Chestnut	65
Citrus	626
Persimmon	82
Fig	250
Loquat	45
Pekan	24
Apricot	291
Quince	78
Pomegranate	187
Plums	357
Avocado	35
Hazelnut	504
Strawberry	71
Berries	68
Pistachio	44
Almond	223
Other fruits	2
Mint	100
Garlic	169
Total	6 939

The facilities of National Gene Bank at AARI for seed collection have been designed and well equipped for the needs of long-term and medium-term storage for both base and active collections, respectively. The facilities are well meeting the international standards. Cold rooms work at minus 18°C for long-term and 0°C for medium term storage. There are also facilities for temporary storage, with rooms working at 4°C. The collections are kept always in the same conditions safely. Humidity is not controlled in the cold rooms. The seeds are dried to 5-6% moisture content and kept in the sealed can and glass jar containers for base and active collections. For temporary and short term storage the aluminum laminated foils are used. All the conditions in the gene bank comply with internationally recommended standards. To keep those standards, the National Gene Bank cold rooms reequipped with modern new cooling equipment and authomatic generators. The isolation of the cold rooms has been restored. The storage capacity of the gene banks is not on the verge. Because the new cold rooms has been accommodated to be worked in minus 18°C and 0°C. The conservation facilities of Field Crop Research Institute consist of deep-freezer to keep the material in aluminum laminated foil bags. When the material received by the gene bank immediately processed for storage after drying. A room type drying facilities exist. The viability are tested for all the material and stored. Viability of the stored material are monitored in 5 years intervals for active and 10 years intervals for base collection. The research is conducted on the germination test methods for some species which has no information on the viability test methods and dormancy mechanism. The 30 907 *herbarium* specimens of national collection are kept at AARI *Herbarium* with modern facilities.

Regeneration and multiplication activities are planned according to the monitoring the samples for viability and quantity. Most regeneration activities are carried out by AARI itself, although some are conducted in cooperation with other institutes who should follow similar regeneration procedures to AARI. During the regeneration and multiplication



seed samples are renewed by taking a random sample of seeds, sowing and growing the resulting plants under conditions so that the seeds harvested will possess the same characteristics as the original population. Regeneration of seeds is required when the germination percentage has fallen below acceptable levels or shortage of seed occurs. As a rule, the germination percentage should be above 75-80%. But for some of the wild species and endemic species, this rate is less since most of that dormancy mechanism unknown. Samples are marked for regeneration when seed is no longer available for distribution. All seed accessions are monitored for these criteria. When regenerating germplasm a number of points must be taken into consideration:

1. Selection within the original population as a result of regeneration procedures should be minimized,
2. No contamination with other samples, both during regeneration and seed handling should be allowed,
3. The breeding system of the crop in question is important. Cross pollinating crops need additional measures to insure proper isolation,
4. The population size of the original sample should be sufficiently large to avoid genetic drift,
5. Compared to self pollinating species, cross pollinating species usually require a higher number of plants for regenerations to maintain the genetic variation that exists within the population.
6. To minimize the impact that regenerations can have on the genetic identity of a seed sample, the frequency of regeneration should be kept as low as possible,
7. Plants that during regeneration clearly seem contaminants and not belonging to the total population are discarded.
8. The reproduction rate should also be considered in order to produce sufficient seeds.

Cryopreservation long-term storage of a living organism at ultra-low-temperature recently started after the construction of the cryopreservation laboratory in 2007 at AARI. The priority is given to the collections that have problem for the seed storage and had difficulties for long term conservation at field gene banks, such as mint and garlic collections. There are some research activities on the *in vitro* storage techniques of some vegetatively propagated plant species especially wild bulby ornamental species such as *Fritillaria*, *Crocus* etc.

Documentation is one of the main functions of the National Program for both *ex situ* (seed and field collections) and *in situ* activities. Database Management System (DBMS) of National Program is centralized database and available for data acquisition; data compilation and preparation; data entry and editing; and data processing, retrieval to support system-wide activities. The quality and quantity of passport and evaluation information in National program DBMS varies widely among crop collections, and within collections, among accessions. So, data for all activities recorded to the standard formats for uniform and good quality data acquisition to database. For *in situ* conservation a data base has been built for complex array of information that is acquired in survey and inventory, management and monitoring of GMZs. Since *in situ* conservation program is complementary to *ex situ* conservation, the two data bases are linked and complementary to each other and components of database management system of national program. Currently, Geographic Information System (GIS) use is constrained by limited georeferenced information especially data gathered from surveys and inventory activities for *ex situ* and *in situ* purposes to evaluate and analyze the quantitative and spatial data. Using GIS technology, external purpose-built programs to link collection information to a broad array of spatial information can be developed. Spatial analysis of collections can lead to a greater understanding of the ecogeographic representation of existing collections or species at site, increasing the efficiency of conserving and managing plant genetic resources and broadening the understanding of the distribution of genetic diversity. National Data Base could potentially serve as an information resource to a broader scientific community, providing relatively independent global data sets to meet the unique needs of environmental modelers.

Information related the crop species of ECPGR, European network for plant genetic resources, has been duplicated at the designated Data Base Centres of ECPGR. A number of European central crop databases have been established through the initiative of individual institutes and of ECPGR Working Groups. The information on these accessions is centralized into one database. The databases hold passport data and, to varying degrees, characterization and primary evaluation data of the major collections of the respective crops in Europe. Turkey has been taken the responsibility of two database, ECPGR *Lens* and Pepper Central Data Bases. Turkey is member of European Plant Genetic Resources Information Infrastructure (EPGRIS), for the development of national inventories of plant genetic resources and for the uploading national data to the searchable catalogue of *ex situ* collections in Europe – EURISCO. A set of data (For 12 000 accessions) has also been designated and loaded to EURISCO web catalogue (<http://eurisco.ecpgr.org>). National Programme staff is members of AEGIS (A European Genebank Integrated System, (http://www.ecpgr.cgiar.org/AEGIS/AEGIS_home.htm)) advisory Committee and EURISCO Advisory Group.

Outside the MARA, the Gene Bank of Osman Tosun within the Field Plants Department, the Faculty of Agriculture, the University of Ankara, has been active since 1936 and has short-term preservation facilities. This organization keeps about 5860 seed accessions; mostly consist of the working collections. Atatürk and Çukurova Universities and other universities with a Faculty of Agriculture are also engaged in similar activities for mostly fruit field collections and working seed collections in short-term conservation. Among these activities contributing to *ex situ* protection, the botanical gardens can be considered: the Botanical Garden of the Aegean University, the Botanical Garden of the Istanbul University and the Atatürk Arboretum of the Istanbul University. In addition, the private botanical gardens and arboretums have also been established by private initiatives in recent years such as Nezahat Gokyigit Botanical Garden, Karaca Arboretum, etc.

Ex situ protection efforts for forest trees (seed gardens, origin trials, progeny trials) are made by organizations affiliated to the Ministry of the Environment and Forestry, especially by the Directorate of Forest Trees and Seeds Improvement and Research. Turkey is a member of the EUFORGEN, and the agreement among member countries for the establishment of a core collection is at the stage of preparation. A total of 169 seed gardens in 8 species, a total of 35 seed plantations in 19 species and a total of 13 clone parks in 5 species have been established to date.

THE STATE OF USE

Turkey's extremely rich agricultural genetic resources constitute a key solution to its many agricultural problems, if they are properly used. Utilization of PGRFA plays a key role in facing major challenges in agriculture such as food security, climate change, water deficit, periodical prolonged drought, salinity and desertification. Therefore, the activities on characterization and evaluation of genetic resources have been substantially enhanced. Characterization and primary evaluation allow identification of a sample and a description of its genetic variation. If proper assessment of a descriptor requires expert knowledge, crop specialists are consulted. Where it is possible characterization and primary evaluation are carried out during the regeneration. To insure proper seed production, plants sometimes receive special treatments, resulting in a typical growth, which makes them unsuitable for proper description. For such crops special evaluation trials are carried out. During these trials users are given the opportunity to view the collections. Active participation of users in the evaluation of germplasm is encouraged by the National program.

Since AARI is not equipped to screen all the collections for full evaluation of properties such as disease and pest resistance, chemical properties and physiological parameters. National program cooperate with breeding programs for the evaluation and characterization. Therefore, the respective crop scientists (breeder/agronomist, pathologist) get opportunity to evaluate and identify the accessions for their use in crop improvement program. The breeding programs also frequent user of national collection some may be collected by themselves. Turkey has active national breeding programs that are extensively using national plant genetic resources collections to improve the resistance to major diseases and insects and tolerance to drought, salinity and extreme temperatures. The users of collections who perform this screening are always requested to feedback their evaluation data. Characterization data obtained during trials performed by users are also returned, and recorded in the National Database Management System. The natural resources and environment and crop research priority areas and programs of MARA which are related to conservation and utilization are given in Table 4.1.

TABLE 4.1
Agricultural Research Priorities, 2006-2010 (www.tagem.gov.tr)

Area of Research Opportunity	Research Programs
Fruit-Vineyard	Viniculture
	Stone Fruits
	Citrus
	Olive
	Fig
	Pome-Fruits
	Organic Fruits
	Subtropical Fruits
	Small Fruits
Industrial Crops	Oil seed crops
	Cotton
	Potato
	Medicinal and aromatic plants
	Other industrial crops
	Organic agriculture industrial crops
	Technology Transfer and Socio-economic Researches in industrial crops



Area of Research Opportunity	Research Programs
Natural Resources and Environment	Plant genetic resources
	Farm animals genetic resources
	Database managements for natural resources
	Environmental toxicology and effects of pesticides and other agricultural pollutants
	Fishery genetic resources
	Agricultural micro fauna and micro flora
Cereals	Bread Wheat
	Durum Wheat
	Maize
	Rice
	Barley
	Technology Transfer and Socio-economic Researches in Cereals
	Other Temperate Cereals
	Organic Agriculture in Cereals
Vegetables and Ornamentals	Protected Vegetables
	<i>Solanaceae</i> crops
	Cutting Flowers
	Cucurbits
	Natural Ornamentals
	Organic Vegetables
	Indoor and Outdoor Ornamental Plants
	Legumes
	Root and Lump Vegetables
	Mushroom
	Other Vegetables
	Socio-economic Researches
	Pasture rangeland and fodder crops
Pasture Rangeland	
Technology Transfer and Socio-economic Researches in Fodder Crops and Pasture Rangeland	
Grain Food Legumes	Chick Pea
	Lentil
	Dry Bean
	Organic Farming in Food Legumes
	Technology Transfer and Socio-economic Researches in Food Legumes
	Other Food Legumes
Nuts	Other Nuts (Almond, Walnut, Chestnut)
	Pistachio
	Nut
	Social Economic Researches
	Organic production

Many decisions in National Gene Bank management are based on expectations about the genetic diversity in and between accessions and (parts of) collections. The most appropriate tool to determine genetic diversity is provided by biochemical analysis. The biochemical characterization is also initiated. AARI has recently set up a facility for biochemical evaluation. The other collaborative institutes also have those facilities in different level.

Total 11 228 seed sample were distributed to domestic and foreign users. Cereals, oil seed Crop, food legumes, forage and vegetable programs are frequent users of the material (Table 4.2). The rich genetic diversity and the national collections become important to plant breeding programs. Especially, the land races are utilized to improve the varieties. The wild crop relatives which are in the first gene pool of crops are also used easy in variety improvements. Many registered varieties are release from those plant genetic collections of Turkey. Especially most of the vegetables, industrial crops, fruits, and forage varieties have been released from the land race collections of Turkey. The registered varieties (1963-2008) in the National List are given in Table 1.3 of Chapter 1. Most of the recently registered varieties are in market now. The land races are also capable for ecological/organic production. Table 4.3 shows the statistics for organic production.

Turkey's Law No. 5553 is generally referred to as the seed law. The Variety Registration and Certification Centre of the Ministry of Agriculture and Rural Affairs (MARA) conduct the variety registration trials (DUS/VCU) and provide the seed and sapling certification services, as well as cooperate with ISTA, OECD and UPOV. This new legislation regulates seeds, not only of field crops and vineyard and garden plants, but also of forest plant species and all propagation materials since 2006. Moreover, the law introduces a new and distinction between "genetic resources" and "plant varieties". "Genetic resources" are defined as both naturally found wild species and those developed by farmers from which plant breeders and scientists can extract genes with "important characteristics". Although farmers, who have developed and improved seeds over millennia, are no more than suppliers of the raw material from which official breeders can produce "improved" seeds, which are considered "plant varieties" and which can then be sold. Both "formal" (certified) and "informal" (not certified) seed sectors exist in Turkey. Formal seed production is mainly focused on improved varieties. Under the law 5553, farmers will be able to continue to save seeds for their own use and to exchange with other farmers without having to register them. But any activity on their part which hints of "trade" will invoke penalties according to Turkey's Plant Variety Act which has been in force since 2004. It is estimated that approximately 25 % of the total seed used each year is supplied by the formal sector in small grain cereals. The informal seed production facilitates the supply and exchange of varieties among small farmers. Informal seed production systems have been effective in maintaining landraces of many crops and several recent projects are promoting community-based and village-based seed production systems to multiply and supply the seed of both improved varieties and landraces of cereals and legumes. Since 5553 does not allow the informal seed sell an effort is underway to establish informal seed production systems through the registration of plant genetic resources by targeting exclusively the conservation of landraces.

TABLE 4.2
Plant species supplied from National Gene Bank in 1998-2008

Plant species	Total nos. of accessions	To foreign users	To domestic users
<i>Agropyron spp.</i>	51		51
<i>Allium spp.</i>	56		56
<i>Astragalus spp.</i>	6		6
<i>Avena spp.</i>	147	4	143
<i>Beta spp.</i>	139	6	133
<i>Brassica spp.</i>	31	8	23
<i>Bromus inermis</i>	17		17
<i>Cannabis sativa</i>	38		38
<i>Capsicum spp.</i>	472	6	466
<i>Carthamus tinctorius</i>	52		52
<i>Cicer spp.</i>	606	5	601
<i>Citrullus vulgaris</i>	96		96
<i>Cucumis flexuosus</i>	26		26
<i>Cucumis melo</i>	332	8	324
<i>Cucurbita spp.</i>	27		27
<i>Cuminum cyminum</i>	14		14



Plant species	Total nos. of accessions	To foreign users	To domestic users
<i>Dactylis glomerata</i>	74		74
<i>Daucus</i> spp.	80	9	71
<i>Dianthus</i> spp.	63		63
<i>Festuca</i>	13		13
<i>Glycine max</i>	15		15
<i>Gypsophila</i> spp.	17		17
<i>Helianthus annuus</i>	290	4	286
<i>Hibiscus esculentus</i>	53		53
<i>Hordeum</i> spp.	492	11	481
<i>Isatis</i> spp.	9		9
<i>Lathyrus sativus</i>	13		13
<i>Lens</i> spp.	48		48
<i>Linum usitatissimum</i>	33		33
<i>Lolium</i> spp.	45		45
<i>Lotus</i> spp.	14		14
<i>Lycopersicon esculentum</i>	472	9	463
<i>Medicago</i> spp.	102		102
<i>Nicotiana tabacum</i>	123		123
<i>Onobryhis</i> spp.	9		9
<i>Origanum</i> spp.	123	2	121
<i>Petroselinum hortense</i>	18		18
<i>Phaseolus vulgaris</i>	718	7	711
<i>Pisum sativum</i>	92		92
<i>Salvia</i> spp.	123		123
<i>Sesamum indicum</i>	201	4	197
<i>Solanum melongena</i>	341	8	333
<i>Spinacia oleraceae</i>	37		37
<i>Thymus</i> spp.	9		9
<i>Trifolium</i> spp.	8		8
<i>Triticum</i> + <i>Aegilops</i>	3 436	10	3 426
<i>Vicia</i> spp.	690	12	678
<i>Vicia faba</i>	249	6	243
<i>Zea mays</i>	1 108		1 108
Toplam	11 228	119	11 109

TABLE 4.3
Organic production of Turkey

Years	Number of product	Number of farmers	Total production area(ha)	Production (ton)
2002	150	12 428	89 827	310 125
2003	179	14 798	113 621	323 981
2004	174	12 806	209 573	378 803
2005	205	14 401	203 811	421 934
2006	203	14 256	192 789	458 095
2007	201	16 276	174 283	568 128

The promotion activities extended to farmers regarding recently developed seed varieties are performed by MARA's General Directorate for Organization and Support, the Provincial Directorates, and by the public and private seed producers in the form of demonstrations and field days. In addition, extension services are supported with published material and radio/TV programs. Private companies, foreign and local, have contracts with farmers (seed growers) to produce commercial and/or certified seeds. Existence of a parallel market of non certified seeds and a significant volume of farm saved seeds (e.g. these two accounts 75 % of the request of the farmers in wheat). MARA, under the chairmanship of the Minister/Undersecretary, formed a "Seed Consultation Committee", in which General directorates of the Turkish Ministry of Agriculture, the State Planning Organization, the Treasury, Farmers' Union of Chambers of Agriculture and Turk-Ted (Seed Industry Association of Turkey) are represented. The committee meets at least once a year and when necessary.



THE STATE OF NATIONAL PROGRAMMES, TRAINING NEEDS AND LEGISLATION

National Programmes

Both government and non-government organizations have been carrying out programs for conservation of biological diversity by various means for a long time. This has been done by (i) *in situ* conservation programs such as National Parks, Nature Reserves, Nature Parks, Wildlife Reserve Areas, Natural Assets, Natural Entities, Specially Protected Areas, Gene Management Zones (GMZs) of *in situ* conservation of genetic diversity, (ii) on-farm conservation for the preservation of landraces/local varieties, and (iii) *ex situ* conservation in Seed and Field Gene Banks, Arboreta, Botanical Gardens.

The Turkish Ministries of Environment and Forestry (MEF), and Agriculture-Rural Affairs (MARA) are the main government institutions for the implementation of the laws and regulations related to the conservation and sustainable use of natural resources. The conservation of plant genetic resources (both *ex situ* and *in situ*) are conducted by MARA and coordinated by AARI of MARA. The National Plant Genetic Resources Conservation Program of MARA involves many research area related to protection of existing plant diversity and their habitat and agro ecosystem. The National Cooperation of this program exists among the formal and informal sector including NGOs. Through this program Turkey is member the various crop and regional networks. The natural resources and environment and crop research priority areas and programs of MARA which are related to conservation and utilization are given in Table 4.1.

The conservation/protection of biological resources (ecosystem and nature conservation) is coordinated by MEF and conducted by MEF or jointly by MARA. Some archaeological sites which are rich in plant diversity are protected and regulated by the Ministry of Culture (MC), but there is an ongoing legislation in the government for these sites to be regulated by the MEF. The General Directorates of Forestry (GDF), General Directorate of Nature Conservation and National Parks (GDNCNP), and research institutes under Ministry of Forestry are responsible for the conservation programs conducted in forest areas. Research Directorate of Forest Trees and Seed Improvement is the main responsible instruction in conducting *ex situ* and *in situ* conservation of genetic diversity of forest trees. The National Environmental Strategies, Plans and Programmes are given below:

- National Environmental Action Plan (1998)
- National Plan for *In Situ* Protection of Plant Genetic Diversity (1998)
- National Biological diversity Strategy and Action Plan (2001 and revised version, 2007; <http://www.cevreorman.gov.tr/belgeler6/NBSAP.pdf>)
- National Agenda 21 Programme (2001)
- National Wetland Strategy (2003)
- Turkish National Forestry Programme (2004)
- National Science and Technology Policies 2003-2023 Strategy Document (2004)
- Turkish National Action Programme Against Desertification (2005)
- National Environmental Strategy (2006)
- National Rural Development Strategy (2006)
- National Plant Genetic Resources/Plant Diversity Program (1976)

Apart from the development plans, there have also recently been various programmes aiming at contributing to rural development related to environment such as: Environmentally Based Agriculture Land Protection Programme; Agriculture Insurance Payments; Rural Development Grants; and Village based Rural Development Programme. Turkey has recently adopted (end of January 2006) a National Rural Development Strategy (NRDS) for the purpose of "improvement and ensuring sustainability of living and job conditions of rural community in their territory, in harmony with urban areas, basically by utilizing local resources and potential, while protecting the environmental and cultural assets". It will serve as a basis for the National Rural Development Plan and the IPARD Plan within which the targeted interventions and national, international and EU financial dimensions are to be elaborated.

The existing and prospective Agricultural and Rural Development Policies are laid down in the following documents:

- Long Term Strategy (2001-2023) and Eighth Five-Year Development Plan (2001-2005)
- Preliminary National Development Plan (2004-2006)
- Medium Term Programme (2006-2008)
- Agriculture Strategy Paper (2006-2010)

The number of non-governmental organizations (NGOs) and their activities has increased recently. Turkish Society for Protection of Nature (TTKD), The Society for Protection of Nature (DHKD), Turkish Erosion Prevention Foundation (TEMA), the Foundation of Conservation Afforestation and Natural Resources, Turkish Environmental Foundation, the Research Foundation for Rural Environmental and Forestry Problems, the Foundation for Conservation and Development of Hunting and Wild Life, the Aegean Foundation of Forestry and the other national or local organizations efficiently involve in the conservation and restoration of environment and habitats especially contribution to public awareness on the protection of biological diversity and natural environment. They conduct various small grand projects on various aspects of biodiversity and agrobiodiversity.

Private sector in Turkey has no interests in directly or indirectly in the conservation of plant genetic resources. However, this sector is greatly involved in the use and trade of plant genetic materials of the country. Even the private sector which is closely interested in the industrial production by using raw materials of plant origin has no contribution to the conservation activities.

The red data book of Turkey for endemic and non-endemic plant species is also revised and published in 2000 and will be updated again soon. Turkey being the first country to implement a national inventory of identification of IPA sites identified and published botanical, geographical and geological characteristics of 122 IPAs in 2004. Those efforts provide a unique opportunity to consider and select the best sites for plants and/or fungi in a broader context, and facilitate the development of landscape scale approaches to conservation. These selected sites can be used to support conservation actions and initiatives such as the protection, research and implementation of plant conservation policy.

Legislation

Since 1960s the conservation of plant diversity is become extensively government policy. The conservation programs in Turkey can be evaluated as programs concerning forest trees, herbaceous and woody relatives of crop plants, and pasture species. Although the some of the agricultural policy affect the plant diversity the conservation of plant diversity is an important strategy in Turkey. a legislation on "Collection and Utilization of Plant Genetic Resources" which published in 1992 regulates the principles of conservation of plant diversity exist in Turkey, and organize the responsibilities and activities of conservation and utilization of plant diversity. The "National Plan on *In situ* Conservation of Genetic Diversity of Turkey" published in 1998, covers all actions in systematic plan to protect *in situ* the plant genetic diversity in their natural habitat and in their agro-ecosystems. This is a plan which incorporates the agricultural policies set the relevant policy objectives, specimen priorities protection, management and public awareness activities. The Regulation and the national plan are incorporation with "National Biodiversity Strategy Action Plan" as its components. Various institutions, ministries and organizations have undertaken duties and responsibilities for conserving the biological diversity. The protection of forests against any possible threats is under the security of Turkish laws and regulations, since the ownership and the rights of utilization of forest resources belong to the state in Turkey, but it is difficult to say that the government regulations for sustainable use and conservation of wild, economic and aromatic plant species which occur mostly in forest and other government lands are sufficient. Nevertheless, various programs with different purposes and in different status such as the National Parks, Nature Conversation Areas, Nature Parks, Natural Monuments, Seed Stands, Gene Conservation Forests and Gene Management Zones have been all established and managed by institutions within the MEF (Table 2.1, Chapter 2).

The Turkish Constitution, Laws and Regulations and international conventions in the field of nature conservation provide the legal framework for seeking the strategy for continuity of biodiversity in Turkey. The Turkish Constitution (1982) stipulates that "the State shall take the necessary precautions towards the protection and utilization of natural resources" and it has some general clauses broadly related to its conservation. For example, Article 56 states that citizens have the right to live in a healthy environment. Article 63 states the principle of protecting cultural and natural resources. So, there are legislative grounds in the Turkish Constitution as well as in various other laws legislated in different dates. At the Summit of EU Heads of State and Government held in Helsinki on 10-11 December 1999, Turkey was unanimously accepted as a candidate member of the European Union. In the light of the Accession Partnership Document formally adopted by the European Council on 8 March 2001, the National Programme for the Adoption of the Acquis was prepared on 19 March 2001. To achieve harmonization with the environmental acquis of the EU and to implement legislation



effectively, the National Environmental Strategy (NEP) was completed in 2006. In the nature conservation sector, the NEP aims to strengthen the existing nature conservation system with a view to the fundamental goals of protecting biological diversity, ensuring its sustainable use and preventing the loss of biological diversity.

The laws and regulations contribute to the conservation and sustainable use of biological diversity and that include provisions concerning the management of resource use are given below (<http://www.cevreorman.gov.tr/belgeler6/NBSAP.pdf>; <http://www.tarim.gov.tr/arayuz/10/menu.asp>; <http://www.tagem.gov.tr/>; <http://www.ttsm.gov.tr>).

The laws and regulations for species and site protection in Turkey:

- The Environmental Law (2872, 09.08.1983) aiming at the protection of the environment, determines and provides for the basic principles related to protecting and improving the environment and preventing its pollution. Law 5491 of 26.04.2006 amending the Environment Law states the importance of protecting biological diversity in Article 6
- Law on National Parks (2873, 09.08.1983)
- Law for the Protection of Cultural and Natural Assets (2863, 23.07.1983)
- Decree-Law Establishing the Special Environmental Protection Agency (383, 19.10.1989)
- Terrestrial Hunting Law (4915, 01.07.2003)
- The Regulation for the Protection of Wetlands
- Law on Aquatic Products (1380, 04.04.1971)
- The Forest Law (6831, 31.08.1956)
- The Regulation on the Collection, Production and Exportation of Natural Flower Bulbs (1995, The Turkish Official Gazette, No: 22371)
- The Regulation for Implementing the Convention on International Trade in Endangered Species of Wild Fauna and Flora
- The Law for the Protection of Animals (5199- 24.06.2004)
- The Apiculture Regulation

Although the legal provisions for species and habitat protection also serve to protect genetic resources, there are legal provisions introduced by the MARA directly for the protection of genetic resources:

- The Regulation Concerning the Collection, Conservation and Utilization of Plant Genetic Resources (1992, The Turkish Official Gazette 21316)
- The Regulation Concerning the Protection of Animal Gene Resources
- The Animal Improvement Law (4631-28.02.2001)
- The Law for the Protection of Breeder's Rights Concerning New Plant Varieties (5042-08.01.2004)
- The Seed-Raising Law (5553-31.10.2006): It replaced Law 308 of 21.08.1963.
- Decree-Law 551 for the Protection of Patent Rights, put into force on 24.06.1995, is intended to protect inventions by issuing patents or utility model certificates in order to encourage the activity of making inventions and to achieve technical, economic and social progress through the application of inventions to industry. It is also a legislative measure concerning genetic resources in the scope of the protection of intellectual property rights on biotechnological inventions.
- The application and authorization procedures for research work in Turkey by foreign scientists are determined by the "Principles Governing Foreigners Wishing to Undertake Scientific Research and Studies or to Shoot Films in Turkey, or Persons Applying in Their Name, and Foreign Press Members" which was put into force through Council of Ministers Decision 88/12839 of 4 April 1988.

The laws and regulations that may contribute to the sustainable use of biological diversity and that include provisions concerning the management of resource use:

- The Forest Law (6831-31.08.1956)
- The Pastures Law (4342-25.02.1998) and the Pastures Regulation
- The Coastal Law (3621/3830-04.04.1990)
- The Soil Protection and Land Use Law (5403-03.07.2005)
- The Law on National Mobilization for Afforestation and Erosion Control (4122-23.07.1995) and the Regulation on Afforestation
- The Organic Farming Law (5262-01.12.2004) and Regulation
- The Regulation on Good Agricultural Practices
- The Regulation Concerning the Protection and Use of Agricultural Land

- Agricultural Control and Agricultural Quarantine Law 6968 of 15.05.1957 and Animal Health and Surveillance Law 3285 of 08.05.1986 rank first among the legislation to ensure the border control, for both health and protection purposes, of living species that will enter or leave Turkey
- Anti-Smuggling Law 5607 of 19.07.2003, in force since 1932 and updated in 2003, and Customs Law 4458 of 27.10.1999 regulate border controls

Turkey has aimed at to participate actively and to take in control the trade and conservation of natural and biological resources by signing international agreements at different dates or collaborative agreements with various organizations. Turkey gives solid efforts for the implementation of these international agreements. The international conventions to which Turkey is party have the force of law and are part of national legislation. The international conventions for the protection of the environment and biological diversity to which Turkey is party are as follows:

- UN Convention on Biological Diversity (CBD) (1997) and the Cartagena Protocol on Biosafety (2004)
- UN Framework Convention on Climate Change (FCCC) (2004)
- Vienna Convention for the Protection of the Ozone Layer (1988) and the Montreal Protocol on Substances Depleting the Ozone Layer (1990)
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1994)
- UN Convention to Combat Desertification (CCD) (1998)
- Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (RAMSAR) (1994)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1996)
- Convention for the Protection of World Cultural and Natural Heritage (1983)
- International Convention for the Prevention of Marine Pollution from Ships (MARPOL) (1990)
- International Treaty on Plant Genetic Resources for Food and Agriculture (2006)
- Convention on Long-Range Transboundary Air Pollution and the Cooperative Programme for Monitoring and Evaluation of the Long-Range Transmissions of Air Pollutants in Europe (EMEP) (1983)
- Convention for the Conservation of European Wildlife and Natural Habitats (BERN) (1984)
- European Landscape Convention (2001)
- Convention for the Protection of Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) (1981) and its protocols including the Protocol on Special Protected Areas and Biological diversity in the Mediterranean (1988)
- Convention for the Protection of the Black Sea Against Pollution (Bucharest) (1994) and its protocols including the Protocol for the Protection of Biological and Landscape Diversity in the Black Sea (2004)

Turkey also participated and agreed to implement the outcomes of the Ministerial Conferences on protection of European forests held in Strassbourg (1990) and Helsinki (1993).

Training

A national strategy which urges public awareness-raising and involvement under the Biological diversity and Resource Management, MARA, MEF and the Ministry of National Education conduct regular training for awareness-raising activities. Strategy and action plan which urges capacity building of NGOs concerning biological diversity under the same project. Only few universities in Turkey offer general courses and/or lectures on PGR. But there is no proper courses related only for the conservation/protection of biodiversity in general and agrobiodiversity in particular have been set up at the universities. AARI as coordination centre for plant genetic resources gives seminars and courses both for international, regional and national level on conservation and use of agrobiodiversity and plant genetic resources. The in country trainings are organised each year mainly to the Project staff, in some cases, courses to tourist guides, extension services staff (Staff of Agricultural Provincial Directorates). AARI has also given the practical training to the students of faculties of agriculture.

Since the national program for the conservation of plant genetic resources and plant diversity a collaborative program therefore the all related skills are available. The National Program has adequately staffed with trained personnel. But need training of junior staff member of the project. There is no differences between men and women on the working any of the subject in Turkey. Therefore men and women equally involved in all aspects of PGR including training programs at all levels.

The national PGR programme has emphasised dissemination of data about plant genetic resources and information about the importance of their conservation and use. Substantial actions for increasing public awareness on the importance of conserving biodiversity and environment in general and agrobiodiversity in particular has been developed and



conducted. The national biological diversity website by MEF has been constructed both in English and Turkish for the awareness of public. Different media support, such as TV, radio, workshops, meetings, posters, leaflets, brochures, posters, badges etc. were used by government agencies (MARA, MEF etc.) and by different biodiversity projects. Agricultural fairs, combined in some cases with prizes distribution to best farmers contributing to conservation of landraces and local breeds have helped in the marketability of products of local agrobiodiversity. Linking agrobiodiversity conservation with eco-tourism was initiated in Turkey along with establishing links with markets have created alternative sources for local peoples. The priorities are given to strengthen the rural development activities in rural areas where rural local people have negative effects on the protected areas with special importance for the awareness program. NGOs from the environmental sector play a significant role in public-awareness raising and enhancing their sensitivity. There are some projects for Improving Eco Tours in Turkey and the public awareness for the protection, "Promoting Public Awareness of Global Environment", and small grant training and public awareness projects by publications and publications for educational material (<http://sgp.undp.org/>).

THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION



Turkey collaborates with number of international, regional and other foreign gene banks since 1960s on the collection and conservation of PGRFA.

Turkey is member of the international organizations, which are either funding sources or actively involved to advocate or to carry out the conservation of world natural resources. Unfortunately, Turkey does not get adequate shares from international funding sources. The World Bank, United Nations-Education, Science and Cultural Organization (UNESCO), International Union for the Conservation of Nature and Natural Resources (IUCN), World Wide Fund for Nature (WWF), Council of Europe-Center Naturopa, the United Nations-Food and Agriculture Organization (UN-FAO), International Commission on Plant Genetic Resources- FAO. Turkey joined the CGIAR in 2005 and Turkey is collaborating with many of the International Agricultural Centers and in particular Bioversity International (previous name was IPGRI) on various aspect of PGR. The collaborative activities have been conducted with International Center of Arid Land Development for Agriculture (ICARDA), International Center for Maize and Wheat Breeding (CIMMYT), International Potato Centre (CIP), etc. Project staff received the short courses from those Centers. Bilateral agreements with some countries in the region like Azerbaijan or centers like Centre for Legumes in Mediterranean Agriculture (CLIMA) have also been developed.

Turkey is member of The European Cooperative Program for Plant Genetic Resources (ECPGR) since 1980 and European Forest Genetic Resources Program (EUFORGEN) since its establishment. Turkey was also member of the West Asia and North Africa Network (WANANET) established in 1992 which actually not operational. Through the membership of ECPGR, Turkey collaborates and cooperates with most of European countries on conservation of plant genetic resources, exchanges the material and data and conducts the joint project. Turkey's participation to Crop and Thematic Working Groups depends on expertise and experience for the active participation. The National PGR Program staff of Turkey is the member of various crop and thematic working group and task forces. National Program staff is also member of AEGIS (A European Gene bank Integrated System, (http://www.ecpgr.cgiar.org/AEGIS/AEGIS_home.htm) advisory Committee and EURISCO Advisory Group.

Turkey is member of various regional organization or partnership such as, the Economic Cooperation Organization (ECO), Black Sea Economic Cooperation (BSEC), and Euro-Mediterranean Partnership. ECO countries (Iran, Pakistan, Turkey, Afghanistan, Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) have developed various projects on Regional cooperation Program for Food Security and Strengthening seed supply in ECO region, The objectives of the Economic Cooperation Organization (ECO) defined as: To promote active regional collaboration and mutual assistance in economic, social, cultural, technical and scientific fields, to facilitate cooperation in various fields including agriculture, ecological and environmental protection within the region Treaty of Izmir (<http://www.ecosecretariat.org/>). Memorandum of understandings signed by ECO Countries with UN organizations (like FAO, UNEP, UNDP etc.), Regional CGIAR centers (like ICARDA) to realize and conduct the objectives related to protection to natural resources and agriculture.

Another regional cooperation is the BSEC-Black Sea Economic Cooperation which was initiated in 1992 as an informal intergovernmental meeting on Black Sea Economic Cooperation and was converted into an international economic organization on 1 May 1999, with the coming into force of its Charter signed in June 1998 in Yalta. The BSEC has its headquarters in Istanbul and is composed of twelve member states (Albania, Armenia, Azerbaijan, Bulgaria, Georgia, Greece, Moldova, Romania, the Russian Federation, Serbia, Turkey and the Ukraine). Eleven of the current 12 member states were founding members. The protection of agrobiodiversity is one of the objectives. BSEC in cooperation with some UN organizations support some projects on the various aspect of agrobiodiversity protection ad public awareness.

The Euro-Mediterranean Partnership (Euro Med) set up in October 2005 to make the relationship between the 25 EU and its 11 Mediterranean Partner Countries and/or states like Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Syria, Tunisia, Turkey and Occupied Palestinian Territory. The Regional Program of Euro Med is currently funding 25 projects under the "Economic and Financial Partnership", number of projects, covering different action areas all of which are conducive to the final goal. One of those projects is SMAP III – Sustainable environmental development Promotes

sustainable development and supports high priority environmental related activities, through technical and financial assistance.

The other way of collaboration in national, regional and international level is the exchange of material and information. Turkish National Program focuses on availability of national collection as part of its goal of maximizing the utilization of breeding resulting from its breeding and research activities, facilitating the access and ensures the continued free exchange of genetic materials. So the national collections are available worldwide for the scientist. These valuable collections preserve the vast genetic diversity of these crops and serve as a source of characteristics that can improve crop production throughout the world. The feed back of results are documented for the information exchange.

ACCESS TO PLANT GENETIC RESOURCES AND SHARING OF BENEFITS DERIVED FROM THEIR USE, AND FARMERS' RIGHTS

Turkish National Program focuses on availability of national collection as part of its goal of maximizing the utilization of breeding resulting from its breeding and research activities, facilitating the access and ensures the continued free exchange of genetic materials. So the national collections are available worldwide for the scientist. These valuable collections preserve the vast genetic diversity of these crops and serve as a source of characteristics that can improve crop production throughout the world. The feed back of results are documented for the information exchange. The Legislation on "Collection and Utilization of Plant Genetic Resources" which exist since 1992 regulates the principles of conservation, access and utilization of plant diversity. An MTA is also used for dispatch of material from the National collection. By feed backing the further access could be possible. Table 7.1 shows the most frequently requested plant species supplied from National Gene Bank in 1998-2008. Total 11 228 seed sample were distributed to domestic and foreign users (Table 4.2, Chapter 4). Cereals, oil seed Crop, food legumes, forage and vegetable programs are frequent users of the material. Most frequently requested plant species are *Triticum* and *Aegilops*, *Zea mays*, *Phaseolus vulgaris*, *Vicia* spp., *Cicer* spp., *Hordeum* spp., *Capsicum* spp., *Lycopersicon esculentum*, *Solanum melongena*, *Cucumis melo*, *Helianthus annuus*, *Vicia faba*, *Sesamum indicum* etc. The fruits and vegetable genetic resources are commonly and most frequently used by national fruit, and vegetable programs. Additionally many samples of Turkish species are conserved in the regional CG Centers and countries gene banks mostly the material collected within the framework of joint project, for example, ICARDA holds around 14 000 accessions of Turkish origin.

TABLE 7.1
Most frequently requested species from national collections

Plant species	Number. of accessions supplied
<i>Triticum + Aegilops</i>	3 436
<i>Zea mays</i>	1 108
<i>Phaseolus vulgaris</i>	718
<i>Vicia</i> spp.	690
<i>Cicer</i> spp.	606
<i>Hordeum</i> spp.	492
<i>Capsicum</i> spp.	472
<i>Lycopersicon esculentum</i>	472
<i>Solanum melongena</i>	341
<i>Cucumis melo</i>	332
<i>Helianthus annuus</i>	290
<i>Vicia faba</i>	249
<i>Sesamum indicum</i>	201
<i>Avena</i> spp.	147
<i>Beta</i> spp.	139
<i>Nicotiana tabacum</i>	123
<i>Origanum</i> spp.	123
<i>Salvia</i> spp.	123
<i>Medicago</i> spp.	102



Below legislations are also related to the access to genetic resources and benefit-sharing in Turkey:

- Resolution of the Council of Ministers No. 8/12839 of 4 April 1988. By the Resolution of the Council of Ministers No. 2003/6270 of 6 October 2003 amending articles 2, 3 and 7 of the above-cited Resolution of the Council of Ministers related to for research applications and permits for living natural resources. MEF receives and finalizes any applications for research permits.
- For the research and gathering/collecting from the wild of the materials showing the qualities of plant genetic resources and of fauna and aquatic organisms genetic resources, the authority is granted to the MARA pursuant to the Regulation on Collection and Utilization of Plant Genetic Resources”, which was entered into force upon its publication on the Official Journal No. 21316 of 15 August 1992.
- The Regulation on the Protection of Fauna Gene Resources, which was entered into force upon its publication on the Official Journal No. 25145 of 21 June 2003, and lastly to the Fisheries Regulation, which was entered into force upon its publication on the Official Journal No. 22223 of 10 March 1995.

As stated in Chapter five there are legislations for variety protection and breeders rights. “The Regulation on the Protection of Breeders’ Rights of Plant Varieties” and “The Regulation of Implementation basics on Farmer Exception” entered into force publishing in the Official Gazette of 12.08.2004 dated, in the context of the Law of 5042. “The Regulation on the Breeders’ Rights utilization of the Officials Working in public Intuitions and Agencies from” entered into force upon publishing in the Official Gazette of 30.04.2005 dated and 25801 numbered.

UPOV Agreement was accepted by the Grand Nation Assembly through Law of 5601 which was published in the Official Gazette of 17.03.2007. Accession of Turkey to UPOV was endorsed by the Cabinet through the Decision of 2007/12433 which is published in the Official Gazette of 28.07.2007.

Turkey became 65th member to UPOV on 18.11.2007. Turkey has limited access to other countries’ genetic resources in agriculture and forestry sectors to introduce the material for domestic scientist, and this access is based on agreements on material transfer and therefore Turkey shares benefit with the resource-provider country. Material Exchange (dispatch from national gene bank and introduction to the domestic scientist) subjects to Plant Quarantine Regime and phytosanitary measures. Phytosanitary aspects are managed by the Agricultural Quarantine and Seed Service, the Plant Protection Service and the Pesticide and Equipment and Veterinary Service of the General Directorate of Protection and Control in MARA. In addition, 81 provincial plant protection units (PPU) ensure the inspection and registration activities. Yearly survey programs determined by MARA provide for controlling the plant health situation of the country. Law no. 6968 Plant Protection and Plant Quarantine published in 1957 provides the legal basis for the **plant health (harmful organisms)**. It describes plant quarantine, movement of plant propagation materials, plant protection activities and measures to be taken. A number of regulations (plant quarantine), implementing regulations (plant quarantine, wood packaging material), communiqués (control measures for certain potato diseases) and circulars refer to this law. The objectives are to prevent the introduction of harmful organisms to Turkey, to prevent the spread of harmful organisms in Turkey and to set the rules for plant protection activities. The list of harmful organisms has been reviewed with the support of an EU funded project with the aim to align with EU and EPPO lists. Import inspections comprise: document check; identity check; phytosanitary inspection (visual inspection and/or lab test). The movement of propagating material requires specific certificates. Turkey does apply protected zones.

The policy of Turkey is to protect its biological diversity, as well as human and animal health, against the possible adverse effects of products developed by using modern biotechnology; however, it is also important to benefit from the current and future advantages of modern biotechnology applications, as long as this is done safely in accordance with national requirements. The main principles of the biosafety system are the precautionary principle, case-by-case evaluation and strategic long-term risk assessment of GMOs, including their impacts on socio-economic structures. As a party to the Convention on Biological Diversity (CBD) since 14 May 1998, and as a participant in the process of preparation of the Cartagena Protocol on Biosafety since 1998, the Republic of Turkey signed the Protocol on 24 May 2000 during the 5th COP to the CBD and adopted it on 17 June 2003 (act 4898, OJ 24 June 2003). The General Directorate of Agricultural Research of MARA has been appointed as a national focal point for the Protocol. In addition, Turkey participated in the UNEP/GEF project on the development of National Biosafety Frameworks, which was also supported by the State Planning Organization and currently discussing national biosafety regulations that might soon enter into force.

Traditional knowledge held by farmers is recognised and documented through the project bases for conservation of plant genetic resources and plant diversity. The ethnobotanical surveys are also conducted to receive the use of genetic diversity by rural people. The national programme experiences that farmers are excited about sharing their knowledge and wish this disseminated. Governmental incentives with the aim to promote organic farming and traditional farming of agricultural ecosystem are also considered to be a part of the national policies recognising traditional knowledge and to preserve local varieties/land races.

THE CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT



Plant genetic resources for agricultural development are crucial for sustainable production, providing the biological basis for food security and supporting the livelihoods of people. These resources are the plant breeder's most important raw material and the farmer's most essential input for improving the quality and productivity of crops.

The contribution of genetic resources in agriculture has shaped the development of humanity through the past 10 000 years. During these period, the principles of cultivation of crops and husbanding of livestock spread from a relatively few centers of origin which Turkey is located one of those. The less direct aspects of the relationship between conservation of access to genetic resources relate to the concept of sustainable use that has become the basis of much conservation policy and discourse in recent years. Turkey is a major agricultural producer. With respect to its climate and land nature, Turkey is suitable for the production of various products. Turkey, while performing the agricultural development project to assure its own food security, also contributes to the achievement of food security in her region and eventually, to the global food security by being the exporter in major commodities. Turkey has adopted the food security in their agricultural policy and the risk analysis is one of the main components of food security policy. Turkey is pursuing the policy of modernization of agriculture with more irrigated lands and greater transition to privatization in the sector. To ensure the food security, development of the well adjusted production techniques with climatic change is necessary. So, for the agricultural sustainability, food security, economic development Turkey has take preventive measures on natural resources (water, soil and biodiversity etc.) conservation and sustainable use that most of the actions and activities were discussed in the previous chapters. In this concept, Turkey has made important policy and legislative progress (including the risk management) under the coverage of European Union harmonization programs and awareness actions for better understand the roles and the economic social, cultural and ecological values of biodiversity in general and agrobiodiversity in particular including plant genetic resources for food and agriculture. A multi-sectoral team for food security was also established for acting as a central mechanism to bring the country's key development partners together to combat hunger. This Thematic Group take on the role of coordination on food and nutrition issues in the country.

As being the center of diversity and the center of origin for many food crops, the PGRFA contribution of Turkey to national, regional and world food security is enormous by sharing the information and material. PGRFA of Turkey is not only for its conservation significance, but also the unprecedented benefits that accrue from the sustainable use of these resources. As discussed earlier the tremendous efforts and actions had been taken on *ex situ* and *in situ* and on-farm conservation of those diverse and unique PGRFA since 1960s as one of the pioneering country. The national gene bank which meets the international standard and field gene banks for vegetatively propagated species are kept in the well conditions and monitoring periodically for regeneration and multiplication need and long term storage and for the sustainable utilization of future generations. There are also efforts on improvements of the national program, facilities and legislative aspects to prevent the existing genetic erosion. The facility improvement is rather slow because the budget shortage. The implementation of the activities of the Global Plan of Action is also considered within the framework of National program which is well developed and well planned and prioritized. The use of national collections by domestic and foreign scientist is high and many accessions genitors of released/improved varieties. Thousands of samples are also duplicated at the gene bank of CGIAR centers and some institutions for the use.

For capacity building for better implementation of conservation and sustainable utilization of PGRFA National program for meeting the global agricultural challenges and food security is one of the essential components of national program and realized by training program, seminars meetings, workshops etc. not only for national level but also regional level by collaborating with regional and international institutions. Through the ECPGR the national project staff has opportunity for information exchange, cooperation on various aspects of PGRFA conservation and utilization. There is substantial evidence to indicate that access to plant genetic resources can enable leverage in technical cooperation, training and

provision of capital equipment among countries. Being the member of the thematic and crop working groups of ECPGR and advisory groups of some program like AEGIS and EPGRIS get benefits to national program to be improvement of the research activities to contribute the food security, agricultural development.

By enhancing global knowledge and developing technical capacity in conservation and utilization of the diversity of crop and wild relatives the new techniques used such as cryopreservation, and advanced facilities are established for conservation and sustainable use. The strong collaboration with related ministries, universities and NGOs are established and through the Program Evaluation Meetings, all related projects of all stakeholders are discussed for better understanding of conservation and sustainable use, for avoiding the duplicate effort and for information exchange.

PGRFA of Turkey mainly the landraces and wild relatives of crops of global importance have always contributed and continue to contribute to overall agricultural development and food security in the world through their use by crop improvement programs. Some national breeding programs have also benefited from the PGRFA either through their direct use in their breeding programs or through the use of national collections. The international or foreign breeding programs have also benefit by exchange of germplasm from the National Gene Bank. The several new sources of resistance biotic and abiotic stress are determined by screening and the evaluating the collections. In addition, the use of wild relatives have contributed significantly as root stocks for better adaptation to harsh conditions and for resistance to major diseases. The new varieties are released and registered by using the national collections. For example AARI had registered 6 common vetch, 2 hairy vetch, 1 Hungarian vetch, 1 Italian ryegrass, 1 clover, 1 alfaalfa, 5 sesame, 1 anise, 42 tobacco, 1 okra, 1 melon, 2 pepper, 11 sour cherry, 11 plum, 21 pomegranate, 3 quince and 8 plum root stock.

In addition to their importance as genetic resources for breeding programs, landraces of Turkey are still widely used by farmers living under harsh conditions or practicing traditional farming systems. In fact, landraces of vegetables, cereals, food legumes, industrial crops fruits are still predominant remote and mountainous regions. These landraces appears to be more adapted to major abiotic stresses and have good qualities for local uses. Consequently, local agrobiodiversity continue to provide the basis for the livelihood of rural communities. Adding value technologies and valorization of this local agrobiodiversity will contribute to the improvement of well being of rural people and therefore to the food security in the country. Many other neglected crops along with the organic nature of the traditional farming could add the value of the landraces. The projects and related research conducted onfarm conservation by government institutions and NGOs are significantly important for the landrace conservation. The local people in the remote and marginal areas of the country depend on these resources for their economic, social and cultural well-being. Yet, the full potential of PGRFA is to be tapped and the economy of the country in general gets benefit significantly in the search for new sources of food stocks, medicines, fiber etc. from those land races even the wild species are utilized by the local and rural peoples. Naturally, the existing and potential fields of use of plant genetic resources go beyond food and agriculture applications. There are several opportunities and uses that could provide major developmental interventions in Turkey. The use of plant genetic resource in the field of medicine and public health is the highest profile in Turkey. An example of their economic importance and influence is the concept of 'green gold'. Knowledge of these plants of medicinal importance plays a major role in generating revenue by local sale and exporting to the government for rural development.

For a well functioning system for conservation of and access to plant genetic resources is important for the future food safety. Plant breeding to meet global developments such as climate change, the spread of pests and plant diseases and other health and environmental challenges will require the input of a broad diversity of accessible genetic resources.

Turkey will continue to support the development of international systems for conservation and use of plant genetic resources as being party to International Treaty for Plant Genetic Resources for Food and Agriculture. For short term country developments, the role of plant genetic resources in economic development (e.g. new products and new crops and niche production and markets) and the contribution regarding agricultural sustainability (e.g. organic farming or ecological farming) are considered to be the most important issues.

