

**FAO International Technical Conference
on Plant Genetic Resources**

**CONSERVATION AND
SUSTAINABLE UTILIZATION OF
PLANT GENETIC RESOURCES IN
THE MEDITERRANEAN**
Sub-Regional Synthesis Report

**Annex 1 of the Report of the
Sub-Regional Preparatory Meeting for
The Mediterranean,
Tunis, Tunisie
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Note by FAO

This Sub-Regional Synthesis Report was endorsed by the Sub-Regional Meeting for the Mediterranean, Tunis, Tunisia, 16-19 October 1995, preparatory to the FAO International Technical Conference on Plant Genetic Resources, as a useful input for the preparation of the Report on the State of the World's Plant Genetic Resources. It constitutes Annex 1 of the Report of the Preparatory Meeting. The Report is being made widely available by FAO as requested by the International Technical Conference.

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The opinions expressed in this report do not necessarily represent the views or policy of FAO or IPGRI.

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I. INTRODUCTION

1. This report covers the East and South Mediterranean sub-region. The countries and territories included in this report are: Mauritania, Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Palestine, Lebanon, Syria, Cyprus and Turkey. Israel, although geographically part of the Eastern and Southern Mediterranean sub-region, is covered by the synthesis report for Europe.

2. The sub-region lies between latitudes 14° to 42° N and longitudes 17° W to 45° E and covers an area of 8,097,740 km². It is characterized by the largest desert in the world, the Sahara, which extends across North Africa from the Atlantic ocean in the west to the Red Sea in the East. The climate of most of the countries in the sub-region, except for Mauritania, is of Mediterranean type, characterized by a short, mild winter with precipitation occurring from November to March, and a hot dry summer separated by a short autumn and spring. Frost is widespread but some parts of the coastal lowlands are frost-free. In the high mountains snow frequently lies for long periods. The Sahara is characterized by high temperatures, absence of frost (except in the high mountains), and, apart from the coastal fringes, a very dry atmosphere with the wind as a continual factor. The climate varies from sub-humid and humid to arid and hyper-arid. The overall average rainfall in the sub-region varies from about 30 mm in the Sahara to over 2,000 mm in the high mountains.

3. The total population in the sub-region is around 200 million, of which more than 75% are the inhabitants of only 4 countries, i.e., Turkey, Egypt, Algeria and Morocco.

a. Agricultural Sector

4. Agriculture plays an important role in the economy of the sub region. 33% of the population live in rural areas. The labour force is around 65 million, of which 37% work in the agricultural sector (Appendix 1).

5. Of the total land area of 800 million hectares, 16% are rangelands, 8% are arable lands, 4% are occupied by forest and 71% are waste lands. Most of the land in the sub-region (70%) is located in the arid zones. Of the 61 million ha of arable land; 77% are rainfed and only 23% are irrigated. Therefore agriculture is very dependent on the climatic factors. In Egypt, all crops are produced under irrigation in the Nile Valley. The percentage of irrigated land in the other countries is as follows: Lebanon (28% of arable



land area), Cyprus (23%), Morocco (13%), Palestine (10%) and Turkey (8%).

6. Agricultural production is dominated by crop production and contributes about 20% of the Gross Domestic Product (GDP) in the sub-region. This contributes 30% to the GDP in each of Algeria, Syria, and Lebanon, and 16-20% in Turkey, Tunisia, Morocco, Mauritania, Egypt, and Palestine. Its contribution is less than 10% in Jordan and Cyprus (Appendix 2).

7. None of the countries and territories in this sub-region are self sufficient in food supply, as shown by the percentage of food import dependency (Appendix 2). Turkey is the only country close to self sufficiency in cereal production. Moreover, all countries and territories import forestry products.

b. Indigenous Plant Genetic Resources

8. It is estimated that the sub-region has a flora of 32,000 species of higher plants, a high proportion of which are endemic (Table 1). Of the flora, 10% are considered as threatened species. The highest plant diversity occurs in Turkey in the Near Eastern sub-region (with 163 plant families, 1225 genera, 9000 species and 3000 plant taxa as endemic) and Morocco in the North African sub-region (with 135 plant families, 940 genera, 4500 species and 600 plant taxa as endemic).

Table 1 *Flora and endemism in the sub-region*

Country	Number of species	Number of endemics	Number of threatened
Algeria	3200	250	145
Cyprus	1760	134	43
Egypt	2112	70	91
Jordan	2500		752
Lebanon	2100	210	5
Libya	1900	134	58
Mauritania	1100		3
Morocco	4500	600	194
Palestine	3000		980
Syria	2100	210	11
Tunisia	2150	170	26
Turkey	9000	3000	1944

(Source: World Conservation Monitoring Centre, 1992 and Country Reports)



II. FOREST GENETIC RESOURCES

9. Two ecogeographical zones can be distinguished in the sub-region: the Mediterranean zone and the sub-Sahara and Sahara zone.

a. The Mediterranean Zone

10. In the past, forest covered a large proportion of this zone. Most types of forest have suffered extreme degradation, and have disappeared completely from some large areas. Some are represented today by no more than tiny relics of stands such as *Celtis australis*, *Pistacia atlantica*, *Fraxinus angustifolia*, *Laurus nobilis*, *Malus trilobata*, *Populus alba* and *Salix alba*. Two forest types, which include at least 60 tree species, can be distinguished in this zone:

- Broad leaved forest (Evergreen sclerophyllous and deciduous oak forests) dominated in North Africa by *Quercus ilex*, *Q. suber*, *Q. coccifera*, *Quercus faginea*, *Q. pyrenaica* and *Q. afares* and in West Asia by *Quercus cerris*, *Q. ithaburensis*, *Q. aucheri*, *Q. vulcanica*, *Q. calliprinos* and *Q. alnifolia*.
- Coniferous forest dominated in North Africa by ten species (*Abies numidica*, *A. pinsapo subsp. marocana*, *Cedrus atlantica*, *Cupressus atlantica*, *C. sempervirens*, *Juniperus phoenicea*, *J. thurifera*, *Pinus halepensis*, *P. pinaster* and *Tetraclinis articulata*) and in West Asia by *Pinus brutia*, *P. nigra ssp. pallasiana*, *P. halepensis*, *P. sylvestris*, *Abies nordmanniana*, *A. cilicica*, *Picea orientalis*, *Cedrus libani*, *C. brevifolia* and *Juniperus excelsa*.

11. Of the remainder of forest species, the majority are Mediterranean endemics, or, if they occur elsewhere, their distributions are centered on the Mediterranean basin. They include: *Abies cilicica*, *A. nordmanniana*, *Acer cappadocium*, *A. monspessulanum*, *Alnus orientalis*, *Arbutus unedo*, *Celtis australis*, *Ceratonia siliqua*, *Chamaerops humilis*, *Crataegus azarolus*, *Fagus orientalis*, *Fraxinus angustifolia*, *F. xanthoxyloides*, *Juniperus oxycedrus*, *J. phoenicea*, *Laurus nobilis*, *Malus trilobata*, *Olea europaea*, *Phillyrea angustifolia* (including *P. latifolia* and *P. media*), *Pinus pinaster*, *Pistacia atlantica*, *P. lentiscus*, *P. terebinthus*, *P. palaestina*, *Prunus lustanica*, *Pyrus gharbiana*, *P. cossonii* (longipes), *P. mamorensis* and *Rhus pentaphylla*.



12. Several Eurosiberian linking species also occur in Mediterranean North Africa, notably *Acer campestre*, *Alnus glutinosa*, *Betula pendula*, *Crataegus monogyna*, *Ilex aquifolium*, *Populus tremula*, *Prunus avium*, *P. padus*, *Sorbus aria*, *S. torminalis*, *Taxus baccata* and *Ulmus campestris*. All have restricted distributions and are virtually confined to the humid and sub-humid climate of the Rif mountains in Morocco, the wetter parts of the coastal plain and coastal ranges in Algeria, and the wetter parts of the seaward slopes of the Atlas Mountains.

b. The Sub-Saharan and Saharan Zone

13. Most species in the Sub-Saharan zone are Mediterranean or Saharan wide or have even wider distributions, except for some endemics which occur in the western part of Morocco such as *Argania spinosa* and *Acacia gummifera*. *Argania spinosa* is the only member of the tropical family *Sapotaceae* to occur on the mainland of Africa, north of the Sahara. Apart from the western Morocco endemics, the only other important group of local endemics is that occurring on Jebel Lakhdar in Libya. Its 100 or so endemic species include *Arbutus pavarii*, *Crocus boulosii* and *Cyclamen rohlfsianum*.

14. The Saharan zone is characterized by *Acacia* communities which occur mainly on the rocky beds of wadis and the deposits of gravelly alluvium of out-wash fans. Except for the *Tamarix* and *Hyphaene* communities and some vegetation types on the summits of the high mountains, all the larger woody plants of the Sahara belong to the *Acacia* communities. Of the larger woody plants, the most important are *Acacia tortilis* subsp. *raddiana*, *A. ehrenbergiana*, *Maerua crassifolia*, *Balanites aegyptiaca*, *Capparis decidua*, *Calotropis procera*, *Salvadora persica* and *Ziziphus mauritiana*. They occur in communities which, when well developed, are physiognomically similar to the bushlands and bushed grasslands of the Sahel zone.



III. WILD SPECIES AND WILD RELATIVES

15. The sub-region is unique in the world from the stand point of plant genetic resources and plant diversity, since it covers two of the Vavilov's Centre of Origin (Near Eastern and Mediterranean Centres). The sub-region is one of the most important centres of diversity for a number of globally important crop plants including many cereals, food legumes, vegetables, forages, fruit trees and nuts (Appendix 3).

16. Primitive landraces, wild crop relatives and other wild plant species from the sub-region continue to provide new sources of important traits to improve agricultural production worldwide. However, most of this diversity is threatened by genetic erosion due to agricultural mechanization, urbanization, and habitat destruction by overgrazing and forest clearing. For instance, wild progenitors of some food legumes, such as chickpea (*Cicer reticulatum* in Turkey and *Cicer atlanticum* in Morocco) are almost extinct and are now exclusively confined to steep rocky slopes where grazing pressure is not as severe.

- Wild relatives and wild ancestors of cereals found in the sub-region include those of wheat (wild einkorn *Triticum boeoticum*, wild emmer wheat *T. dicoccoides*); goat grass *Aegilops* (*Ae. ovata*, *Ae. triuncialis*, *Ae. ventricosa*, *Ae. triaristata*, *Ae. neglecta*, *Ae. geniculata*); barley, (*Hordeum spontaneum*, *H. bulbosum*, *H. marinum*, *H. leporinum* and *H. murinum*); oats (*Avena. maroccana*, *A. agadiriana*, *A. atlantica*, *A. ventricosa*, *A. weistii*, *A. eriantha*, *A. barbata*, *A. murphyi*, *A. longiglumis*, *A. hirtula*, *A. sterilis*, etc.) and rye (*Secale* sp.).
- The wild and weedy forms of food legumes occur in the sub-region mainly those of lentil (*Lens orientalis*, *L. nigricans*, *L. ervoides*, *L. montbretii*, *L. odemensis*); pea (*Pisum humileare*, *P. elatius*) and chickpea (*Cicer reticulotum*, *C. judaicum*, *C. pinnatifidum*, *C. echinospermum*, *C. bijugum* and *C. atlanticum*).
- The wild relative of *Brassica* (*B. cretica*); wild *Raphanus raphanistrum*; wild celery (*Apium graveolens*); wild beet (*B. maritima* and other *Beta* spp.); wild watermelon (*Citrillus colocynthis*); wild cardoon/artichoke (*Cynara cardunculus*); wild carrots (*Daucus* spp.); wild rockets (*Eruca* spp.) wild lettuce (*Lactuca* spp.) and wild mustard (*Sinapis* spp) are some of the wild species commonly used as vegetable or salad plants originated from the sub-region. Many other wild plant species are used as salad and vegetable plants, but are not utilized in development.



- Some wild relatives of forage grasses and legumes which commonly occur in the sub-region include: those of alfalfa (*Medicago sativa*); annual medics (40 species: *Medicago aculeata*, *M. intertexta*, *M. laciniata*, *M. littoralis*, *M. macrocarpa*, *M. murex*, *M. noena*, *M. orbicularis*, *M. polymorpha*, *M. radiata*, *M. rigidula*, *M. rotata*, *M. secundiflora*, *M. sauvagei*, *M. scutellata*, *M. tornata*, *M. truncatula*, *M. tuneata*, etc.); lupin (*L. atlanticus*, *L. angustifollius*, *L. cosentinii*); Egyptian or berseem clover (*Trifolium alexandrium*); strawberry clover (*T. fragiferum*); white clover (*T. repens*); subterranean clover (*T. subterraneum*); *Phalaris* (*P. aquatica*, *P. minor*); fodder peas (*Lathyrus articulatus*, *L. clymenum*, *L. gorgonii*, *L. ochrus*, *L. odoratus*, *L. sativus*, *L. tingitanus*, etc.); the Apennine peninsula-sulla (*Hedysarum coronartium*); vetches (*Vicia articulata*, *V. ervilia*, *V. narbonensis*, *V. sativa*, *V. villosa*, *V. hybrida*, *V. palestina*,...); grasses (*Festuca*, *Eragrostis*, *Stipa*) and other fodder crops (*Astragalus*, *Bituminaria*, *Lotus*, *Ononis*,..).
- Many indigenous fruit trees and nuts are also found in the sub-region. These woody plants are valuable genetic resources as food crops because of their resistance to insects and diseases. Such species as chestnut (*Castanea sativa*) and walnut (*Juglans regia*) are valuable fruit genetic resources. Wild apple (*Malus spp.*), wild pear (*Pyrus spp.*), wild plum (*Prunus spp.*), wild pistachios (*Pistachia atlantica*, *P. lentiscus*, *P. palestina*, *P. terebinthus*,), wild hazel nuts (*Corylus spp.*), wild cornell cherry (*Cornus sanguinea*), wild almond (*Amygdalus spp.*) are some of wild relatives of fruit trees found in the sub-region. Most of those wild relatives are utilized as rootstocks. There are also wild relatives of other fruits like wild strawberry (*Fragaria spp.*) and wild blackberries (*Rubus spp.*). The sub-region is also the land of oil trees such as olives (*Olea europea*) and Argane (*Argania spinosa*). The latter is endemic to Morocco and has a limited area of distribution. Some other trees are considered as industrial plants such as *Rhus coriaria* (which is rich in tannin), and the carob tree, *Ceratonia siliqua* (used in the chocolate industry).
- Wild progenitors of ornamental species such as *Allium*, *Anemone*, *Arum*, *Centaurea*, *Chonodoxa*, *Cistus*, *Colchicum*, *Crocus*, *Cyclamen*, *Delphinium*, *Dianthus*, *Eranthis*, *Fritillaria*, *Galanthus*, *Gladiolus*, *Gypsophilla*, *Helleborus*, *Hyacinthus*, *Iris*, *Laurus*, *Leucojum*, *Lilium*, *Muscari*, *Myrtus*, *Narcissus*, *Nectaroscordum*, *Nerium*, *Ophrys*, *Orchis*, *Ornithogalum*, *Paeonia*, *Pancratium*, *Retama*, *Rosa*, *Scilla*, *Scorzonera*, *Silene*, *Sternbergia*, *Tulipa*, *Viola* are indigenous to the sub-region. Unfortunately their numbers are rapidly decreasing from some developmental activities, the use of herbicides and inconsiderate exploitation.



- More than 500 species are used as medicinal or aromatic species in the sub-region. These are in danger of extinction mainly because of human activity by collecting these plants for domestic and industrial use. Many of these plants are endemic: *Achillea*, *Acanthus*, *Aconitum*, *Alkanna*, *Allium*, *Althea*, *Amygdalus*, *Anabasis*, *Angelica*, *Arbutus*, *Artemisia*, *Asparagus*, *Asperula*, *Brassica*, *Calotropis*, *Capparis*, *Carum*, *Ceratonia*, *Colchicum*, *Convallaria*, *Crateagus*, *Delphinium*, *Digitalis*, *Ephedra*, *Euphorbia*, *Equisetum*, *Foeniculum*, *Ferula*, *Ferulago*, *Fragaria*, *Galanthus*, *Gentiana*, *Glycirrhiza*, *Gypsophilla*, *Helycrysum*, *Helleborus*, *Herniaria*, *Hyoscyamus*, *Inula*, *Ixiolirion*, *Lamium*, *Lavandula*, *Laurus*, *Leucoium*, *Linum*, *Liquidambar*, *Lycopodium*, *Malva*, *Marrubium*, *Matricaria*, *Melilotus*, *Mentha*, *Narcissus*, *Nepeta*, *Nigella*, *Orchidaceae*, *Origanum*, *Paeonia*, *Peganum*, *Papaver*, *Pimpinella*, *Pistacia*, *Prangos*, *Primula*, *Quercus*, *Rhamnus*, *Rhus*, *Rosa*, *Rosmarinus*, *Rubia*, *Ruscus*, *Salvia*, *Satureja*, *Saponaria*, *Scolymus*, *Sidenritis*, *Symphytum*, *Tanacetum*, *Teucrium*, *Thymbra*, *Thymus*, *Trigonella*, *Ulmaria*, *Vaccinium*, *Valeriana*, *Veratrum*, *Verbascum*, *Viola*, *Zizyphus*.

IV. LANDRACES AND OLD CULTIVARS

17. The sub-region is rich in highly variable landraces of domesticated crops with unique characteristics. Landraces have persisted *in situ* because of the nature of the farming systems in the sub-region. In fact, landraces and local varieties have been conserved in a dynamic way by farmers since they started cultivation of crops. By growing a mixture of diversified local materials, farmers were always able to select varieties adapted to local environmental conditions. However, the adoption of uniform new crop cultivars, nitrogenous fertilizer, and increasing mechanization in agriculture have reduced the area of local crop production and resulted in the disappearing of traditional diversity based farming systems. Landraces can still be found in isolated and marginal areas, such as mountains and oases where traditional cultivars are still grown.

18. The diploid einkorn (*Triticum monococcum*) and the tetraploid emmer wheat (*T. dicoccum*), the two-row barley landraces (*H. distichum*) and six-row barley landraces (*H. vulgare*) are still grown in some of the countries in the sub-region such as Turkey, Jordan, Morocco, Palestine, etc.. Old varieties and landraces of fruit trees such as almonds, prunes, pears, apples, hazelnuts, olives, etc.. are also found in the sub-region.



V. ASSESSMENT OF PGR PROGRAMMES AND ACTIVITIES

a. National programmes policies and legislation

National programmes and policies

19. The plant genetic resources activities in the sub-region, except for Turkey, are not organized in an integrated national programme *per se*. However, in most countries and territories several Departments and Institutions within different Ministries (Agriculture, Education, Scientific Research, etc.) have programmes, which partly address plant genetic resources. These activities are mainly implemented through the breeding and selection programmes within the Research Institutes and Universities and through the natural resources management activities conducted by the Departments of forestry and livestock within Ministries of Agriculture. Except for Mauritania, these activities can be considered as multi-institutional programmes. The leading breeding programme in all the countries is within the National Agronomic Research Centre or Institute. Appendix 4 gives a summary of the status of the national programmes, policies and legislation.

20. Because of the lack of government policies in the plant genetic resources activities, most of the plant genetic resources conservation programmes, except for Turkey, do not receive enough support from the policy makers and the budget is not really secure. In Tunisia, for instance, the genebank facilities were established in the early 1980's, and after a few years the project faced difficulties due to lack of coordination and budget. The lack of coordination between different institutions dealing with the plant genetic resources activities is the bottleneck of many of the national programmes. This case is relevant in Egypt where despite all the plant genetic resources activities conducted by various institutions, efforts and fund are scattered because of lack of coordination. At this point, it is worth emphasizing the role played by the WANANET in strengthening the national programmes by reinforcing the role of the national plant genetic resources committee and by creating a good coordination between different institutions within each country and between programmes within the sub-region. In fact, through the establishment of the national plant genetic resources committees in 1993, scientists from different institutions within Turkey, Morocco, Jordan, Lebanon and Syria established a good collaboration between them.



21. Activities on the conservation and utilization of plant genetic resources have been limited to date due to various factors including the Israeli occupation. As a result of the peace process, the Ministry of Agriculture has been created in the Palestine territory and a specialized institution on dryland studies and applied research has been established. The initial steps towards national programmes have been laid out; however, this development requires intensive involvement from international and regional organizations and institutions in order to establish and to strengthen the activities and programme on plant genetic resources in Palestine.

22. The Convention on Biological Diversity (CBD) has an important influence on national policies in providing the legal framework for conservation of biological diversity. Following the Convention, all the countries in the sub-region have established national environmental commissions. Therefore, environmental and biodiversity conservation and sustainable use strategies and plans are being developed in almost all the countries. In some countries, such as Morocco, the national plant genetic resources coordinator is a member of the national environmental commission and is heavily involved in the preparation of the national strategy. Despite the presence in most countries and territories of several Non Governmental Organizations (NGOs) dealing with biodiversity conservation, their activities are generally limited to wildlife conservation and are not yet heavily involved in plant genetic resources conservation activities. Still, in most of the countries, the plant genetic resources conservation and management is considered as a small part of the overall environment components and is not receiving enough support. Much greater efforts from the national and international plant genetic resources communities are needed to convince the decision makers in each country of the valuable role of plant genetic resources in securing food for humanity.

Legislation

23. Turkey is the only country within the sub-region which has established laws specially for the protection of plant genetic resources. However, all the other countries protect wild flora through legislation on forests. However, experience has shown that the degree of protection afforded to wild flora through such legislation is very limited. Therefore, since the signing of the CBD, legislation in these countries on forests has been reviewed to include provisions for sustainable forest conservation and development, taking into account all the socio-economic effects.

24. All the countries and territories in the sub-region, except for Mauritania and Palestine, have preventive actions through phytosanitary, quarantine and seed certification legislation for controlling the importation and exportation of plant materials. In general, all the countries allow the



transfer of disease free and noxious weedfree materials including *in vitro* plant materials. Though the quarantine laws are strict, their application varies from country to country. In Jordan, for instance, germplasm materials can easily flow from the country. The application of the laws varies also with the type of the crop, this is the case of cotton in Egypt and citrus and date palm germplasm in Morocco for which the rules are strict.

25. On the other hand, a large majority of countries from the region have not established intellectual property rights yet, although in Morocco, the UPOV convention is under consideration. Despite the beginning of involvement of some private companies in plant breeding and biotechnology activities, it is noteworthy that the private sector is still absent from the plant genetic resources conservation activities in the sub-region.

26. Political and socio-economic transformations in all the countries, such as structural adjustment policies and privatization programmes, are not emphasizing the role of the plant genetic resources. Most of the national programmes are under-staffed with respect to plant genetic resources scientists. By limiting the research budget and the number of newly recruited scientists, structural adjustment policies may have a negative effect on the capacity building of these programmes. Privatization programmes need to be rationalized so that public investment in plant genetic resources activities is reinforced. Even if the private sector is willing to invest in breeding cash crops, it will be unrealistic for it to carry out plant genetic resources conservation and genetic enhancement for most crops, or breeding of underutilized crops.

b. Sub-regional programmes and networks and international collaboration

27. All countries in the sub-region (not including the territory of Palestine) are members of the FAO Commission on Plant Genetic Resources and all of them, except Jordan, have signed the International Undertaking to promote the conservation, exchange and utilization of plant genetic resources for food and agriculture. All countries ratified the Convention concerning the World Cultural and Natural Heritage and all, except Cyprus, Mauritania and Syria, are also members of the Plant Protection Convention. Six countries from the sub-region Algeria, Egypt, Mauritania, Morocco, Tunisia and Jordan, are party to the Ramsar Convention on Wetlands of International Importance and only Algeria, Cyprus, Egypt, Morocco, Tunisia and Jordan are also members of the CITES Convention. Table 2 gives the status of the biodiversity related conventions signed by the countries in the sub-region. Other multilateral treaties on a regional basis, such as the African convention on the conservation of nature and natural resources have been adopted by



most countries in the sub-region. The Convention on Biological Diversity has been signed by all countries but only Egypt, Jordan, Lebanon and Tunisia have already ratified it.

28. All countries and territories have established good working relations and linkages with the CGIAR Centers (IPGRI and International Agricultural Research Centers (ICARDA, CIMMYT, CIP, etc.). Several varieties developed in CIMMYT are used by the countries in the sub-region. ICARDA's mandate in plant genetic resources activities in the region consists of collecting, conservation, characterization, evaluation and promotion of utilization of barley, wheat, lentil, chickpea, faba bean and forage legumes. In agreement with IPGRI, ICARDA will serve as a world depository for the germplasm of barley, lentil, faba bean and chick pea.

29. IPGRI has established strong cooperation with the countries in the sub-region. IPGRI's mission is to encourage, support and engage in activities to strengthen the conservation and use of plant genetic resources worldwide, with special emphasis on the needs of developing countries. Within this mission, several plant genetic resources activities and storage facilities were funded in the sub-region. As a result of the collaboration between the countries FAO, ICARDA and IPGRI's WANA Group, the WANA plant genetic resources Network (WANANET) was created in 1992. Thirteen countries (Algeria, Cyprus, Egypt, Iran, Jordan, Lebanon, Libya, Morocco, Pakistan, Tunisia, Turkey, Syria, and Yemen) from WANA region participated in the workshop. Representatives of ICARDA, IPGRI, FAO and ACSAD are also members of the Steering Committee of the network. The aim of the network is to coordinate plant genetic resources activities better within the countries and the region and to provide and disseminate information on plant genetic resources. The objectives of the network are:

- Coordination on plant genetic resources within each WANA country (national committee and national coordinators).
- Implementation of national strategies through project proposals that are developed by national programme.
- Information exchange between and within the countries.



Table 2 International agreements

Country/ Territory	CBD	FAO Commission PGR	FAO Internat- ional Undertaking	WHC	Wet- lands	CITES	Plant Protection	Regional Convention
Algeria	Yes	Yes	Yes	Yes	Yes	Yes	Yes	African
Cyprus	Yes	Yes	Yes	Yes	Yes	Yes	No	European
Egypt	Yes	Yes	Yes	Yes	Yes	Yes	Yes	African
Jordan	Yes	Yes	No	Yes	Yes	Yes	Yes	-
Lebanon	Yes	Yes	Yes	Yes	No	No	Yes	-
Libya	Yes	Yes	Yes	Yes	No	No	Yes	African
Mauritan	Yes	Yes	Yes	Yes	Yes	No	No	African
Morocco	Yes	Yes	Yes	Yes	Yes	Yes	Yes	African
Palestine	No	No	No	Yes	No	No	No	
Syria	Yes	Yes	Yes	Yes	No	No	No	-
Tunisia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	African
Turkey	Yes	Yes	Yes	Yes	No	No	Yes	European

Global Conventions:

- **CBD:** Convention on Biological Diversity (Rio, 1992).
- **WHC :** Convention on the protection of the World Cultural and natural Heritage (Paris, 1972).
- **Wetlands:** Convention on Wetlands of International Importance (Ramsar, Iran 1971).
- **CITES:** Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington, 1973).
- **Plant Protection:** International Plant Protection Convention (Rome, 1951).



Regional Conventions:

- **African :** African convention on the Conservation of Nature and Natural Resources (Algiers, 1968).
- **European:** Convention of the Conservation of European Wildlife and Natural Habitats (Bern, 1979).

30. FAO also has some technical cooperation projects in individual countries in the sub-region. Projects with some relation to plant genetic resources are reported in Table 3. Most are funded through UNDP. Some biodiversity projects funded by the Global Environment Facility (GEF) in the sub-region are also summarized in Appendix 5.

Table 3 *Plant genetic resources projects recently executed by FAO in the sub-region*

Project codes and dates	Country	Title of the project	Impact on plant genetic resources
UNDP/CYP/88/002 04.88-12.94	Cyprus	Plant genetic resources and plant protection	High
UNDP/LEB/91/002 05.93-06.95	Lebanon	Improvement and development of oil crops in South Lebanon	Fair
UNDP/MAU/92/002 01.93-12.92	Mauritania	Support to the extension of quality seed production of traditional	Fair
UNDP/MAU/92/007 10.92-10.96	Mauritania	Foundation seed production of improved varieties	Fair
UNDP/RAB/88/024 01.89-12.94	Regional	Control of Bayoud disease of date palm (Phase II)	Medium
UNDP/RAB/88/025 12.92-08.96	Regional	Control of virus and virus-like diseases of fruit crops (Phase II)	Fair
UNDP/SYR/92/016 01.94-10.97	Syria	Improved olive oil production and processing	Fair



Project codes and dates	Country	Title of the Project	Impact on Plant genetic resources
UNDP/TUR/93/001 01.94-06.95	Turkey	Establishment of National network for Integrated Pest Management (IPM)	Fair
UTF/TUR/003/TUR 01.84-12.94	Turkey	Agricultural extension and applied research	Fair

c. Conservation activities

Ex situ conservation

Ex situ collections

31. *Ex situ* conservation in the sub-region is implemented both for national seed and vegetative collections which are preserved in seed genebanks and field genebanks respectively. The national collections include landraces and wild relatives (both for seed and vegetative collections), other wild species which are of special economic importance (medicinal, aromatic, ornamental etc.) and endemic plant species. Appendix 6 summarizes the *ex situ* activities in the sub-region. The absence of adequate seed conservation, evaluation and documentation facilities, as well as qualified staff, are factors which have caused, in the past, the loss of much of the germplasm collections in the sub-region.

Table 4 Origin of ICARDA collections (December 1993)

Crop	Origin of accessions				
	WANA		Other countries		Total
	Number	%	Number	%	Number
Cereals	32,545	63.6	18,609	36.4	51,154
Barley	9,233	44.0	11,735	56.0	20,968
Wild Hordeum	1,391	90.3	149	9.7	1,540
Durum Wheat	12,222	68.9		31.2	17,751
Bread Wheat	6,665	93.2	486	6.8	7,151
Other Triticum	1,248	87.3	182	12.7	1,430
Aegilops	1,786	77.2	528	22.8	2,314
Food Legumes	12,894	64.8	7,009	35.2	19,903
Chickpea	6,700	78.9	1,795	21.1	8,495
Wild Cicer	263	97.0	8	3.0	271
Lentil	3,988	55.2	3,240	44.8	7,228
Wild Lens	315	81.6	71	18.4	386



Crop	Origin of accessions				
	WANA		Other countries		Total
	Number	%	Number	%	Number
Faba Bean	1,628	46.2	1,895	53.8	3,523
Forages	14,644	65.7	7,652	34.3	22,296
Medicago	5,791	79.9	1,460	20.1	7,251
Vicia	2,247	48.8	2,357	51.2	4,604
Pisum	467	13.7	2,951	86.3	3,418
Lathyrus	1,180	83.3	237	16.7	1,417
Trifolium	2,741	95.4	131	4.6	27,872
Other genera	2,218	81.1	516	18.9	2,734
Grand Total	60,083	64.4	33,270	35.7	93,353

32. Because of the importance of the sub-region as a centre of diversity, germplasm collecting has been undertaken by international scientists and institutions since the beginning of the century. By the early 1980's and with the staffing of national institutions with trained scientists, countries have paid great attention to collecting plant genetic resources, especially crop species. Collecting activities have mainly been conducted by national institutions in collaboration with international centers and institutes such as IBPGR (IPGRI), ICARDA and institutions from developed countries, i.e. USA, Great Britain, Canada, France, Australia, etc. During the last decade, expedition missions in most countries and territories, except for Mauritania, Libya and Palestine, became frequent and were conducted in a systematic manner based on priorities to serve national genetic resources and breeding programmes.

33. IBPGR's (IPGRI) expeditions in the sub-region resulted in the collection of 28,878 samples during 123 collecting missions in the Mediterranean region. 64% of ICARDA collections are composed by accessions from West Asia and North Africa (WANA) region. These represent about 60,083 accessions (Table 4).

34. In the Maghreb countries, i.e. Algeria, Libya, Morocco and Tunisia, Herbaceous species (Forage and pastoral species) are the most collected. In Morocco, a total of 20,000 accessions representing mainly cereals, food legumes and forage crops are maintained in the storage facilities at different institutions (National Agronomic Research Institute (INRA), Agronomic and Veterinary Institute Hassan II (IAV Hassan II) and Livestock Department (CPSP). Early collections in Tunisia were undertaken to serve the breeding programmes. These were all active collections of annual species (durum wheat, barley, forage crops and cucurbitaceae). Some of these collections are



conserved in genebanks at the international level (USA, Italy and Australia, in particular). Currently, 1,070 accessions of different crops are maintained by the National Agronomic Research Institute (INRAT) and the Arid Areas Institute (IRA).

35. In Mauritania, *ex situ* activities are still at an initial stage. Some collecting missions were undertaken by international institutions such as IPGRI and the germplasm is conserved outside the country.

36. Collecting activities in Cyprus are organized by the Agricultural Research Institute (ARI). A total of 1,155 accessions of different crops are conserved at the CYPARI genebank. Faba beans were given priority in collecting because of the need for immediate evaluation and utilization.

37. In the past, institutions and individuals in Egypt have collected crop germplasm all over the country according to their needs and, in the absence of a national programme, good coordination between the parties involved was not achieved. A collection of about 7,000 seed samples representing different crops is stored at the Plant Genetic Resources Section in Bahteem, of the Field Crop Research Institute of the Agricultural Research Center.

38. In Jordan, several collecting missions have been conducted by different institutions for collecting cereal, food legumes and forage and pasture germplasm. More than 4,000 accessions of these crops are maintained at ICARDA genebank.

39. Two collecting missions were carried out during 1992-94, in Lebanon by the National Agronomic Research Institute (INRA) and a total of 196 samples of wheat and barley landraces and wild relatives were collected. These accessions are being characterized and evaluated.

40. In Syria, although collection missions have been implemented on a regular basis since 1970, there is a need to conduct more collecting missions and further studies are required on such accessions for environmental stresses such as drought, heat and salinity. There are about 8,750 accessions kept in the cold stores of the Genetic Resources Unit of the Directorate of Scientific Agricultural Research. The most important holdings of this bank are wild species and landraces of wheat, barley, chickpea, lentil and maize.

41. For vegetatively propagated crops and perennials, field genebanks are used to conserve the collections in most countries within the sub-region. There are 15 such field genebanks in Syria for conserving approximately 1,465 local landraces and exotic varieties of fruit trees. In Turkey, the vegetatively propagated material, mainly fruit genetic resources, are kept in field genebanks at 13 institutes. In Tunisia, 848 collections of fruit trees (date



palm, pomegranate, fig, olive, almond, apricot, grapes, etc.) are maintained in field genebanks by INRAT and IRA. The research institutions in Morocco, are conserving 746 species (3,000 accessions) of vegetatively propagated crops and fruit trees and perennials as field genebanks; also, 40 nurseries "Arboretum" of an area of 400 ha maintaining 114 populations of native and exotic forest trees were established. In Egypt, the Horticultural Research Institute of the Agricultural Research Center has established field genebanks for the conservation of the most important fruit trees and "landraces"; there are also six botanic gardens, some of which have collections dating back to 1873. Also the Desert Research Institute (Genetic Resources Unit) initiated field conservation for fruit trees under rainfed conditions. In Cyprus, besides field genebanks for conserving fruit trees maintained by the ARI and the Department of Agriculture, the Forestry Department has established a field genepool for the protection and conservation of the forest genetic resources.

Storage facilities

42. None of the countries in the sub-region, except Turkey, has a functional central national genebank. National collections in these countries are kept, as active collections, in facilities scattered between institutions. Drying facilities are lacking in most cases and efforts are spent in maintaining these collections through regeneration. In some countries and territories such as Algeria, Jordan, Lebanon, Mauritania and Palestine, even medium-term storage facilities are lacking and the situation has to be started from scratch. In the remaining countries, i.e. Cyprus, Egypt, Morocco, Syria and Tunisia, efforts were made by different institutions during the last decade to build medium term storage facilities to conserve national collections, though, these are not always properly working due to various maintenance factors such as electricity and compressor problems.

43. Until 1985, germplasm in Cyprus was stored under ambient conditions, in paper bags. Accessions were gradually grown for regeneration/multiplication in order to maintain seed viability according to IBPGR standards. In 1985 the CYPARI Genebank which contains mainly indigenous material, was established, funded by the Government of Cyprus and the IBPGR. The accessions are stored at 0-4°C with 50% RH. Seeds are gradually cleaned and transferred in hermetically sealed laminated foil bags. The material conserved in the genebank is only used by the staff of the Agricultural Research Institute (ARI).

44. In Egypt, a Genetic Resources Section of the Agricultural Research Center was established in 1987. The Section carries out the exploration, germplasm exchange, multiplication, characterization, evaluation, documentation and conservation of the center's mandate crops (cereals, food legumes, root and tuber crops and forage crops). The facilities consist of seed



cleaning and processing laboratories, a seed drying room, a large room and 2 small rooms for medium-term storage (0-5°C), and one large room for long term storage (between-15 & -18°C). These facilities are of limited capacity and to satisfy the country needs, a proposal to create a new national genebank is being developed.

45. Most of the collected material in Jordan is preserved at international genebanks (ICARDA, Japan, Canada, in particular). Recently the country has established a genetic resources unit at the National Center for Agricultural Research and Technology Transfer (NCARTT). The unit has four rooms, each measuring 35 m³, however these are not operational at present because of technical problems. A project proposal for establishing a national genebank for the country with long term storage and medium-term storage facilities was developed in cooperation with the IPGRI/WANA Office. For forest species, the country established a seed center in 1992 in cooperation with GTZ, aiming to conserve seeds of forest trees. This seed center has an active collection where seeds are stored in medium-term storage slightly above 5°C from which samples are drawn for distribution, exchange, multiplication and evaluation.

46. In Morocco, most of the institutions (INRA, IAV Hassan II, CPSP) have active collections at +4°C in five storage rooms. Base collections exist only for forage and pasture species (10,187 accessions), these are stored at -18°C in the same institutions. The seeds are stored in aluminum packs according to the international recommendations for seed conservation. However, there is no guarantee of long term reliable storage due to maintenance and electricity problems. A need for a national genebank exists. Following the signing of the FAO Plant Genetic Resources Undertaking, a project proposal for the establishment of the national genebank was developed in collaboration with FAO and IPGRI.

47. The Directorate of Scientific Agricultural Research in Syria has a medium-term cooling store, (90 m³, temperature 0 - 4°C and humidity 45-55%). It has been in use since 1987 with technical assistance from IBPGR. A new medium-term cooling store building was completed in 1995 (108 m³, temperature 0-4°C, and humidity 25-35%).

48. In Tunisia, a genebank was created at the "Institut National de Recherche Scientifique et Technique" (INRST) in 1982 for the conservation of national collections. It has cold rooms, seed processing and laboratory equipment. However, due to lack of funds and collaboration, the unit is facing some difficulties. Tunisia now plans to maintain its resources through a network of collections. The Arid Areas Institute (IRA) established a programme in 1986 for the conservation of forage and pasture germplasm of



the arid zones of the country. The Institute has a storage room of 24 m³ and the temperature is kept at 8°C.

49. The national seed genebank of Turkey was established in 1972 at the Aegean Agricultural Research Institute (AARI) in Izmir, to preserve genetic resources material collected since 1964. These facilities have been designed for the long-term and medium-term storage for both base and active collections, respectively. Cold rooms are kept at minus 18°C for long-term and 0°C for medium term storage. There are also facilities for temporary storage, with rooms kept at 4°C. For the safe duplication of the base collection, other storage facilities are available in Ankara (at the Field Crop Research Institute). These facilities consist of deep-freezers to keep the material in aluminum laminated foil bags. There are some research activities on the *in vitro* storage techniques of some vegetatively propagated plant species.

Germplasm regeneration, characterization and evaluation

50. Regeneration of germplasm is used by institutions lacking storage facilities in countries and territories within the sub-region to maintain genetic diversity and to conserve the collections. In countries with some storage facilities, regeneration of accessions is undertaken when viability of materials decreases below 85%. Regeneration and multiplication of collections is a bottleneck for most institutions within the sub-region since it requires large amounts of labor and funds.

51. Major efforts have been extended for evaluation for stress tolerance (abiotic and biotic). Several countries have screened a large number of germplasm accessions for hessian fly resistance in wheat, fusarium wilt and ascochyta blight resistance in chickpea and orobanche resistance and chocolate spot resistance in faba bean. Cold tolerance and drought tolerance screening has been carried out for several crops.

52. Although, characterization, evaluation and documentation are in advance stages in some countries, much more effort and international assistance are still needed in the sub-region. In most countries, IBPGR/IPGRI descriptors for characterization and evaluation are generally followed by scientists. For other countries, i.e. Lebanon, Jordan, Syria, some germplasm has been jointly evaluated by national institutions and ICARDA, and is well documented.

53. In Algeria, characterization and evaluation of the collected material is the main task conducted by several departments at the universities, but has been carried out on only a few cultivars. Conservation, documentation and regeneration activities still need to be developed. The establishment of a national plant genetic resources center and legislation related to the plant



genetic resources are some activities that should be considered in the near future.

54. The accessions held by the Agronomic Research Centre (Centre National de la Recherche Agronomique et de Développement Agricole, CNRADA) in Mauritania are maintained through cyclic multiplications and regenerations. International assistance is needed in establishing storage facilities and in strengthening the country's capabilities in characterization, evaluation, documentation and utilization of plant genetic resources.

55. In Morocco, characterization and evaluation are done by breeders, plant selection specialists and by research associates. Sixty per cent of forage and pasture accessions are characterized. Agronomic evaluation has been conducted for species of special interest (wheat, barley, medics, date palm, etc.). Efforts have been made for screening date palm collections for Bayoud disease caused by *Fusarium oxysporum*.

56. In Turkey, the characterization activities are carried out within the framework of the National Plant Genetic Resources Research Project (NPGRRP). The plant group (cereals, food legumes, forage crops, vegetables, industrial crops, fruit and grape, medicinal and aromatic plants, ornamental plants groups) teams are responsible for this task. The evaluation programs of plant groups are conducted in cooperation with the National Plant Breeding Programs. The characterization and evaluation activities were also started in recent years for seed propagated plants, while characterization and evaluation of fruit collections are conducted parallel to other research and breeding programmes.

Documentation

57. The status of documentation of genetic resources collections in the sub-region varies from one country to another, and even between institutions within the same country. Through the workshops and training on documentation organized by international institutions and organizations (FAO, IPGRI and other CGIAR Centers), countries are moving towards well organized and computerized documentation systems.

58. In Algeria, documentation of plant genetic resources collections is mostly kept manually. However, for a number of samples, the passport, characterization and evaluation data are being computerized. In Egypt, data is partially computerized. Most of the germplasm that is used is kept by both the breeders and the Genetic Resources Section, and the link to the Genetic Resources Section needs to be strengthened. Both the information and the seed flow from/to the users is not well developed. A national programme is



under development with the aim of coordinating and expanding the role of the Genetic Resources Section of the ARC.

59. All the collected materials in Morocco are well documented and the information is computerized particularly for forage species. In Turkey, documentation is one of the main functions of the National Plant Genetic Resources Research Project (NPGRRP) for both *ex situ* and *in situ* activities. Passport data for *ex situ* conservation, evaluation and regeneration data is recorded on standard formats and a computerized database is available.

***In situ* conservation**

60. *In situ* conservation activities in the sub-region started with the establishment of forest laws. Since then, several national parks, protected areas, wildlife reserves, and bird sanctuaries have been created (Table 5). *In situ* conservation programmes and activities are carried out in the framework of Forestry Plans, Desertification Control Plans and Range Management and Rehabilitation Programmes as in Algeria, Tunisia, Morocco and Mauritania. Natural forest management and conservation projects exist in all countries, however, these areas are not managed with the aim of overall ecosystem conservation.

61. Among countries and territories in the sub-region, Algeria has the greatest percentage of protected area in relation to size, with 2 biosphere reserves covering more than 7 million hectares, followed by Mauritania which has one national park of 1,173,000 ha in the wetlands (as stated by IUCN reports).

62. Most countries have ratified several conventions and treaties related to biodiversity conservation (Table 2). However, it should be noted that the lack of financial support and poor involvement of local communities in conservation project formulation and implementation, renders the management of the protected areas more difficult and less effective. To promote the conservation of the environment, several Non Governmental Organizations (NGO) have been created in most countries but their role is still limited, largely due to lack of funds.



Table 5 National parks, protected areas and reserves in the sub-region

Country/Territory	National parks and protected areas		Other reserves and protected sites (Rangelands, etc.,..)
	Number	Area (ha)	Area (ha)
Algeria	9	53,157,706	79,100
Egypt	9		
Jordan	6		47,200
Mauritania	5	1,200,000	48,000
Morocco	4	98,503	2,000,000
Palestine		5,000	35,000
Syria	3		50,000
Tunisia	6	40,778	
Turkey			98,386

63. Before the coming into force of the Convention on Biological Diversity, none of the countries had carried out any organized action of *in situ* conservation of wild relatives of cultivated plants. Turkey is the only country in the sub-region that has initiated such action, in 1994. In fact, within the frame work of Turkish *in situ* conservation of Genetic Diversity Project which is a Global Environment Facility (GEF) project, some forest tree species will be conserved in a selected site (Kaz Daglari), and *in situ* Gene Management Zones (GMZS) will be established for targeted tree species. This project is aimed at protecting both non-woody and woody crop relatives on the basis of an integrated multi species approach. The project also aims to integrate *in situ* conservation with existing *ex situ* conservation programmes.

64. Formal institutional programmes and projects on "on farm conservation" are lacking in the sub-region. Nevertheless, conservation of landraces and local varieties has been undertaken by farmers since they started cultivation of crops. Through traditional ways of crop management and the selection of best crops and best seeds, farmers have contributed, and are still contributing, to crop improvement. As a result, a great diversity of traditional plant genetic varieties has been created. By their "know how", farmers have often found ways to overcome the environmental constraints (harsh environment, diseases, etc..) through the growing of mixture varieties. However, under demographic pressure and agricultural intensification based on a limited number of improved varieties, much of the traditional diversity-based farming systems are disappearing, and landraces and local varieties persist *in situ*, mainly in isolated and marginal areas in the sub-region.



Genetic erosion of wild species and landraces is alarming and thus an inventory, evaluation and conservation of plant and animal genetic resources is urgently needed.

d. Uses of plant genetic resources in the sub-region

65. Plant genetic resources from the sub-region have been widely used in breeding programmes around the world. Several traits and characters such as high yield, disease and insect resistance, cold or drought tolerance serve as the basis of crop improvement in these programmes. A good example concerns local ecotypes of forages from North Africa that have been used at an international level to produce commercial cultivars such as Berber, Ichkhel and Kasba of *Dactylis glomerata*; El Golea, Sirocco and Soukra of *Phalaris aquatica*; Djbeniana, Grombalia, Maris Jebel, Maris Kasba and Mornag of *Festuca arundinacea*, Demnat and Gabes of *Medicago sativa*, Rivoli of *Medicago tornata*, El Gara of *Ornithopus compressus* and Jebala of *Ornithopus pinnatus*; etc. During the last decade, and with the collaboration of the CGIAR centers, national breeding programmes within the sub-region have made a great effort to improve germplasm collections, and to enhance germplasm evaluation and utilization within the sub-region, particularly for cereals, food legumes and forage crops. Many variety releases in the sub-region for field crops have been through use of germplasm collected in this region or from direct selection from this germplasm.

66. Most of the countries in the sub-region have strong and adequately staffed breeding programmes. However, in Libya and Mauritania, these programmes still need to be staffed with trained scientists. Evaluation of the germplasm in the sub-region is not done in a systematic way but in response to the breeder's objectives and needs. In fact, plant genetic resources are utilized locally by the research institutions and universities either to develop improved varieties through breeding or to make available good cultivars to be used by farmers. Breeding activities are Government funded in all the countries. Despite the involvement of the private sector in seed commercialization and distribution in all of the countries, it is not the case for the breeding activities, except in Turkey, Egypt and Morocco where private companies are becoming involved in these activities. Farmers are being involved during demonstration and yield trials but are not directly involved in breeding work. With regard to forest genetic resources, there are several collections available as field genebanks in several countries as stated in Section C.



67. In Cyprus, plant breeding is conducted only at the Agricultural Research Institute (ARI). Efforts are concentrated on hybridization programmes of cereals, faba bean and forage crops using local landraces and improved varieties introduced from the CGIAR Centers, mainly ICARDA and CIMMYT. Evaluation of faba bean for agronomic traits has been conducted since 1981. Germplasm evaluation of fruit trees (olives, citrus, loquats, figs and pomegranates) is also carried out. Seed distribution is well organized. Orchards of forest seed production have been established. The variety improvement programme of field crops aims at better utilization of the limited resources (land, water) by increasing yields and improving the quality of production. During the last 25 years, the breeding programme of ARI has produced new varieties of durum wheat, barley, forage crops and food legumes, which are grown by farmers. There is a need for improved facilities (field and laboratory equipment) and training of scientific and technical staff on modern methodology (genetic engineering etc.).

68. The breeding programme in Egypt is mainly carried out by the Agricultural Research Center. It is oriented to meet the national food needs, taking into consideration biotic and abiotic stresses as well as yield and agronomic characteristics. In the last decade, the Field Crop Research Institute, which includes 16 sections dealing with germplasm enhancement and evaluation as well as crop improvement, has released many high yielding cultivars of wheat, barley, maize, rice, faba bean, soybean, lentil, sorghum, onion, sesame, flax and fodder crops. These varieties have almost doubled the national production of wheat, maize and rice. Also, several varieties have recently been released for fruit trees, cotton and sugar cane; however, the vegetable and fruit trees programme needs to be strengthened. Seed production and distribution is well organized according to the seed certification regulations.

69. Wild genetic material collected from Jordan is mainly stored in genebanks outside the country. Therefore, the plant breeding programmes in Jordan are concentrated on enhanced germplasm of cereals and food legumes introduced from CGIAR centers, mainly CIMMYT and ICARDA. Field crop breeding using local germplasm is being conducted by public sector institutions, with the objective of producing varieties which can tolerate the stress conditions, mainly drought. Several wheat and barley varieties have been released. Recently the research at universities has become active in the production of potato seeds using tissue culture techniques. However, there are still no field genebanks for fruit trees to be used in breeding and the country imports large quantities of fruit plants. The private sector is very active in supplying seeds to farmers, especially through importation of hybrid seeds of vegetable crops. It is of vital importance that efforts are coordinated and genebanks established.



70. The breeding programme in Lebanon is carried out by the National Agronomic Research Institute (INRA). Since 1960, several wheat varieties have been released using CIMMYT semi dwarf varieties. Hybridization and population selection are used in breeding programmes to develop improved varieties with traits such as adaptation to the local environmental conditions, resistance to disease and high yield. Certified seed production does not cover the farmers demand. INRA is in charge of cereal seed production, but private companies are importing seeds and plants of fruit trees and vegetables.

71. In Mauritania, all the plant genetic resources activities are conducted by the National Research Centre "Centre National de Recherche Agronomique et de Développement Agricole (CNRADA)" at Kaedi. This center counts about 15 researchers in all fields. The main objectives of this center are to reduce the cereal deficit (Sorghum, Rice, Mil) and to meet the country's food needs. Mass selection of landraces and traditional cultivars and adaptation of cultivars introduced from the region, through CGIAR centers and UNDP/FAO projects, are the prime tasks of the breeding programme. As stated before, Mauritania is lacking in seed laws, thus no certified seeds are produced in the country. Farmers use their own seeds and the Government is making efforts to organize the sector by developing community stocks and by promoting the use of the best local cultivars within a UNDP/FAO project on the extension of quality seed production of traditional varieties "Appui à la vulgarisation de la production de semences traditionnelles de qualité".

72. In Morocco, plant breeding has been considered the main axis of agricultural research for improvement of crop productivity. Plant breeding programmes are based on (1) local germplasm, such as pasture and forage, some fruit trees and date palm germplasm, (2) exclusively on introduced germplasm, mainly for horticultural crops (vegetables and fruit trees (apple and plum), and (3) hybridization between the local and the introduced germplasm as it is in the case of cereals, oil crops and forest trees. The plant breeding efforts undertaken, mainly by the National Agronomic Research Institute (INRA), using both the local and the introduced germplasm, have contributed to the creation and registration of 138 varieties. These improved varieties are for different species which are economically and socially important to the country (wheat, barley, food legumes, forages, date palm, fruit trees, etc.). Seventy five cereal varieties were released, 6 of which by the private sector. The main objective of the research programme is to meet the national food needs. Traits considered in the breeding programmes are: adaptability to drought, disease and insect resistance and high yield. During the last decade the yield improvement due to genetic gain is 35% for soft wheat, 60% for durum wheat and 50% for barley. A great effort has been made by INRA to select resistant genotypes of date palm to the "Bayoud" disease (*Fusarium oxysporum*). For forage crops, research is conducted by



INRA, the Agronomic Institute Hassan II (IAV) and the Livestock Department (CPSP). Several varieties of fruit trees were also released, however, the vegetable breeding programme is still too weak and all the hybrid varieties used are imported. Seed production and distribution is well organized according to the seed certification laws. The private sector is heavily involved in seed commercialization.

73. The breeding programme in Syria is carried out by the Directorate of Scientific Agricultural Research. A good collaboration exists between scientists working in the genetic resources unit and the plant breeders. After preliminary evaluation, germplasm materials are supplied to the breeders. Plant breeding programmes concentrate on wheat, barley, chickpea, lentil and faba bean, using local landraces and hybridization, with introduced varieties from CGIAR centers. Plant breeding programmes give special importance to traits such as drought resistance, earliness, disease resistance and high yield. As a result of breeding work since the early 1970s several varieties of wheat, barley, chickpea, lentil, maize and faba bean have been released. Neither foreign companies nor the private sector conduct plant breeding activities in Syria. There is, however, close collaboration with ICARDA and ACSAD in developing the above varieties. Plant breeders also collaborate closely with farmers to conduct on-farm trials under the different farmers' conditions before officially releasing such varieties. Distribution of seeds of the main crops is organized through a State related company.

74. The breeding programme in Tunisia is led by the National Agronomic Research Institute (Institute National de Recherche Agronomique, INRAT). Presently, all plant genetic resources activities are related to the objectives of the breeding programmes. These programmes consist of population selection of local materials and hybridization materials with good traits such as precocity, disease resistance, frost adaptation etc.. All these activities tend to improve crop production (forage plant crops, cereals and some vegetables) and to secure food for the country. Despite some success with cereals and vegetables, the genetic diversity of forage crops has not yet been explored due to lack of means, sufficient scientists and lack of private companies for seed multiplication of forage crops. The use of plant genetic resources in the breeding programmes allows Tunisia to have plant materials adapted to local conditions (adaptation to drought for barley, resistance to Hessian fly for wheat, quality for pepper, etc..). To further develop the breeding programmes the Government is considering the establishment of breeder's rights which will finance the research institutions and motivate the private sector to invest in this field.

75. In Turkey, there are 19 National Projects working on crop improvement. The objectives of most breeding programmes are to improve the new varieties with high yield, resistance to stress factors and resistance to



diseases/pests. These programmes have established a good working relationship with the National Plant Genetic Resources Research Project (NPGRRP). The latter is concentrating its efforts to collect and conserve plant species, either under threat or required by the National Crop Research Projects. Characterization and evaluation activities of plant genetic resources are also being carried out with the collaboration of national crop research projects. Therefore the respective crop scientists (breeders/agronomists, pathologists) will have the opportunities to evaluate and identify the accessions for their utilization in crop improvement programmes. Most frequently used plant species are *Triticum*, *Hordeum*, *Vicia spp.*, *Sesamum*, *Helianthus*, *Phaseolus*, *Cicer*, *Cucurbita*, *Hibiscus*, *Lactuca*, *Pappaver*, etc.. The fruits and vegetable genetic resources are commonly and most frequently used by national fruit and vegetable programmes. Food legumes and oil seed crop programmes are also frequent users of the material. The plant breeding activities are primarily conducted by government funded programmes but some private companies and multinational companies have breeding activities. Farmers are not involved in the breeding work *per se* but improved varieties are introduced to them with on-farm trials by breeders and through demonstrations by extension experts. The improved varieties released from the national plant genetic resources collection are the direct benefit of the country's agricultural sector.

VI. NEEDS, OPPORTUNITIES AND CONSTRAINTS

a. Needs and Constraints for the Sub-region at the technical, institutional and policy level

The following needs and constraints have been identified for the sub-region as a whole.

National Programmes

76. Elaboration of national strategies and programmes for the conservation and utilization of plant genetic resources for sustainable development. The commitment of policy makers is essential to achieve this goal.



77. Encouragement of collaboration between different scientists and institutions dealing with plant genetic resources within the countries. The establishment/strengthening of National Plant Genetic Resources Coordination Committees at a high level is necessary to achieve this collaboration.

78. Assistance for developing legislation on plant genetic resources including intellectual property rights and farmer's rights.

Research, Training and Capacity building

79. Capacity building is needed at all levels for the national programmes of all countries in germplasm collecting, characterization, evaluation, conservation, regeneration, documentation and utilization.

80. The development of basic specialized training activities in botany, *in situ* conservation, forest genetics, ecology and global and multi-disciplinary approaches. Training is also required for administrators, technicians and managers, concerning current policies for plant genetic conservation and utilization.

81. The emergence of a center of excellence engaged in training on plant genetic resources in coordination with various higher-level educational and research institutions (MSc and Ph.D. levels).

Adequate conservation

For in situ conservation

82. Preparation of a national plan for conservation of wild of crops.

83. Inventories of areas with high plant diversity. Determination of genetic diversity of target species in selected sites. Survey of endangered and threatened species.

84. Setting up of policies for sustainable *in situ* conservation of crops.

85. Promotion of *in situ* conservation of crops (on-farm conservation) based on an integrated system approach that includes socio-economic studies on the conservation of crops, determination of genetic diversity and conservation biology research on target species.



86. The management and restoration of ecosystems, taking into account the existing economic and social constraints. The protection of water and soils should also be at the center of biological conservation concerns.

For ex situ conservation

87. Creation/reinforcement of national genebank facilities for both seed and vegetatively propagated species.

88. Promoting/strengthening the conservation and use of desert plants and underutilized species.

89. Extend the conservation work to horticultural crops (fruit trees, date palm and vegetables) and mobilize the means to ensure their long-term management (field genebanks).

90. Engagement of different institutions in the *ex situ* conservation of wild plants, mainly through genebanks of forest species, arboreta and botanic gardens. These conservation structures should be developed, supported and organized to meet precise objectives.

Adequate use

91. Strengthening the evaluation and documentation capabilities of national programmes to ensure a flow of germplasm and information, which will lead to better use of germplasm.

92. Reinforcement of breeding programmes of fruit trees, vegetables and pasture species to enhance local germplasm use.

93. Promotion of "on farm" or decentralized breeding for adequate use of landraces.

94. Establishment of better institutional linkages between conservation, evaluation and utilization programmes and structures.

Sub-Regional Collaboration

95. Encouragement of the exchange of plant genetic resources information and materials at a regional and international level through the creation and/or the reinforcement of specialized networks. The mandate of these networks is to promote collaborative research, exchange of information, exchange



of experience and to formulate proposals for sub-regional projects. Special attention should be paid to the spreading of information within the networks and between structures.

96. Emergence of sub-regional plant genetic research centres in different countries to keep a duplicate of base collections of specific crops and to maintain and make available central inventory database on plant genetic resources of the sub-region for such crop/group of species.

97. The reinforcement of collaboration in different fields offered by different International Centers or institutions such as CIHEAM, IPGRI, ICARDA, FAO, UNDP and others.

b. Opportunities and comparative advantages of the sub-region

98. A number of joint research projects and networks have been developed across the sub-region. WANANET enabled the organization of national programmes and promoted cooperation within the region. ICARDA helped in the enhancement of germplasm and evaluation through sub-regional research. Several seminars and training workshops conducted in the region were opportunities for scientists to exchange the views and experiences. However, networking and projects are by far the best way of promoting collaboration between countries within the sub-region. Some of the sub-regional projects that have been or are being developed by FAO in the area are listed in Table 3. New sub-regional projects are also under preparation and might be considered as contributing to the implementation to the Global Plan of Action:

- The Maghreb GEF project entitled "Conservation and sustainable use of the diversity of plant genetic resources in the Maghreb" is being developed for Algeria, Morocco and Tunisia. The objective of this project is to seek to arrest the genetic erosion through enhanced conservation of the plant genetic resources, including their utilization and by facilitating dialogue between and within the Maghreb countries for a better management of their common patrimony.
- Several countries with technical support from IPGRI, are developing a project to strengthen the scientific basis and capacity for *in situ* conservation (On farm conservation). Turkey and Morocco were selected as priority countries to carry out the study in the sub-region. The specific objectives of the collaborative research programme are:
 - To improve capacity in national programmes to undertake *in situ* conservation.



- To develop biological and socio-economic science for *in situ* onservation of agricultural biodiversity.
- To plan and implement country programmes for *in situ* conservation.
- To provide training for planning and implementing *in situ* conservation programmes.



Appendix 1 *Basic facts of the countries and territories in the sub-region*

Country/ Territory	Population (1000) 1992		Active population (1 000) 1991	
	Total	Labor force (1000) 1992	Total	Land use (1000 Ha) 1991
Mauritania	2,142	63.59	685	63.50
Marocco	26,359	34.60	8,202	34.82
Algeria	26,360	22.80	6,194	23.31
Tunisia	8,542	22.37	2,855	22.38
Libya	4,882	13.19	1,209	13.15
Egypt	54,825	39.51	15,287	39.52
Jordan	3,536	5.43	897	5.13
Palestine	1,630	3.37	255	5.10
Lebanon	2,789	7.85	866	7.85
Syria	13,472	23.01	3,340	22.99
Chyprus	714	19.75	331	19.64
Turkey	58,165	42.30	25,274	46.30
Total	203,416	33.93	65,395	37.06



Appendix 1 (continued)

Country Territory	Land use (1 000 Ha)				
	Total Surface	Arable area			
		Total Arable Area & Permanent crops	Arable area as % of total Land area	Permanent crops as % of Arable area	Irrigated Area as % of Arable area
Mauritania	102,522	205	0.20	1.46	5.85
Marocco	71,230	9,620	13.51	6.44	13.25
Algeria	238,174	7,653	3.21	7.42	5.07
Tunisia	15,536	4,875	31.38	40.35	4.76
Libya	175,954	2,160	1.23	16.20	12.31
Egypt	99,545	2,643	2.66	14.23	100.00
Jordan	8,893	402	4.52	26.37	-
Palestine	618	232	37.54	6.47	9.48
Lebanon	1,023	306	29.91	29.41	28.10
Syria	18,392	5,625	30.58	13.42	12.44
Chyprus	924	156	16.88	31.41	23.08
Turkey	76,963	27,689	35.98	10.92	8.67
Total	809,774	61,566	7.60	23.37	23.77



Appendix 1 (continued)

Land use (1 000 Ha)				
Country/ Territory	Forest		Permanent Pasture	Other lands
	Total area	% of Total Land area	Total area	% Total Land area
Mauritania	4,420	4.31	97,897	95.49
Marocco	9,050	12.71	52,758	74.07
Algeria	4,050	1.70	226,471	95.09
Tunisia	668	4.30	9,993	64.32
Libya	695	0.39	173,099	98.38
Egypt	31	0.03	96,871	97.31
Jordan	70	0.79	8,421	94.69
Palestine	30	4.85	356	57.61
Lebanon	80	7.82	637	62.27
Syria	730	3.97	12,037	65.45
Chyprus	123	13.31	645	69.81
Turkey	20,199	26.25	29,075	37.78
Total	40,146	4.96	708,206	87.46

(Data from FAO statistics, 1990-95).



Appendix 2 Trade values of the countries and territories in the sub-region

Country/ Territory	% Agric. GDP	Food import dependency (%)	Food & Animals import 1,000\$
Mauritania	18,0		142,15
Marocco	17,0	28,0	507,696
Algeria	30,0	71,0	2,245,890
Tunisia	16,0	59,0	301,038
Libya	5,0	73,0	989,050
Egypt	20,0	45,0	1,946,990
Jordan	10,0	85,0	656,128
Palestine	21,0		
Lebanon	30,0		463,717
Syria	30,0	29,0	609,692
Chyprus	6,1		202,694
Turkey	16,0	5,2	44,170

(Data from FAO statistics, 1990-95).



Appendix 2 (continued)

Country/ Territory	Food & Animals export 1,000\$	Cereals & Prep. import 1,000\$	Cereals & Prep. export 1,000\$
Mauritania	40,190	56,580	210
Marocco	593,717	220,064	1,334
Algeria	25,980	749,510	
Tunisia	132,611	107,151	19,977
Libya	430	352,910	
Egypt	221,720	961,680	40,780
Jordan	167,851	222,164	11,567
Palestine			
Lebanon	128,906	96,500	
Syria	361,269	259,911	41,647
Chyprus	165,727	77,584	2,646
Turkey	266,538	11,255	46,615

Country/territory	Forestry products import 1,000\$	Forestry products export 1,000\$
Mauritania	3,033	
Marocco	226,094	60,719
Algeria	362,000	
Tunisia	158,410	5,415
Libya	75,750	
Egypt	16,727,420	
Jordan	60,949	9,267
Palestine		
Lebanon	70,374	2,451
Syria	114,966	113
Chypus	66,911	430
Turkey	24,402	4,170



Appendix 3 Major Crops originating from Mediterranean and West Asian regions

Crops		Mediterranean Centre	Near Eastern Centre
Cereals			
Oats	<i>Avena</i> spp.	+(<i>A. strigosa</i>)	+(<i>A. byzantina</i>)
Barley	<i>Hordeum vulgare</i>	+	+
Rye	<i>Secale cereale</i>		+
Wheats	<i>Triticum durum</i>	+	+
	<i>Triticum aestivum</i>	+	+
Pulses			
Chickpea	<i>Cicer arietinum</i>		+ (Centre secondaire)
Lentil	<i>Lens culinaris</i>		+
Peas	<i>Pisum sativum</i>		+ (Centre secondaire)
Faba bean	<i>Vicia faba</i>	+	
Vegetables			
Lettuce	<i>Lactuca sativa</i>	+	
Turnip	<i>Brassica campestris</i>	+	
Cabbage	<i>Brassica oleracea</i>	+	
Radish	<i>Raphanus sativus</i>	+	
Onion	<i>Allium cepa</i>	+ (Centre secondaire)	+ (Centre secondaire)
Garlic	<i>Allium sativum</i>	+ (Centre secondaire)	+ (Centre secondaire)
Carrot	<i>Daucus carota</i>		+
Artichoke	<i>Cynara scolymus</i>	+	
Mustards	<i>Sinapis-alba/Brassica nigra</i>	+	
Spices and plants producing etheric oils			
Cumin	<i>Cuminum cyminum</i>	+	
Peppermint	<i>Mentha piperita</i>	+	
Fennel	<i>Foeniculum vulgare</i>	+	
Oil crops			
Olive	<i>Olea europaea</i>	+	
Safflower	<i>Carthamus tinctorius</i>	+	
Fruit trees and nuts			
Fig	<i>Ficus carica</i>		+
Almond	<i>Prunus amygdalus</i>		+
Apricot	<i>Prunus armeniaca</i>		+
Pistachio	<i>Pistacia vera</i>		+
Pomegranate	<i>Punica granatum</i>		+
Plum	<i>Prunus ciracefera</i>		+
Pear	<i>Pyrus</i> spp.		+ (Asie mineure)
Grapes	<i>Vitis vinifera</i>	+	+
Fiber/Jute crops			
Flax(linseed)	<i>Linum usitatissimum</i>		+
Sesame	<i>Sesamum indicum</i>		+
Forages			
Lucerne	<i>Medicago sativa</i>		+
Berseem	<i>Trifolium alexandrinum</i>	+	
Vetch	<i>Vicia sativa</i>	+	+



Appendix 4 National Programmes and legislations in the sub-region

Country/ Territory	National Programme ¹	Programme Status ²	Laws for PGR Protection	Budget Security ³
Algeria	Breeding	Multi	No	+-
Chyprus	PGR/Breed.	Multi	No	+-
Egypt	Breeding	Multi	No	+-
Jordan	Breeding	Multi	No	+-
Lebanon	Breeding	Multi	No	+-
Libya	Breeding	Multi	No	+-
Mauritania	Breeding	Mono	No	+-
Marocco	Breeding	Multi	No	+-
Palestine				
Syria	Breeding	Multi	No	+-
Tunisia	Breeding	Multi	No	+-
Turkey	PGR/Breed.	Multi	Yes	Oui

¹ None of the countries and territories, except Turkey, has an integrated PGR programme, but institutions within countries have breeding programmes.

² Most countries have a multi-institutions programme.

³ +/-: The budget for PGR activities is not really secure and varies from year to year.



Appendix 4 (continued)

Country/ Territory	Presence of Nat PGR Committee	Coordination Status between Institutions	Quarantine & Phytosanitary Legislation	Seed Certification Laws
Algeria	No	Good	Yes	Yes
Chyprus	Yes	Good	Yes	Yes
Egypt	No	No	Yes	Yes
Jordan	Yes	Little	Yes	Yes
Lebanon	No	Little	Yes	Yes
Libya	No	Little	Yes	Yes
Mauritania	No	No	No	No
Marocco	Yes	Little	Yes	Yes
Palestine				
Syria	No	Little	Yes	Yes
Tunisia	Yes	Little	Yes	Yes
Turkey	Yes	Good	Yes	Yes

Country/ Territory	Forestry Laws	Intellectual Property Rights	Involvement of Private Sector
Algeria	Yes	No	No
Cyprus	Yes	No	No
Egypt		No	No
Jordan		No	No
Lebanon	Yes	No	No
Libya	Yes	No	No
Mauritania	Yes	No	No
Morocco	Yes	No	Little in breeding
Palestine		No	No
Syria	Yes	No	No
Tunisia	Yes	No	No
Turkey	Yes	No	Little in breeding



Appendix 5 Biodiversity projects in the sub-region, Global Environmental Facility (GEF)

Country	Project/Name/ Number	GEF Implementing Agency	Executing Agency	Associated Participation
Algeria	El Kala National Park and Wetlands Management 5 ALGGE001 (TF 28641)	World Bank	Ministry of Agriculture, National Conservation Agency, El Tarf Wilaya	To be determined
Egypt	Red Sea Coastal and Marine Resources Management 5EGTGE001 (TF 28628)	World Bank	Tourism Development Authority, Egyptian Environmental Affairs Agency, Red Sea Governate	UNEP
Jordan	Conservation of the Dana & Azraq Protected Areas JOR/92/G31	UNDP	Govt. of Jordan	Royal Society for the Conservation of Nature
Turkey	<i>In situ</i> conservation of Genetic Biodiversity 7TURGE001/2 (TF 28632)	World Bank	Govt. Ministries of Agriculture & Rural Affairs, Forestry & Environment	Turkish Society for the Protection of Nature



Appendix 5 (continued)

Country	Entry into Work Program	Approved Date	Duration	Status
Algeria	5/91	4/94	4 years	Grant effective 9/94
Egypt	5/92	11/92	3 years	Grant awaiting effectiveness due to delays from associated Bank loan.
Jordan	5/92	5/93	3 years	Under implementation. First annual review held 2/95. Both project components processing well in accordance with established workplan
Turkey	5/92	2/93	5 years	Under implementation

Source: Global Environmental Facility, Quarterly Operational Report, April 1995.



Appendix 6 Plant genetic resources conservation programmes in the sub-region

Country/ Territory	<i>In situ</i> conservation activities	
	<i>In situ</i> conserv. of forest & wild species	On farm conservation programmes
Mauritania	Yes	No
Marocco	Yes	No
Algeria	Yes	No
Tunisia	Yes	No
Libya	Yes	No
Egypt	Yes	No
Jordan	Yes	No
Palestine		
Lebanon		No
Syria	Yes	No
Chypris	Yes	No
Turkey	Yes	No

Country/ Territory	<i>Ex situ</i> conservation activities			
	National collections	Field Genebank	National Genebank	Storage facilities
Mauritania	Yes	Yes	No	Mid term
Marocco	Yes	Yes	No	Mid and Long term
Algeria	Yes	Yes	No	-
Tunisia	Yes	Yes	No	Mid term
Libya	Yes	Yes	No	-
Egypt	Yes	Yes	No	Mid & Long term
Jordani	Yes	Yes	No	No
Palestine				
Lebanon	Yes	Yes	No	No
Syria	Yes	Yes	No	Mid term
Chyprus	Yes	Yes	No	
Turkey	Yes	Yes	Yes	Mid and Long term



Appendix 6 (continued)

Country/ Territory	<i>Ex situ</i> conservation activities				
	Drying facilities	Duplicated samples	Regeneration activities	PGR Documentation	Distinction between Charact. and Evaluation
Mauritania	No	Outside	Yes	Manual	No
Marocco	Yes	Outside	Yes	Partially computerized	Yes
Algeria	No	Outside	Yes	-	Yes
Tunisia	No	Outside	Yes	Manual	Yes
Libya	-	Outside	Yes	-	-
Egypt	Yes	Outside	Yes	Partially computerized	Yes
Jordan	No	Outside	No	Partially computerized	Yes
Palestine					
Lebanon	No	Outside	No	Manual	No
Syria	No	Outside	No	Partially computerized	Yes
Chyprus		Outside	Yes		Yes
Turkey	Yes	in & and outside	Yes	Computerized	Yes



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