

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

**CONSERVATION AND
SUSTAINABLE UTILIZATION OF
PLANT GENETIC RESOURCES IN
CENTRAL ASIA**
Sub-Regional Synthesis Report

**Annex 1 of the Report of the
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West and Central Asia**
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I. INTRODUCTION

The Sub-Region and its Agricultural Sector

1. The South-West Asia sub-region as defined in this report includes the following countries: Afghanistan, Bahrain, Iran, Iraq, Oman, Pakistan, Qatar, Saudi Arabia, Turkey, United Arab Emirates (UAE) and Yemen.
2. Covering an area of 7,316,410 sq. km, the sub-region stretches from Turkey in the west to Pakistan in the east and contains some of the world's highest mountains, with peaks exceeding 7000 meters on the Pakistan/Afghanistan border and 5000 meters in Iran. It is also home to the deepest exposed depression on land, the shore surrounding the Dead Sea, which is 400 meters below sea level. The sub-region has a total population of 317,504,000 inhabitants.
3. Climatic and ecogeographical conditions in the region vary from the fertile alluvial lowlands of Iraq to the dry sand-seas of the Rub'al Khali in Saudi Arabia. Climates vary from sub-humid (>120 days growing period) to arid (<75 growing period). Countries with Mediterranean climate have relatively mild temperatures and precipitation in the winters and hot, dry, rainless summers. The monsoonal Near East sub-region (particularly Pakistan) is characterized with hot climate and rainy summers. Areas of Saudi Arabia may receive no rain for several year and in parts of southeast Turkey and Saudi Arabia, the daily maximum and minimum temperatures can differ by as much as 30°C.
4. Of the 700 million hectares total land area, 26% are permanent pastures, 11% are arable lands, 7% are occupied by forest and 55% are wasted lands. Most of the land in the sub-region (70%) is located in the arid zones. Of the 81 million hectares of arable land, 61% are rainfed and only 39% are irrigated; this shows that agriculture is very dependent on the climatic factors. In fact, drylands occupy small, but significant, areas in most countries but Oman and Pakistan, in particular, have a heavy reliance on irrigation (Appendix 1).
5. Agriculture plays an important role in the economy of the sub region, except for some oil producing countries. The degree of urbanization within the region varies from country to country. About 42% of the population live in rural areas and of 99 million counted as labor force, 42% are occupied in the agricultural sector (Appendix 1).



6. Agricultural production is dominated by crop production and it contributes for more than 20% of the Gross Domestic Product (GDP) for countries such as Pakistan, Iran, Yemen and Afghanistan. The high income countries such as Bahrain, Kuwait, Qatar, Saudi Arabia and the UAE have less than 5% of their GDP generated by agriculture (Appendix 2).

7. Most countries in the sub-region have ratios of arable land per capita below the world average of 0.28 ha and almost all of them are not self sufficient in food supply (Appendix 2). Turkey is the only country close to self sufficiency in cereal production. Even in some oil-rich countries, the level of food imports, as percentage of export revenue, has been rising since the mid-eighties because of declining oil prices. On the other hand, all countries import forestry products.

8. Currently, each country in the region is faced with difficulties associated with past and continuing pressures on its natural resources. These pressures include serious soil erosion, loss of arable land, loss of water resources and loss of species diversity as forests and woodlands disappear and rangelands become deserts.

Indigenous Plant Genetic Resources

9. The sub-region has provided humankind with food, fibre, oil and other economic plants for thousands of years. Many of the world's most popular food comes from plants which originated in the area. It is estimated that the sub-region has a flora of more than 15,000 species of higher plants, a high proportion of which are endemic (Table 1). Of the flora, more than 10% are considered as threatened species. The highest plant diversity occurs in Turkey (with 163 plant families, 1,225 genera, 9,000 species and 3,000 plant taxa as endemic).

Forest genetic resources

10. The forest distribution in the sub-region is largely governed by the climatic and edaphic factors. Generally, we can distinguished two forest types: the Mediterranean forest and the desert like scrub forest. The Mediterranean type forest include a wide range of genera and species of evergreen and deciduous trees and shrubs. Important hardwood genera include *Quercus*, *Abies*, *Alnus*, *Cedrus*, *Cupressus*, *Juniperus*, *Pinus*, *Picea*, *Acer*, *Aesculus*, *Prunus*, *Fraxinus*, *Fagus*, *Ficus*, *Populus*, *Tilia* and *Ulmus*. There are no Iranian native *Abies*, *Picea* and *Pinus* species. The temperate deciduous tree genera such as *Alnus*, *Acer*, *Aesculus*, *Prunus*, *Fraxinus*, *Corylus* and *Ulmus* are met fairly



Table 1 Flora and endemism in the sub-region

Country	Number of species	Number of endemics	Number of Threatened species
Afghanistan	3 500	1 100	4
Bahrain	196	0	
Iran	6 533	2 200	301
Iraq	2 921	190	1
Kuwait	235	0	1
Oman	1 021	74	2
Pakistan	4 930	372	14
Qatar	221	0	
Saudi Arabia	1 737	34	2
Turkey	9 000	3 000	1 944
United Arab Emirates	342	0	
Yemen	2 336	135	134

(Source: World Conservation Monitoring Centre, 1992)

associated in Himalayan temperate forest. The main genera of scrub forest occurring in drier areas include *Acacia*, *Ziziphus*, *Prosopis*, *Calotropis*, *Tamarix*, *Capparis*, *Euphorbia*, *Haloxylon*, *Leptadaenia*, *Calligonum*, etc... Patches of mangrove forests along the coast of the Red Sea and the Persian Gulf include species of *Avicennia* and *Rhizophora*.

Wild Species and Wild Relatives

11. The sub-region is unique in the world from the stand point of plant genetic resources and plant diversity since it covers three of the Vavilov's Centre of Origin (Mediterranean, Near Eastern and Central Asian 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).

12. 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, as new techniques allow the use of wider gene pools. 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) are almost extinct and are now exclusively confined to steep rocky slopes where grazing pressure is not as severe.



13. 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. crassa*, *Ae. speltoides*, *Ae. squarrosa*, *Ae. triaristata*, *Ae. triuncialis*, *Ae. umbellulata*,..), barley (*Hordeum bulbosum*, *H. spontaneum*, *H. marinum*, *H. leporinum* and *H. murinum*,..), oats (*Avena. clauda*, *A. barbata*, *A. fatua*, *A. sativa*, *A. byzantina*, *A. eriantha*, *A. barbata*, *A. macrantha*, etc.) and rye (*Secale sp.*).

14. 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*, *P. sativum*,..) and chickpea (*Cicer reticulotum*, *C. pinnatifidum*, *C. echinospermum*, *C. bijugum*, *C. arietinum*,..).

15. Other genera with a diversity of wild relatives of vegetables include *Brassica nigra* (wild Brassica), *Raphanus raphanistrum*, *Apium graveolens* (wild celery), *Beta spp.* (wild beet), *Citrillus colocynthis* (wild watermelon), wild carrots (*Daucus spp.*), wild lettuce (*Lactuca spp.*) and wild mustard (*Sinapis spp.*). Many other wild plant species are used as salad and vegetable plants, but still are not utilized in development.

16. Some wild relatives of forage grasses and legumes which commonly occur in the sub-region include those of alfalfa (*Medicago sativa*), annual medics (*Medicago spp.*), sainfoin (*Onobrychis spp.*), clovers (*Trifolium spp.*), vetches (*Vicia articulata*, *V. ervilia*, *V. narbonensis*,..); grasses (*Agropyron*, *Bromus*, *Elymus*, *Festuca*, *Eragrostis*, *Stipa*) and other fodder crops (*Astragalus*, *Bituminaria*, *Lotus*, *Ononis*,..).

17. 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 insect, disease and their wild adaptation, such species as chestnut (*Castanea sativa*) and walnut (*Juglans regia*) are some valuable fruit genetic resources. Wild citrus (*Citrus spp.*), 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 rootstock. 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 *Olea crysophylla*). Some other species of high interest as industrials or stimulants include *Nicotiana tobacum*, *Coffea arabica* and *Qata edulis* (in Yemen).



18. Wild progenitors of ornamental species such as *Allium*, *Anemone*, *Arum*, *Centaurea*, *Chonodoxa*, *Cistus*, *Colchicum*, *Crocus*, *Cyclamen*, *Delphinium*, *Dianthus*, *Eranthis*, *Fritillaria*, *Galanthus*, *Gladiolus*, *Gypsophilla*, *Helleborus*, *Hibiscus*, *Hyacinthus*, *Iris*, *Laurus*, *Leucojum*, *Lilium*, *Muscari*, *Myrtus*, *Narcissus*, *Nectaroscordum*, *Nerium*, *Ophrys*, *Orchis*, *Ornithogalum*, *Paeonia*, *Pancreatium*, *Retama*, *Rosa*, *Scilla*, *Scorzonera*, *Silene*, *Sternbergia*, *Tulipa* and *Viola* are indigenous to the sub-region. Unfortunately their numbers are rapidly decreasing from the continuous developmental activities, the use of herbicides and the inconsiderate exploitation.

19. Most of the species used as medicinal or aromatic species in the sub-region, are subject of extinction mainly because of man activity in the wild either by collecting these plants for domestic or industrial use. Many of these plants are endemics:

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
Glycyrrhiza
Gypsophilla
Helycrysium
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.

Landraces and Old cultivars

20. Agriculture developed in the area about 10,000 years ago, when early farmers domesticated plants and animals, and started the process of clearance and modification of natural vegetation in Iraq in order to grow crops. A village site found near Nineveh in Iraq dated provisionally at 9000 B.C. shows evidence of agricultural practices. The ancient land of Mesopotamia, between the Tigris and Euphrates rivers, in what is now Iraq is a part of the “Fertile Crescent”, an arc extending from an area east of the Mediterranean to the lower Zagros mountains in Iraq and Iran, witnessed the beginnings of sedentary agriculture. The name is an indication of the rich soils and the numerous plants that once thrived there.

21. The sub-region is rich in highly variable domesticated crops as well as landraces with unique characteristics. The main cultivated crops in the sub-region are cereals (wheat, barley, rice, maize, sorghum, millet, etc.), food legumes (lentil, chickpea), vegetables (tomato, Brassica, potato, chilies, onion, garlic, coriander, etc.), industrial and stimulant crops (cotton, jute, sugarcane, sugarbeet, groundnut, sesame, linseed, tobacco, coffee, Qat, etc.). 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. Whereas the main popular fruits are citrus, apples, apricots, peaches, pears, plums, grapes, almonds, pomegranates, dates, mangos, papayas, bananas and guavas.



22. 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. This is the case of Yemen where some of the important traditional crops such as finger millet (*Eleusine crocana*) and oil rape (*Brassica napus var. napus*) are now grown only in very specific areas. Some of the factors that cause partial loss of landraces in this country are terrace deterioration, seasonal flood destruction and the expansion of Qat (*Qata edulis*) cultivation.



II. ASSESSMENT OF PGR PROGRAMMES AND ACTIVITIES

National Programmes Policies and Legislation

National programmes and policies

23. The plant genetic resources programmes in the sub-region are at different stages of development. They range from well developed structures such as in Iran, Pakistan and Turkey to those that are at more or less advanced formative stages as in Iraq and Yemen. In the first three countries, public awareness on the importance of germplasm for human survival has greatly increased among policy makers, public organizations and individuals. In the remaining countries, Afghanistan, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE, the plant genetic resources activities are not yet organized in a national programme. Appendix 4 gives a summary of the status of the national programmes, policies and legislation.

24. Iran, Pakistan and Turkey have the strongest PGR programmes in the whole region of Near East. In each of these countries, all plant genetic resources activities are administered from one national center (Plant Genetic Resources Institute in Pakistan (PGRI), National Plant Genebank of Iran (NPGBI) and National Plant Genetic Resources Research Project in Turkey (NPGRRP)) which has national mandate of collection, conservation, evaluation and documentation of Plant Genetic Resources. The position of the Responsible of the center is secure and the relevant Ministry can abolish or expand the research activities at this center.

25. In Pakistan, the Plant Genetic Resources Institute (PGRI) of Agricultural Research council is a federal institute which coordinates with the provincial research institute and IARC to cater the needs of national scientists. Its activities are being funded by the Government of Pakistan and technical assistance is being provided by the Japan International Cooperation Agency (JICA) in the form of long and short term experts, equipment and chemicals.

26. Iran has set up a managing committee of the national plant genetic resources programme for drafting legislation and policies related to the conservation and use of plant genetic resources in the country. Realizing the importance of plant genetic resources in applied plant breeding, the National Plant Genebank of Iran (NPGBI) was placed in the Seed and Plant Improvement Institute (SPII) in order to strengthen the role of SPII in agricultural development.



27. The annual programme budget is prepared by the Institute and approved by the government through relevant ministries. In Iran, for instance, each member of the National Program Committee drafts his own budget based on its requirements which has already been worked out as a maintenance and expansion plan, and the budget has to be approved by the parliament through the appropriate higher ministry or authority. In any case the Government is committed to providing a secure level of funding. In other countries, the budget fluctuates accordingly to the economic situation of each country, from year to year.

28. Because of the lack of government policies in the plant genetic resources activities, most of the plant genetic resources conservation programmes, except for Turkey and to some extent Iran, are not receiving enough support from the policy makers and the budget is not really secure. At this point, it is worth emphasizing the role played by the IPGRI/WANANET in strengthening the national programmes by reinforcing the role of the national plant genetic resources committee and by creating 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, starting 1993, scientists from different institutions within Turkey, Iran, Pakistan and Yemen did establish a good collaboration between them.

29. 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 established their national environmental commissions. Consequently, environmental and biodiversity conservation and sustainable use strategies and plans are being developed in almost all the countries. Despite the presence in most countries and territories of several Non Governmental Organizations (NGOs) dealing with biodiversity conservation, their activities are still 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. More 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 the food for humanity.

Legislation

30. All countries in the sub-region protect wild flora through legislation on forests. Experience has shown that the degree of protection afforded to wild



flora through such legislation is very limited. For that reason, and following the signing of the CBD, the legislation on forests in these countries is being reviewed to include provisions for sustainable forest conservation and development taking into account all the socio-economic changes. However, there is a need to protect by legislation the valuable plant genetic diversity existing in each country of the sub-region, to conserve it both *in situ* and *ex situ* before it disappears for ever.

31. Turkey, Iran, Iraq, Pakistan and Yemen have preventive actions through phytosanitary, quarantine and seed certification legislation for controlling plant materials importation and exportation. In general, these countries allow the transfer of plant material free from disease and any infection, and there is no restriction on the importation and exportation of *in vitro* plant material. Even the quarantine laws are strict, their application varies from country to country and uncontrolled introductions of plant materials might occur. Pakistan's economy, for instance, has suffered a serious setback from cotton and banana due to its loss/relaxation of quarantine measures.

32. Iran is the only country in the region which has an intellectual property right legislation, however this law has some weaknesses as far as plant genetic resources are concerned and it is under review at the moment. Pakistan is also preparing a document to become a member of the International Union for the Protection of New Varieties of Plant (UPOV). Once the government approves this document Breeder's Rights (BR) and Intellectual Property Rights (IPR) will be enforced in the country.

33. None of the countries in the sub-region, except Turkey, has established laws for protecting the plant genetic resources. In Pakistan the Chairman of PARC is the competent authority to decide their fate. In Iran, genetic resource collections are the property of the owners and within the food security plan, the government judge the genetic resources as a support to back up the organizations responsible for increasing agricultural production. In Iraq, the head of GRU has been permitted by the Ministry of Agriculture to supply the seed samples upon request within the country and abroad.

34. All the countries consider plant genetic resources as heritage of mankind which should be available free of charge to researchers within the region and abroad on a mutual exchange basis. As a number of countries become members of UPOV and Breeder's Right, Intellectual Property Rights and Farmer's Right may become a hurdle for exchange of germplasm in future and for the collection of germplasm worldwide.



35. 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 plant genetic resources conservation activities in the sub-region.

36. The political and socio-economic transformations in all the countries, such as the structural adjustment policies and the privatization programmes are not emphasizing the role of plant genetic resources. In fact, most of the national programmes are not well staffed with plant genetic resources scientists and by limiting the research budget and the number of newly recruited scientists, the structural adjustment policies may have a negative effect on the capacity building of these programmes. Privatization programmes should also be rationalized so that public investment in plant genetic resources activities are reinforced. Even if the private sector is willing to invest in breeding cash crops, it would be unrealistic for it to carry out plant genetic resources conservation activities, genetic enhancement and breeding of underutilized crops.

Sub-Regional Programme and Networks and International Collaboration

37. Afghanistan, Iran, Iraq, Pakistan, Turkey and Yemen are members of the FAO Commission on Plant Genetic Resources, but only Bahrain, Iran, Iraq, Kuwait, Oman, Turkey and Yemen adhered to the International Undertaking to promote the conservation, exchange and utilization of plant genetic resources for food and agriculture. It is agreed that no country in the world is self sufficient in plant genetic resources and all countries are interdependent. Therefore, all countries in the sub-region believe that an international fund for plant genetic resources will strengthen the FAO role in fulfilling its commitments on plant genetic resources and will expedite the conservation activities in the developing countries. All these countries support the proposal for creation of this fund and some of them are willing to be donors to it.

38. All countries, except Kuwait and the United Arab Emirates, ratified the Convention concerning the World Cultural and Natural Heritage and only Iran and Pakistan are also members of the Ramsar Convention on Wetlands of International Importance. Seven countries from the sub-region, Bahrain, Iran, Iraq, Oman, Pakistan, Turkey and Yemen signed the Plant Protection Convention and Afghanistan, Iran, Kuwait and UAE are party to the CITES Convention. The Convention on Biological Diversity has been signed by all countries, except Saudi Arabia, but only Oman and Pakistan have already



ratified it. Table 2 gives the status of the biodiversity related conventions signed by the countries in the sub-region.

Table 2 International collaboration

Country	CBD	FAO PGR Commission	FAO Undertaking	WHC	Wetlands	CITES	Plant Protection
Afghanistan	Yes	Yes	No	Yes	No	Yes	No
Bahrain	Yes	No	Yes	Yes	No	No	Yes
Iran	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Iraq	No	Yes	Yes	Yes	No	No	Yes
Kuwait	Yes	No	Yes	No	No	Yes	No
Oman	Yes	No	Yes	Yes	No	No	Yes
Pakistan	Yes	Yes	No	Yes	Yes	Yes	Yes
Qatar	Yes	No	No	Yes	No	No	No
Saudi Arabia	No	No	No	Yes	No	No	No
Turkey	Yes	Yes	Yes	Yes	No	No	Yes
United Arab Emirates	Yes	No	No	No	No	Yes	No
Yemen	Yes	Yes	Yes	Yes	No	No	Yes

39. All countries have established good working relations and linkages with the CGIAR Centers (IPGRI and International Agricultural Research Centers (ICARDA, CIMMYT, CIP, CIAT and IRRI). Exchange of germplasm and training are two of the important items in all of these agreements. Some countries such as Saudi Arabia and Iran are among the donating countries to some CGIAR Institutes. The International Agricultural Research Centers had made a significant contribution to the crop improvement in the sub-region by providing genetic resources, and enhanced material to crop breeders in different countries for wheat, maize, rice, potato, food legumes, sorghum & millet, groundnut, vegetables etc. Through its Genetic Resources Unit, ICARDA plays a role in the exploration, the conservation and the enhancement of the utilization of the diversity of crops for which ICARDA has either a global or regional responsibility (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.



40. IPGRI has established a 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 and IPGRI WANA Group, a plant genetic resources network 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. Also representatives of ICARDA, IPGRI, FAO and ACSAD are members of Steering Committee of the network. The objectives of this network are:

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

41. Some countries, such as Pakistan, are collaborating with Regional Research Centers (Asian Vegetable Research and Development Centre (AVRDC) in Taiwan and International Centre for Integrated Mountain Development (ICIMOD) in Nepal). Pakistan has also established collaborative relation with the People's Republic of China and Government of Japan to promote Plant Genetic Resources activities in the region.

42. In 1977, FAO launched a regional project on plant genetic resources, including six countries Afghanistan, Iran, Iraq, Pakistan, Syria and Turkey. Under this project which was financed by the Swedish International Development Authority (SIDA), plant genetic resources conservation activities were initiated and some related equipment purchased. Presently, 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. 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/OMA/88/006 12.88-01.93	Oman	Date palm improvement	Medium
UNDP/PAK/89/014 03.91-12.96	Pakistan	Fruit development in Baluchistan (Phase III)	Medium
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/TUR/93/001 01.94-06.95	Turkey	Establishment of National network for Integrated Pest	Fair
UTF/TUR/003/TUR 01.84-12.94	Turkey	Agricultural extension and applied research	Fair

- **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:** International Plant Protection Convention (Rome, 1951).

Conservation activities

In situ conservation

43. Forest genetic resources and wildlife are conserved *in situ* through setting up national parks, protected areas, wildlife reserves, and bird sanctuaries. These conservation programmes and activities are carried out in the frame of Forestry Plans, Desertification Control Plans and Range Management and Rehabilitation Programmes as in Iran, Iraq, Pakistan, Saudi Arabia and Turkey. To preserve Pakistan's major ecosystem and to protect the threatened species of wildlife and forest trees, 7 national parks, 72 sanctuaries, 76 games reserves and one biosphere have been established. In Iran, there are 64 forest reserves and 77 protected areas, amongst which there are 7 national parks and 24 wildlife sanctuaries.



44. 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 of enough involvement of local communities in conservation project formulation and implementation, renders the management of the protected areas more difficult and inappropriate. To promote the environment conservation, several Non Governmental Organization (NGO) have been created in most countries but their role is still limited due to lack of funds.

45. Before the coming into force of the Convention on Biological Diversity, none of the countries had carried out any organized action on *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.

46. Government and institution driven 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 their traditional ways of crop management and selection of best crops and seeds, farmers contributed and are still contributing to crop improvement. As a result, a great diversity of traditional plant genetic varieties was created. By their “know how”, farmers usually found better ways to overcome the environment caprices (harsh environment, diseases, etc..) through the growing of varieties mixture. However, under demographic pressure and agricultural intensification using a limited number of improved varieties, most of the traditional diversity-based farming systems are disappearing and landraces and local varieties have persisted *in situ*, only in isolated and marginal areas in the sub-region. It is stated that the genetic erosion of wild species and landraces is alarming and thus an inventory, evaluation and conservation of plant and animal genetic resources is of urgent need.

***Ex situ* conservation**

***Ex situ* collections**

47. *Ex situ* conservation programmes in the sub-region are at different stages of development. They are well developed in Turkey, Iran, and Pakistan,



in organizational stages in Iraq and Yemen and almost lacking in the other countries. Where *ex situ* conservation activities exist, they are implemented both for national seed and vegetative collections which are preserved in seed genebank and field genebanks respectively. The national collections include landraces and wild relatives (both for seed and vegetative collections), other wild species which are especially economically important (medicinal, aromatic, ornamental etc.) and endemic plant species. Appendix 6 summarizes the *ex situ* activities in the sub-region.

48. Because of the importance of the sub-region as a centre of diversity, germplasm collecting has been undertaken by international scientists and institutions since 1940. However, 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 most germplasm collections in the sub-region. By the early 1980's, with development of national programmes, acquisition of minimal to comprehensive conservation facilities and staffing of national institutions with trained scientists, countries such as Turkey, Iran, Iraq, Pakistan and Yemen have paid great attention to collecting plant genetic resources, especially crop species. Collecting activities have mainly been made by national institutions in collaboration with international centers and institutes such as IBPGR (IPGRI), ICARDA and IRRI. The expedition missions became frequent and conducted in a systematic manner based on priorities to serve national genetic resources and breeding programmes. However, all the germplasm collected is not representative of the large genetic diversity found in the sub-region. To capture maximum crop genetic variability, further collection expeditions for major and minor crops should be undertaken.

49. In Iran, at present, a total of 155 species are conserved in the National Plant Genebank (NPGBI). These species belong to 125 crops, of which more than 40,000 samples are available. The collection at NPGBI contains mainly indigenous material, nevertheless it contains some material received from ICARDA, ICRISAT and various sources in Canada, Japan, China, Russia, USA and India. Although the size of collection in different species varies, less than 5% of the total stocks in the NPGBI have a foreign origin. The material in NPGBI are equally important, however the cereal collection with its vast number of samples is regarded as one of the best sets. Very little stock in the NPGBI are referred to and used each year and the main users are research students who are working on projects. About 5% of the total stocks in the collection have been sent to foreign users. Although the activities of the NPGBI during the short period of time since it was established have been satisfactory, the investment made by the government on the NPGBI has not been yet returned in terms of crop improvement. But, realizing the long term



use and benefits, the government has not been discouraged from further investments into this matter.

50. In Pakistan, the Plant Genetic Resources Institute (PGRI) has undertaken twenty eight plant collection expeditions in different agro-ecological regions of the country in collaboration with the national coordinated commodity programmes and International Agricultural Research Centre (IARC). As a result of these efforts, more than 8,000 samples of different crops have been assembled. The major portion of these collections are primitive land races. About 1,000 accessions of different crops are annually distributed to national breeders, universities and other international agencies for utilization in their breeding programmes. The proportion of germplasm supplied abroad is slightly higher than the local demand. It is expected that the domestic demand of germplasm will increase as soon as PGRI start publishing crop catalogues with passport and evaluation data.

51. In Iraq, the local collection generally comprises landraces and indigenous cultivars. Within the country, 1,400 samples of cereals, oil seed crops, medicinal plants etc. were collected and conserved in the genebank. In addition to this, 5,000 accessions of wheat (Spring) were acquired from USA for a breeding programme. These are also being maintained in the national genebank of Iraq at Abu Gharib. Presently this project is not financially secure and needs special attention both for equipment and funds.

52. In Yemen, more than 21 expeditions were carried out in different parts of the country. The collection is made up of nearly 8,000 samples representing several crops: *Vigna unguiculata*, *V. radiata*, *V. aconitifolia*, *Lentils*, *Fenogreek*, *Dolichos*, *Lablab*, *Phaseolus*, Faba bean, Alfalfa, Peas and Sesame. However, most of the accessions left in the country were subject to loss due to poor conservation facilities. Since the establishment of the Plant Genetic Resources Unit (PGRU) in 1988, all material collected has been well conserved and the existing collection size is about 2,500 samples.

53. IBPGR's (IPGRI) expeditions in the sub-region resulted in collecting 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).



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
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

54. For vegetatively propagated crops and perennials, field genebanks are used to conserve the collections in most countries within the sub-region. In Turkey, the vegetatively propagated material, mainly fruit genetic resources are kept in field genebanks at 13 institutes. In Pakistan, the research work on the conservation of vegetatively propagated crop plants such as potato and sweet potato has recently been initiated on minimal growth media. The research work will be further extended to Cryo-preservation for which the facilities are available. The present facilities have been developed in collaboration with Japan International Cooperation Agency (JICA), keeping in view the international standard for seed preservation. In Yemen, in an attempt to establish *ex situ* conservation in a manageable way under the collaborative regional programme of IPGRI/WANANET, several clones of landraces of figs



and pomegranate were planted in a field genebank at the Northern Highland Regional Station.

Storage facilities

55. Conservation infrastructures and facilities in the sub-region vary from one country to another and they range from well developed genebanks and centres to very scanty ones. Turkey, Iran and Pakistan have by far the most advanced conservation facilities. National collections in Iraq and Yemen are kept, as active collections, in facilities at the plant genetic resources units. In the other countries, *ex situ* conservation activities are lacking or at their initial stage and the situation has to be looked at from scratch.

56. The national seed genebank of Turkey was established in 1972 at the Aegean Agricultural Research Institute (AARI) in Izmir to preserve the collected genetic resources material 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 working at 4°C. 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.

57. In Pakistan, the Plant Genetic Resources Institute has two types of conservation facilities i.e. short term (working collection) and medium term storage. This national genebank was established in 1993 under the project “Genetic Resources Preservation and Research Lab.” which was financed by Japan. This genebank has the capacity to accommodate 60,000 seed samples, each of 500 g. The seed is stored with 10% moisture content at 15°C at 45% RH in hermetic plastic bottles using silica gel. The bottles are kept in mobile shelves to utilize maximum space. Whereas under medium term storage the accessions are kept in laminated foil bags at 6-7% moisture content. The medium term storage measures 50 sq.m. and is partitioned into eight chambers. Each chamber has the capacity to accommodate 8,000 accessions separately. These chambers are being operated at 5°C at 40% RH. In addition to these facilities five chest type deep freezers are being used for long term preservation. About 10 g seed of 50,000 accessions can easily be stored in these freezers. To ensure the safety and longevity of the precious germplasm, a continuous power supply is available.

58. In Iran, the National Plant Genebank was established in 1983 and has storage conditions which comply with international recommendations set by IPGRI . The cold storage facilities includes 7 rooms with a total capacity of 7000 samples of 300 grams each. Five of the storage rooms are maintained at -



15°C to -20°C and 2 are at 0 - 5°C. The samples of the base collection are held for long storage at -15 to -20°C where there is no humidity control. The samples of active collection are held under short storage 0 - 5°C in which the humidity is kept between 30 - 35%. Aluminum packets or jars are used for holding the samples in long storage, whereas paper packets are used for short storage. The amount of seed for each entry varies between 5 and 300 grams.

59. In Iraq, the plant genetic resources unit has a cold store of 40 m², capable of housing a minimum of 10,000 aluminum cans. In the winter months the cold store can run at 5°C but during the three hottest months it may run at 10°C. There are two deep freezers for long term conservation. However, there is no humidity control in the genebank and there is no standby electric generator. Therefore the cold storage room suffers from high humidity and temperature fluctuation, which has an adverse effect on seed viability.

60. The material conserved in the existing genebanks is duplicated either within the country, in the sub-region or at international centres. The base collection of the national genebank in Turkey is duplicated in another storage facility available in Ankara (at Field Crop Research Institute). In Iraq, the cereals germplasm has been duplicated at Bari, Italy and some wild wheat samples have been duplicated at Izmir, Turkey; Kyoto, Japan, and ICARDA. In Iran, safe duplicates of germplasm conserved at the NPGBI are being kept at a new cold storage unit in Mashhad. The Iranian national genebank is also conserving some material for Afghanistan. In Pakistan, the Plant Genetic Resources Institute (PGRI) has already duplicated its material for safety e.g. rice germplasm at the International Rice Research Institute (IRRI), Philippines, wheat, barley & chickpea at ICARDA - Aleppo, Syria and vegetable, mung & mash germplasm at the Asian Vegetable Research and Development Centre (AVRDC), Taiwan. The PGRI is also collaborating with WANANET and has accepted the responsibility of conserving all crop reference seed samples. So far Iran and Cyprus have sent some wheat and barley samples for conservation.

Germplasm regeneration, characterization and evaluation

61. Regeneration of the germplasm is the only mean 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 is decreased below 85% or the conserved material stock is too small to meet the scientist requirement. Regeneration and multiplication of collections is a bottleneck for most institutions within the sub-region since it requires a large amount of labor and funds.



62. In Pakistan, the PGRI has a field, glass house and growth chambers facilities for regeneration of both self and cross pollinated crop germplasm. Efforts are made to regenerate the material under a healthy environment and the qualified staff, labor and logistic arrangements are available to maintain the possible genetic identity of the original stock. As the material (bulk population) is being multiplied/regenerated at a centre other than its place of origin, there are chances that some of the recessive allele may disappear during this process of regeneration. More than 50% of the seed stock has been regenerated once, whereas about 15% germplasm has been regenerated more than twice. The original and regenerated seed stock are maintained in the genebank separately.

63. In Iran, regeneration is carried out by qualified personnel of the NPGBI and precautions are taken to prevent any contamination. However, out crossing materials is particularly problematic when the amount of seed is not sufficient enough to preserve the original genetic identity or in cases where there are various morphotypes in a seed population. No satisfactory solution has been found to this problem yet. When there is more than one regenerated population, in any one stock, it is the last lot which is taken for the next regeneration, however older regenerated stocks are maintained as long as they are viable.

64. In Iraq, difficulties are experienced for multiplication/rejuvenation of cross pollinated crops germplasm to maintain the genetic integrity of a bulk population sample. Due to the deteriorating condition of the genebank all the material has been duplicated at ICARDA both for conservation and rejuvenation.

65. The collection of germplasm is of no use unless it is properly characterized and evaluated. In most countries, IBPGR/IPGRI descriptors for characterization and evaluation are generally followed by scientists. Assessment of genetic diversity of collections held by the genebanks or of the naturally occurring diversity has been minimal. In fact, all the work related to germplasm characterization concerns mainly morphological and agronomic traits, and comprehensive genetic diversity studies at the molecular level are still limited. Although, characterization, evaluation and documentation are in an advanced stage in some countries, much more efforts and international assistance are still needed in the sub-region.

66. The preliminary characterization in Pakistan is undertaken by PGRI scientists during the multiplication of collected crop germplasm according to IPGRI's descriptors. But in case the particular crop descriptor is not available, respective crop coordinator/breeder is consulted for the characterization of the



crop. With the establishment of Research Laboratories at PGRI, evaluation of wheat, chickpea, maize, sorghum and millet germplasm has been started by the researchers of the institute. At present about 65 % crop germplasm has been characterized at NARC except for *Aegilops* which was multiplied and characterized at the Arid Zone Research Institute, Quetta.

67. In Iran, about 40% of the collection has been characterized and less than 5% has been evaluated. Characterization is done by the NPGBI staff, whereas evaluation is done under research projects which are approved first by the scientific board of the SPII. Evaluation usually takes place at the SPII fields near Karaj. However, studies such as those requiring exposing a plant material to pathogen inoculum, could take place anywhere in the country at SPII substations. Evaluation parameters are mostly agronomic readings, nevertheless biochemical data such as those related to the baking quality of wheat are also measured when required. Evaluation data, so far, have not had any impact on the applied plant breeding work yet; therefore, the SPII is reviewing its policies on evaluation and trying to coordinate and integrate the NPGBI more into the breeding system.

68. In Turkey, the characterization activities are carried out within the framework of the National Plant Genetic Resources Research Project (NPGRRP). The plant groups (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 in parallel to other research and breeding programmes.

69. The evaluation of indigenous landraces, primitive cultivars and their wild relative must be carried out for the entire national germplasm. The evaluation will definitely be helpful to incorporate local desirable traits into the modern cultivar for sustainable agricultural production. It is strongly urged that evaluation be carried out at multi location and also be collaborated with IARC or with any other research Institute having international repute. The multi location evaluation of crop germplasm will enhance the validity of data. The collaborative evaluation of crop germplasm be carried out with the International Agricultural Research Centre which will provide an opportunity to the respective country scientist to work with IARC as trainee scientist to evaluate the respective crop germplasm. Any crop which is not dealt by the IARC, then FAO may designate a crop based research institute for germplasm evaluation studies. This will not only promote the germplasm evaluation work



but will also improve the technical competence of the developing countries scientist.

Documentation

70. 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, CGIAR Centers), countries are achieving a step towards a well organized and computerized documentation.

71. Pakistan, Iran and Turkey have established a computerized documentation systems. But the computer systems in these countries are not connected to any international network yet and users can obtain information only on the basis of a written request In Iraq, passport and characterization data are kept in manual forms. At present, about 80% of the collections, in Pakistan and 40% in Iran, are fully documented. *In situ* conservation activities are not well documented, except in Turkey and Iran, where computerization of information on these activities has begun.

Uses of Plant Genetic Resources in the Sub-Region

72. Plant genetic resources from the sub-region have been widely used in breeding programmes around the world. Several traits and characters such as high yielding, disease and insect resistance, cold or drought tolerance, etc.. serve as the basis of crop improvement in these programmes. 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.

73. The main objective of the agricultural research programme, in most countries of the sub-region, is to meet the national food needs. There are two main functions of national plant breeding programmes: improving of local varieties and to adopt introduced germplasm to local needs. Improving the local varieties can be achieved through selection procedures or through incorporating them in a crossing programme. The main objective of the crossing programme is to increase productivity, disease resistance and tolerance to biotic and abiotic stresses that lead to sustainable agriculture development. Adoption of introduced germplasm is mainly as a result of selection germplasm that prove superiority. The selected germplasm either goes through normal evaluation steps until it reaches the releasing level, or goes into a breeding programme in order to utilize the genetical traits in crossing programmes.



74. 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 where private companies are being 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.

75. In Turkey, there are 19 National Projects working on crop improvement. The objectives of most breeding programmes are improving the new varieties with high yielding, resistant to stress factors and resistant to disease/pest. These programmes have established good working relations 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 is also being carried out with the collaboration of national crop research projects. Therefore the respective crop scientists (breeder/agronomist, pathologist) get an opportunity 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 programs. 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 breeder and through demonstrations by extension experts. The improved varieties released from the national plant genetic resources collection are a direct benefit of the country's agricultural sector.

76. In Pakistan, there are five major crops in the country, namely wheat, cotton, rice, sugarcane and maize. Their productivity is very low compared to their potential. The main function of national breeding programmes is to evolve high yielding better adaptive, resistant to pest and diseases with a broad genetic base, a crop variety for sustainable crop production. The staple food of Pakistan is wheat and the requirements are not met. However, the country



exports reasonable quantities of cotton, rice and sugar. Therefore, breeding of these crop are export oriented to meet the requirement of importing countries. However, the conventional breeding is being undertaken for major food crops and it has almost negligible support from bio-technology. There is no fruit, minor millet or forest tree breeding programmes in the country. The major constraints for crop improvement programme is a lack of proper research labs, and trained manpower. These constraints are directly related with the economic condition of the country. To overcome this situation, the Government has allowed the public sector seed cooperations to evolve high yielding crop varieties. Presently Pioneer, Cargill, Sandoz, Lever Brothers and ICI multinational seed companies are marketing their hybrid varieties of sunflower, maize, millet and sorghum in the country.

77. In Iran, the Seed and Plant Improvement Institute (SPII) is the only organization responsible for the breeding of improved cultivars of crop plants and their release. Part of the material stored in the genebank has been used in the applied breeding program within the country. Species distributed by the NPGBI in the last three years include: *Oriza sativa*, *Triticum spp.*, *Aegilops spp.*, *Hordeum vulgare*, *Citrus lanatus*, *Beta vulgaris*, *Phaseolus vulgaris*, *Helianthus annuus*, *Vicia spp.* Other plant material in use in the research departments of SPII are usually triose received from CGIAR institutes. Wheat tolerance to rust and pre sprouting are two of important breeding objectives in the Cereal Department of the SPII.

78. In Iraq, the most important crop-species which has been requested from GRU, Iraq for its utilization by the national commodity programmes and abroad are wheat, barely, rice, maize, sorghum, chickpea, cotton, tomatoes, faba bean, forage species and sunflower. For the last three years mainly cereal germplasm has been utilized by the breeders and during this period the germplasm was also supplied outside the country i.e. Japan, Russia, Italy, Czechoslovakia, ICARDA Syria. the Atomic Energy Commission, IPA, the Agriculture Research Center and the College of Agriculture's breeders were the main user of cereal germplasm. It is worth mentioning that the plant breeding activities are not adequate in vegetables, forages, food legumes, horticultural crops and medicinal plants. The medicinal plants, forages, and most of the wild species have not been used in the country since they have been collected. All the plant breeding work is being carried out by the Government fund and at present there is no private seed company in this business. The plant breeder's product is supplied to the farmer gradually with the help of public funded seed companies.



Capacity for utilization

79. The capacity for plant genetic resources utilization varies from one country to another. Many of the institutions in the sub-region have the potential to undertake work on plant genetic resources utilization, but the main problem is the limited financial resources to run the facilities. The Gulf countries, Iraq and Yemen, are also lacking enough qualified staff to conduct all their breeding programmes. Despite the limited number of breeders in some fields in Pakistan, Turkey and Iran, the capacity of utilization of genetic resources in these countries is more or less adequate. Several varieties have been developed in these countries and a good example is the rice variety released by the Rice Research Institute in Pakistan. This variety, now being cultivated in 95% of the rice areas in Pakistan, has not only increased yield per unit area but also enhanced the county's export of rice to middle east countries. However, the capacity building of most institutions dealing with plant genetic resources in the sub-region need to be strengthened and there is a need for the transfer of new technologies and training of staff in the application of these technologies.



III. NEEDS, OPPORTUNITIES AND CONSTRAINTS AND PRIORITIES FOR THE GLOBAL PLAN

Needs and Constraints for the Sub-Region at the Technical, Institutional and Policy Level

80. The conservation and utilization of plant genetic resources in the sub-region are faced with several needs and constraints which have to be addressed if advances are to be made in the integration of plant genetic resources in economic development. It is important to realize that each country has its own specificities and the needs may differ from country to country. Based on the assessment made in the previous sections, the following needs and constraints have been identified for different national programmes in the sub-region.

Policy level

81. Elaboration of national strategies and programmes for the conservation and sustainable utilization of plant genetic resources for sustainable development, the commitment of the policy makers is essential to achieve this goal. The enhancement of local germplasm, particularly the indigenous landraces and cultivars, in the national programmes should be set as priority. Assistance should be given to the Gulf countries for developing plant genetic resources activities.

82. Allocation of sufficient budgets for plant genetic resources activities at the research, training and development level.

83. Encouragement of the 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 the high level is necessary in achieving this collaboration.

84. Assistance for developing legislation on plant genetic resources including intellectual property rights and farmer's rights since the existing legislation does not adequately cover the plant genetic resources issues.

85. Creation of public awareness through development of effective integrated mechanisms for sensitizing policy makers, scientific and farming communities on conservation of plant genetic resources. An education and awareness campaign needs to be carried out for target groups and at schools.



Institutional level and Capacity building

86. Strengthening the national plant genetic resources programmes through provision of facilities, necessary equipment and manpower development.
87. Capacity building is needed at all levels for the national programmes of all countries in germplasm collecting, characterization, evaluation, conservation, regeneration, documentation and utilization.
88. The development of basic specialized training activities in botany, *in situ* conservation, forest genetics, ecology and global and multi-disciplinary approaches. To set up training for administrators, technicians as well as managers, in relation to the new concept of plant genetic diversity.
89. 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).
90. Development/strengthening of herbarium facilities for documentation of flora and plant specimens.

Technical level

For *in situ* conservation

91. Preparation of national plans for conservation of wild relatives of crops.
92. Inventories of areas with high plant diversity. Determination of genetic diversity of target species in selected sites. Survey of endangered and threatened species.
93. 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. Set up regulations for sustainable *in situ* conservation of crops.
94. 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

95. Creation/reinforcement of national genebanks facilities for both seed and vegetatively propagated species. In the Gulf countries and Afghanistan, the situation has to be addressed from scratch.



96. Germplasm collection and re-collection in countries like Afghanistan, Bahrain, Iraq, Kuwait, Oman, Qatar, UAE, Saudi Arabia and Yemen where conservation infrastructures are lacking or different factors such as wars have hindered germplasm collections. To capture maximum crop genetic diversity, further collection expeditions for major and minor crops should be undertaken in all countries.

97. Characterization and evaluation for both quantitative and qualitative traits should be carried out at morphological and genetic levels using isozyme and biochemical techniques.

98. Promoting/strengthening the conservation and use of desert plants and under utilized species.

99. 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).

100. 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.

For Adequate use

101. Strengthening the evaluation and documentation capabilities of national programmes to ensure a flow of germplasm and information, this will lead to better use of germplasm. The utilization of crop germplasm could be further enhanced if these are tested at different agro-ecological areas.

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

103. Promoting “on farm” or decentralized breeding for adequate use of landraces. This can be enhanced by the involvement of farmers in the development of breeding objectives and in germplasm characterization and evaluation

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

105. Assistance to countries with less experience in utilization of plant genetic resources to plan, finance and integrate their genebank into their applied plant science system. In this respect, training of the users of plant genetic resources are as important as the training of the genebank staff.



Sub-Regional Collaboration

106. Encouragement of plant genetic resources information and materials exchange 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.

107. Commitment for participation and implementation of regional intergovernmental initiatives and cross-border activities on plant genetic resources activities through financial and human contribution from member countries.

108. 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.

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

Opportunities and Comparative Advantages of The Sub-Region

110. A number of joint research projects and networks have been developed across the sub-region. The 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. Yet 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 in the area are listed in Table 3. A new sub-regional project is also under preparation and might be considered as contributing to the implementation to the Global Plan of Action:

- 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 was selected as a priority country to carry out the study in the sub-region. The specific objectives of the collaborative research programme are:



Appendix 1.1 Basic facts of the countries and territories in the sub-region. (Data from FAO statistics, 1990-95)

Country	Population		Labor force (1000) 1992		Land use (1000 Ha)
	Total	% of total population in Agric. Sector	Total	% total labor force in Agri	Land Area
Afghanistan	18 461	53,42	5 843	50,13	65 209
Bahrain	50	18,00	233	1,72	68
Iran	57 166	25,35	16 375	26,10	164 800
Iraq	20 249	19,07	5 524	19,08	43 737
Kuwait	1 334	0,00		??	1 782
Oman	1 615	38,08	428	38,08	21 246
Pakistan	130 604	51,94	37 434	48,68	79 610
Qatar	396	0,00		??	1 100
Saudi Arabia	15 251	36,84	4 363	37,31	214 969
Turkey	58 165	42,30	25 274	46,30	76 963
United Arab Emirates	1 656	2,42	842	2,26	8 360
Yemen	12 557	54,85	3 008	54,36	52 797
Total	317 504	42,15	99 324	41,91	730 641



Appendix 1.2 Basic facts of the countries and territories in the sub-region. (Data from FAO statistics, 1990-95)

Country	Land use (1 000 Ha)				
	Land Area	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
Afghanistan	65 209	8 054	12,35	1,79	34,27
Bahrain	68	2	2,94	50,00	50,00
Iran	164 800	15 050	9,13	6,31	38,21
Iraq	43 737	5 450	12,46	3,67	46,79
Kuwait	1 782	5	0,28	0,00	40,00
Oman	21 246	61	0,29	73,77	95,08
Pakistan	79 610	21,140	26,55	0,00	80,42
Qatar	1 100	6	0,55	0,00	0,00
Saudi Arabia	214 969	2 375	1,10	3,16	39,58
Turkey	76 963	27 689	35,98	10,92	8,67
United Arab Emirates	8 360	39	0,47	25,64	12,82
Yemen	52 797	1 610	3,05	6,52	19,38
Total	730 641	81 481	11,15	5,59	39,00



Appendix 1.2 Basic facts of the countries and territories in the sub-region. (Data from FAO statistics, 1990-95)

Country	Land use (1 000 Ha) 1 991				
	Land Area	Forest		Permanent Pasture Other lands	
		Total area	% of Total Land area	Total area	% Total Land area
Afghanistan	65 209	1 900	2,91	55 255	84,74
Bahrain	68			66	97,06
Iran	164 800	18 020	10,93	130 530	79,21
Iraq	43 737	1 880	4,30	36 407	83,24
Kuwait	1 782	2	0,11	1 775	99,61
Oman	21 246			21 185	99,71
Pakistan	79 610	3 480	4,37	52 468	65,91
Qatar	1 100			1 094	99,45
Saudi Arabia	214 969	1 200	0,56	211 394	98,34
Turkey	76 963	20 199	26,25	29 075	37,78
United Arab Emirates	8 360	3	0,04	8 318	99,50
Yemen	52 797	4 060	7,69	47 127	89,26
Total	730 641	50 744	6,95	594 694	81,39



Appendix 2 Trade values of the countries and territories in the sub-region. (Data from FAO statistics, 1990-95)

Country	Contribution of Agriculture to GDP (%)	Percent GDP on food import	Food & Animals import 1 000\$	Food & Animals export 1 000\$
Afghanistan	29	0,3	103 663	70 231
Bahrain	4	0,7	212 322	653
Iran	26	-	1 830 666	424 391
Iraq	18	-	555 648	18 786
Kuwait	1	0,4	237 740	9 670
Oman	3	0,4	440 263	46 402
Pakistan	23	0,1	603 860	464 610
Qatar	2	0,4	252 655	6 884
Saudi Arabia	10	0,3	3 504 300	429 000
Turkey	16	-	44 170	266 538
United Arab Emirates	2	0,3		
Yemen	26	0,7	597 158	34 669
Total			9 868 875	2 155 114

- To improve capacity in national programmes to undertake *in situ* conservation.

Country	Cereals & Prep. import 1 000\$	Cereals & Prep. export 1 000\$	Forestry products import 1 000\$	Forestry products export 1 000\$
Afghanistan	159 769	41 600	1 273	
Bahrain	32 266	162	36 164	
Iran	736 241	283	488 104	20 150
Iraq	288 961		117 378	
Kuwait	63 510	3 030	102 440	
Oman	89 692	9 374	46 878	
Pakistan	147 286	346 556	154 210	
Qatar	35 322	107	18 015	
Saudi Arabia	945 200	281 400	336 700	1
Turkey	11 255	46 615	24 402	4 170
United Arab Emirates	215 750	60 520		
Yemen	253 578	3 200	10 499	
Total	2 978 830	792 847	1 336 063	24 3500

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



Appendix 3 Major Crops originating from Mediterranean and West Asian regions

Crops		Mediterranean Centre	Near Eastern Centre	Central Asian Centre
Cereals				
Oats	<i>Avena spp.</i>	+(<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>		+(2nd center)	+
Lentil	<i>Lens culinaris</i>		+	
Peas	<i>Pisum sativum</i>		+(2nd center)	
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>	+(2nd center)	+(2nd center)	+
Garlic	<i>Allium sativum</i>	+(2nd center)	+(2nd center)	
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 spp.</i>		+(Asia minor)	+
Walnut	<i>Juglans regia</i>			+
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>Trifoliumalexandrinum</i>	+		
Vetch	<i>Vicia sativa</i>	+	+	



Appendix 4 National Programmes and legislation in the sub-region

Country/ Territory	National Programme ¹	Laws for PGR Protection	Presence of Nat PGR Committee	Quarantine & Phytosanitary Legislation	Intellectual Property Rights	Involvement of Private Sector
Afghanistan	Breeding	No	No	Yes	No	No
Bahrain		No	No		No	No
Iran	PGR/Breeding	No	Yes	Yes	Yes	No
Iraq	Breeding	No	Yes	Yes	No	No
Kuwait		No	No		No	No
Oman		No	No	Yes	No	No
Pakistan	PGR/Breeding	No	Yes	Yes	No	Little in breeding
Qatar		No	No		No	No
Saudi Arabia			No		No	No
Turkey	PGR/Breeding	Yes	Yes	Yes	No	Little in breeding
United Arab Emirates		No	No		No	No
Yemen	Breeding	No	Yes	Yes	No	No

- To provide training for planning and implementing in situ conservation programmes.

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

Country	Project/Name/ Number	GEF Implementing Agency	Executing Agency	Associated Participation	Entry into Work Program	Approved Date	Duration	Status
Pakistan	Biodiversity (Under development)							Pending
Turkey	In situ 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	5/92	2/93	5years	Under implementatio
Yemen	Protection of Marine Ecosystems of the Red Sea	UNDP		UNEP				



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

Country	In situ conservation activities		Ex situ conservation activities	
	In situ conserv. of forest & wild species	On farm conservation programmes	National collections	Field Genebank
Afghanistan	Yes	No	Yes	
Bahrain	Yes	No	No	
Iran	Yes	No	Yes	Yes
Iraq	Yes	No	Yes	Yes
Kuwait	Yes	No	No	
Oman	Yes	No	No	
Pakistan	Yes	No	Yes	Yes
Qatar	Yes	No	No	No
Saudi	Yes	No	No	No
Turkey	Yes	No	Yes	Yes
United Arab	Yes	No	No	
Yemen	Yes	No	Yes	Yes

Country	Ex situ conservation activities				
	National Genebank	Storage facilities	Duplicated samples ¹	Regeneration activities	PGR Documentation
Afghanistan	No		Outside		
Bahrain	No				
Iran	Yes	Mid & Long term	In/Outside	Yes	Computerized
Iraq	Yes	Not in use	Outside	Yes	Manual
Kuwait	No	Mid & Long term			-
Oman	No				
Pakistan	Yes	Mid & Long term	In/Outside	Yes	Computerized
Qatar	No				
Saudi Arabia	No				
Turkey	Yes	Mid & Long Term	In/Outside	Yes	Computerized
United Arab Emirates	No				
Yemen	No	Mid & Long Term		Yes	Manual



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