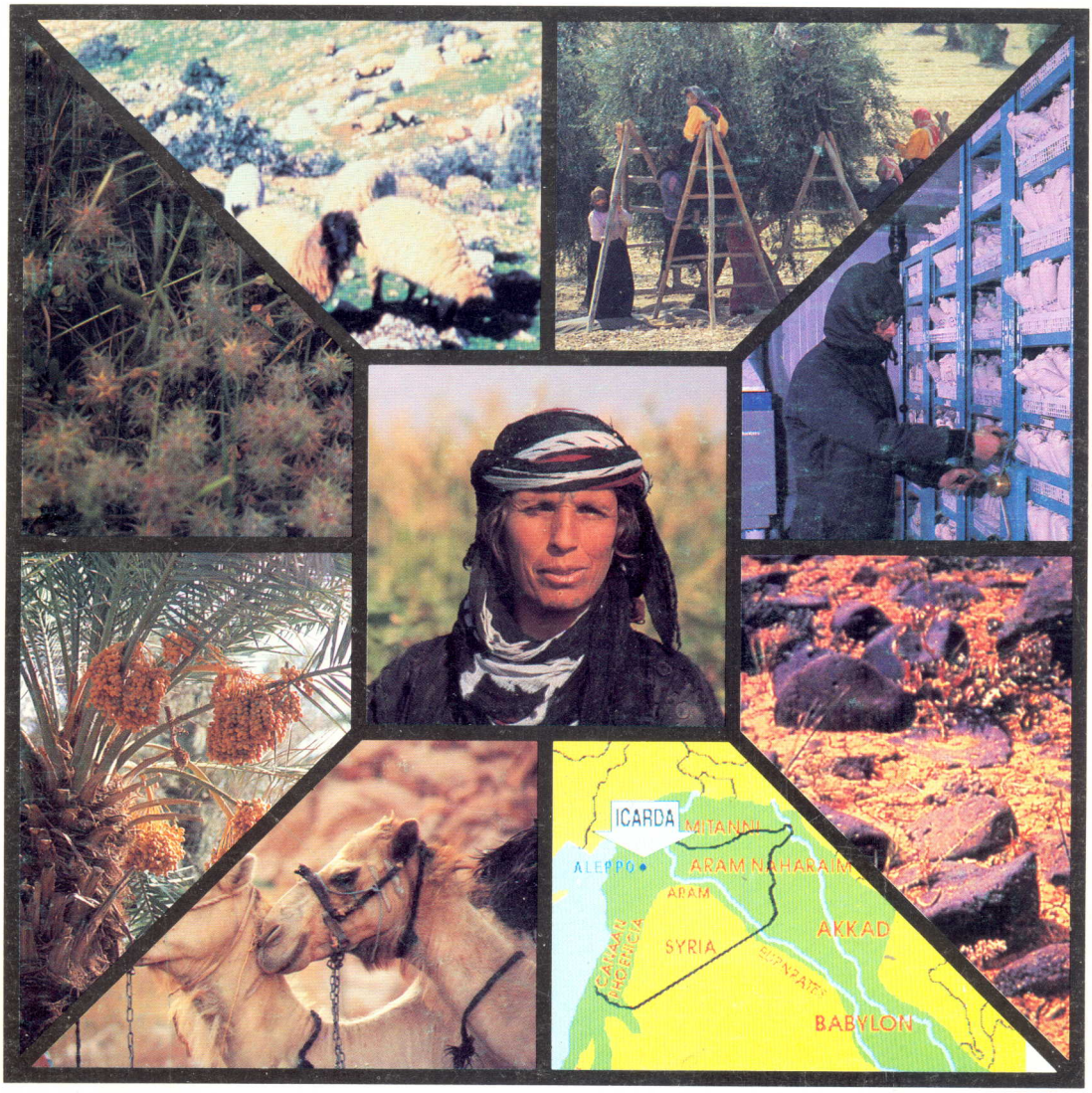
Dryland Biodiversity Conservation through Natural Resource Management



International Center for Agricultural Research in the Dry Areas
ICARDA

About ICARDA

Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is governed by an independent Board of Trustees. Based at Aleppo, Syria, it is one of 16 centers supported by the Consultative Group on International Agricultural Research (CGIAR), which is an international group of representatives of donor agencies, eminent agricultural scientists, and institutional administrators from developed and developing countries who guide and support its work.

The CGIAR seeks to increase agricultural production, in a sustainable way, to feed the growing populations of the developing world. It aims to alleviate poverty and malnutrition and, consequently, contribute to human welfare and social stability.

ICARDA's mission is to meet the challenge posed by a harsh, stressful, and variable environment in which the productivity of winter rainfed agricultural systems must be increased to higher sustainable levels; in which soil degradation must be arrested and possibly reversed, and in which the quality of the environment needs to be assured. ICARDA meets this challenge through research, training, and dissemination of information in a mature partnership with the national agricultural research and development systems.

The Center has a world responsibility for the improvement of barley, lentil, and faba bean, and a regional responsibility in West Asia and North Africa for the improvement of wheat, chickpea, forage and pasture—with emphasis on rangeland improvement and small ruminant management and nutrition—and of the farming systems associated with these crops.

Much of ICARDA's research is carried out on a 948-hectare farm at its headquarters at Tel Hadya, about 35 km southwest of Aleppo. ICARDA also manages other sites where it tests material under a variety of agroecological conditions in Syria and Lebanon. However, the full scope of ICARDA's activities can be appreciated only when account is taken of the cooperative research carried out with many countries in West Asia and North Africa and elsewhere in the world.

The results of research are transferred through ICARDA's cooperation with national and regional research institutions, with universities and ministries of agriculture, and through the technical assistance and training that the Center provides. A range of training programs is offered extending from residential courses for groups to advanced research opportunities for individuals. These efforts are supported by seminars, publications, and specialized information services.

Dryland Biodiversity Conservation through Natural Resource Management

Summary Proceedings of a Workshop
5-9 February 1995, Amman, Jordan

Editor

John M. Peacock

Sponsors

United Nations Environment Programme (UNEP)
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International Plant Genetic Resources Institute (IPGRI)
Arab Center for the Studies of Arid and Semi-Arid Zones (ACSAD)

International Center for Agricultural Research in the Dry Areas
ICARDA
P.O. Box 5466, Aleppo, Syria

1995

Citation: Peacock, J.M. (ed.). 1995. Dryland Biodiversity Conservation through Natural Resource Management. Summary Proceedings of a Workshop, 5-9 February 1995, Amman, Jordan. ICARDA, Aleppo, Syria.

ISBN: 92-9127-031-8

Workshop Organizing Committee: John Peacock (Coordinator/Chairman, ICARDA), Scott Christiansen (ICARDA), Jan Valkoun (ICARDA), Youssef Barkoudah (ACSAD), Yawooz Adham (IPGRI), Nasri Haddad (ICARDA).
Language Editor: C.M. Anthea Vaughan
Production Supervisor: Guy R. Manners

ICARDA
P.O. Box 5466, Aleppo, Syria
Telephone: (963 - 21) 225112/213477
Fax: (963 - 21) 213490/225105
Telex: 331208/331263/331206 ICARDA SY
E-mail: *icarda@cgnet.com*

Contents

Foreword

In 1992, the Earth Summit in Rio brought the destruction of our Earth's biodiversity to the world's attention. In its broadest sense, **biological diversity**, or **biodiversity**, encompasses the variety and variability of all living organisms and their habitats. Nowhere is this devastation so great as in the drylands. Although the number of species there may be low, many are of global importance. The most valuable part of the plant diversity is that which supplies the world's food or the **agro-biodiversity.**

Most of the major food crops originated in drylands. Species originating in the Near East alone include wheat, barley, rye and oats; faba bean, peas, chickpea and lentil; safflower, rapeseed and linseed; numerous species of fruit and vegetables; numerous pasture species; and some medicinal, aromatic and ornamental plants. This region is uniquely rich in dryland agro-biodiversity and still contains the wild progenitors and relatives. The importance here is in the within-species genetic diversity, rather than between-species variation or "species richness". Yet these drylands contain a significant endowment of plants and animal species, including micro-organisms.

These species have evolved under harsh conditions of temperature and drought, and cultivated species have been farmed and selected over 10,000 years, each one adapted to a specific niche. This unique richness of genes forms the genetic material upon which future plant-breeding efforts are based.

Not only is agro-biodiversity so important, but drylands also provide some critical habitats for wildlife. Wetlands within drylands (e.g. the Azraq Oasis in north-east Jordan) serve as indispensable resting and breeding grounds for migratory birds, and they are highly vulnerable to land degradation and excessive drainage.

The Near East agro-biodiversity is being lost at a phenomenal rate. The need to feed the ever-increasing populations of people and livestock pushes the agricultural and rangeland frontiers into more and more marginal land. This increased pressure on fragile ecosystems has led to desertification. At present desertification threatens about 3.6 billion hectares in over 100 countries. With these pressures, biodiversity can only be maintained if its conservation is an integral part of land use.

This is the ultimate goal of a project "Conservation, Management and Sustainable Use of Drylands Biodiversity in the Near East" designed to address the loss of biodiversity in drylands. To this end the UNEP-funded workshop in Amman in February 1995 brought together national agricultural research systems of the Near East, international agricultural research centers, and advanced institutions from around the world. It was the second opportunity these organizations had to meet together and discuss their goals.

Two major components of the project, and the workshop, which I would like to highlight are training and capacity building. Training has always been a major component of the work of all organizations in the region; however, in this project, it is not just a case of sending national staff out of the region, but emphasis is on the need to bring trainers into the region to teach in the context of the environment. Capacity building is crucial for the spread of new technologies and ways of thinking both to decision-makers and land-users. These people operate in completely different worlds and our public awareness messages, research and development actions must be tailored to the language of both clients.

I would very much have liked to attend this workshop, but the Ministerial-level meeting of the CGIAR in Lucerne was held on the same days. Interestingly, my sentiments about the workshop were reflected in the opening statement made by Her Excellency Ruth Dreifus, Switzerland's Minister of the Interior, and I quote: "Despite the extraordinary progress of the twentieth century, we have witnessed developments in our global society that are quite simply unacceptable. It is unacceptable that hundreds of millions of people, mainly women and children, go hungry and lack the necessary calorie intake to carry out their daily tasks. Yet the physical suffering entailed by a situation of extreme poverty pales in comparison with the moral hardship endured by those who are marginalized from the rest of society.

"It is equally unacceptable that, each day, our generation's agricultural and industrial production destroy a little more of the **environmental capital** we have inherited from our parents. Our behavior in this regard is irresponsible, and our grandchildren—quite rightly—will not be able to be very proud of us. These fundamental issues were addressed at the Earth Summit in Rio, in June 1992, and in Cairo, in September 1994."

The workshop, I believe, addressed this important issue. Where else in the world is there such a concentration of the world's "environmental capital" but here in the Near East? ICARDA with its partners, intends to take the necessary steps to conserve this valuable resource for world's use. This workshop was a great beginning.

Adel El-Beltagy
Director General
ICARDA

Preface

The need for concerted international action and regional cooperation to protect biological diversity, including dryland biodiversity, was recognized by the Convention on Biological Diversity, the Desertification Convention and Agenda 21.

This workshop was organized by the sponsors to address this overall need. It is the second in a series of meetings designed to maximize the sharing of information and research findings among scientists involved in biodiversity conservation efforts in the Fertile Crescent. The participants included representatives of national agricultural research programs in Iraq, Jordan, Lebanon, Palestine, Syria and Turkey and international and non-governmental organizations. Farmers and other land users will participate in future workshops.

The specific needs and anticipated outputs were taken from the UNEP Project Document and provide a background to the overall objectives of the workshop.

Needs

- To overcome the serious erosion of dryland biodiversity.
- To promote *in situ* and *ex situ* conservation and sustainable use of dryland biodiversity and genetic resources.
- To provide governments with the broadest possible diversity of dryland germplasm essential to sustainable agricultural development of arid zones.
- To enhance dryland productivity through integrated management of natural resources.
- To assist governments and local peoples to incorporate biodiversity conservation and sustainable-use issues in dryland natural resources management.
- To encourage the generation and use of knowledge on the productivity of marginal dryland.
- To develop human resources for the implementation of integrated programs for management of dryland natural resources.

Outputs

- Increased number of dryland species surveyed, their germplasm collected and deposited in national genebanks and in those network genebanks that hold the world base collections.
- Increased number of national/regional programs for ecogeographic surveying, collection and conservation of dryland genetic resources and for their use in dryland development.
- Improved management and enhanced productivity of dryland natural resources upon which agricultural productivity is based.

Assumptions to Achieve Results

- Trainees under the project will return to assigned positions and promote integrated natural resources management in dryland areas.
- Adequate skills, minimum infrastructures, and programs will be developed at the national and regional levels.
- Biodiversity concerns will be incorporated in dryland national development programs.
- ACSAD, ICARDA and IPGRI and other specialized institutes will continue their technical and financial support of relevant programs.

In a statement issued at the end of the workshop, participants said:

> *'The Fertile Crescent is one of the Earth's richest sources of genetic diversity of crops, such as wheat, that now feed the entire world. The scientific community throughout the region must work together to find economic alternatives to resource abuse, such as over-grazing and habitat destruction. We owe it to the land users, the stewards of our nation's soil, crop landraces and native domesticated breeds.'*

Agenda

Saturday, February 4th

19:00 Arrival and Registration of Delegates

Sunday, February 5th

08:00 Registration

09:00-09:30 **Opening Ceremony**

Chairman: Dr Nasri Haddad,
Regional Coordinator, ICARDA
Rapporteurs: Dr Rick Tutwiler
Dr Salvatore Ceccarelli

Opening Remarks from:
Dr Muhammad Wardeh,
Representing the Director General, ACSAD
Dr Aart van Schoonhoven,
Deputy Director General, ICARDA
Dr Masa Iwanaga,
Deputy Director General, IPGRI
Mr Ghaleb Abou Orabi,
General Secretary of the
Minister of Agriculture, Jordan

09:30-10:00 Break

10:00-10:30 **Dryland Biodiversity - The Need**
Workshop objectives, expectations and outputs.

Speaker: Dr John Peacock, Chairman,
Biodiversity Task Force, ICARDA

10:30-13:30 **Working Session 1. Ecosystem Selection**

Chairman: Dr Michel Abi Antoun
Rapporteurs: Dr Toby Hodgkin
Dr Larry Robertson

10:30-11:00 **Speaker:** Dr. Jan Valkoun (ICARDA)

Working Session 1 (contd.)

11:00-13:30 Discussion

13:30-14:00 Break

14:00-16:00 **Working Session 2. Ecosystem Management**

Chairman: Dr Shady Hamadeh
Rapporteurs: Dr Larry Robertson
Dr Jan Konopka

14:00-15:00 Speakers: Dr Myrna El-Haber (Lebanon)
Prof. Paul Struik (Wageningen)
Dr Awni Taimeh (Jordan)
Dr Muhammad Wardeh (ACSAD)

15:00-16:00 General discussion

Monday, February 6th

08:00-12:30 **Working Session 3. Complementary Conservation Strategies**

Chairman: Dr Awni Taimeh
Rapporteurs: Dr Jan Konopka
Ms Morag Ferguson

08:00-10:30 Speakers: Dr Nigel Maxted (Univ. Birmingham)
Dr Kamal Khairallah (Jordan)
Dr Toby Hodgkin (IPGRI)
Dr Youssef Barkoudah (ACSAD)

10:30-10:45 Break

10:45-12:30 General discussion

12:30-13:00 Break

13:00-16:00 **Working Session 4.**
Utilization and Value of Biodiversity

Chairman:	Dr Youssef Barkoudah
Rapporteurs:	Dr Abdullah Jaradat
	Dr Nigel Maxted

13:00-14:30 **Speakers:**
Dr Azzedine Al-Shamma (Iraq)
Dr Keith Pike (WSU, Pullman)
Dr Salvatore Ceccarelli (ICARDA)
Dr Adel Gouda (ACSAD)

14:30-16:00 General discussion

Tuesday, February 7th

08:00-10:30 **Working Session 5.**
Local Community Participation, Indigenous Technical Knowledge and Land Tenure

Chairman:	Dr Jad Isaac
Rapporteurs:	Dr Ruth Raymond
	Dr Abdullah Jaradat

08:00-09:30 Speaker: Dr Rick Tutwiler (ICARDA)

09:30-10:30 General discussion

10:30-10:45 Break

10:45-13:30 **Working Session 6.**
Training Issues of the Region

Chairman:	Dr Mohiddin Issa
Rapporteurs:	Dr David Cooper
	Dr Scott Christiansen

10:45-12:30 **Speakers:**
Dr Shady Hamadeh (Lebanon)
Dr Nigel Maxted (Univ. Birmingham)
Prof. John MacArthur (Univ. Bradford)
Dr Shaun Hobbs (CABI)
Dr Harriet Gillett (WCMC)

12:30-13:30 General discussion

13:30-14:00 Break

14:00-16:00 **Working Session 7. Public Awareness**

Chairman: Mr Irfan Özberk
Rapporteurs: Dr Salvatore Ceccarelli
Ms Morag Ferguson

14:00-15:15 **Speakers:** Dr Jad Isaac (Palestine)
Dr Ricardus El-Haber (Lebanon)
Dr Ruth Raymond (IPGRI)

15:15-16:00 General discussion

17:30-19:00 Workshop dinner

19:00 Demonstration of training and research aids

Wednesday February 8th

09:00-15:00 Field trip organized by Royal Society for Conservation of Nature (RSCN) and the Azraq Project to:
Azraq Oasis Conservation Project (GEF/UNDP funded)
and El-Shomari (Wild Life Reserve)

Thursday February 9th

08:00-10:00 **Summary of Working Sessions**

Chairman: Dr Azzedine Al-Shamma
Rapporteurs: Dr Rick Tutwiler
Dr Toby Hodgkin

08:00-09:00 **Speakers:** Session Chairpersons and/or Coordinators

09:00-10:00 General discussion

10:00-11:00 Break (Prof. Qualset finalizes his Synthesis Report)

11:00-12:00 **Synthesis of Workshop Findings**

Speaker: Prof. Calvin Qualset,
Univ. of California, Davis, USA

12:00-12:30 Clarification and discussion

12:30-13:00	**Plenary Session**	
	Speaker:	Dr Aart van Schoonhoven, DDG- ICARDA
13:00-13:30	Break	
13:30-16:00	**GEF/UNDP Biodiversity Project** Specific discussion on reformulation	
	Chairman:	Dr Aart van Schoonhoven, DDG
	Rapporteurs:	Dr Scott Christiansen Dr Ruth Raymond
16:00	Closing remarks	

Participants

IRAQ

Azzedine M. Al-Shamma
IPA Agricultural Research Center
P.O. Box 39094
Baghdad, Iraq
Tel no. +964 1 5117944

ITALY

Antonio Raschi
CNR - IATA
Piazzale Delle Cascine 18
50166 Firenze
Italy
Tel no. +39 55 301422
Fax no. +39 55 308910

JORDAN

Mohammad Ababneh
NCARTT
Director of Rainfed Agriculture
Research Programme
Amman, Jordan
Tel no. +962 6 725411/2
Fax no. +962 6 726099

Suleiman Abdulaziz Abaddi
Ministry of Agriculture
Forestry Department
National Coordinator for
Watershed Management
Amman, Jordan
Tel no. +962 6 842751
Fax no. +962 6 837929

Nabeel Ismail Abu-Shriha
Agricultural and Environmental
Public Awareness
P.O. Box 922821
JES (Jordan Environment Society)
Amman, Jordan
Tel no. +962 6 699844/699143
Fax no. +962 6 695857

Amer Sh. Al-Homoud
Ministry of Planning
Water and Environment
Directorate
P.O. Box 9095 (Home)
Amman 11191, Jordan
Tel no. +962 6 644466
Fax no. +962 6 649341

Qassem M. Al Mamdouh
NCARTT
National Coordinator Mashreq Project
Amman, Jordan
Tel no. +962 6 725411/2
Fax no. +962 6 726099

Ghaith H. Fariz
Azraq Oasis Conservation Project
P.O. Box 1165,
Amman, Jordan
Tel no. +962 6 629500
Fax no. +962 6 830726

Khaled A. Irani
Royal Society for the
Conservation of Nature (RSCN)
Director of Wildlife Reserves
RSCN, P.O. Box 5169,
Amman, Jordan
Tel no. +962 6 837931/2
Fax no. +962 6 847411

Kamal Khairallah
NCARTT/GRU
GRU-Researcher
Amman, Jordan
Tel no. +962 6 725411/2
Fax no. +962 6 726099

Ibrahim Khalil
Ministry of Agriculture
Head of Forestry Seed Center
Amman, Jordan
Tel no. +962 6 842751
Fax no. +962 6 837929

Sobhia Saifan
NCARTT
GRU Research Assistant
Amman, Jordan
Tel no. +962 6 725411/2
Fax no. +962 6 726099

Maha Syiouf
NCARTT
GRU Research Assistant
Amman, Jordan
Tel no. +962 6 725411/2
Fax no. +962 6 726099

Kamal Tadros
NCARTT
Director Range Research Programme
Amman, Jordan
Tel no. +962 6 725411/2
Fax no. +962 6 726099

Awni Y. Taimeh †
Soil and Irrigation Department
Faculty of Agriculture
University of Jordan
Amman, Jordan
Tel no. +962 6 843555 ext. 2531
Fax no. +962 6 833059
Tlx no. 21629 UNUJ JO

† **Present address:** Director General, NCARTT, P.O. Box 639, Amman, Jordan.

LEBANON

Michel Abi Antoun
Researcher
Agricultural Research Institute
Tel Amara - Rayak
Lebanon
Tel no. +961 8 900037/47/57
Fax no. +961 8 900047 LE /
+961 1 882124 LE

Myrna Semaan El-Haber
Friends of Nature
Horsh Ehden Nature Reserve
Ministerial Committee
P.O. Box 967, Jounieh,
Lebanon
Tel no. +961 9 913159/
+961 3 668864
Fax no. +961 1 887933

Ricardus M. El-Haber
Friends of Nature/NGO
National Focal Point RAC/SPA
Researcher
Marine Research Centre/CNRS
University Lecturer
P.O. Box 967, Jounieh,
Lebanon
Tel no. +961 9 913159/
+961 3 668864
Fax no. +961 1 887933

Shady Hamadeh
American University of Beirut
and Green Line Association
P.O. Box 11-0236, Beirut
Lebanon
Tel no. +961 1 350000 Ext. 4458
Fax no. +961 1 212 4781995
Tlx no. 20801 LE

Boutros Mouawad
Foundation Rene Mouawad
Friends of Horsch Ehden
Forest Nature Reserve
Hazmieh Imm Moritra
B.P. 468 Hazmieh
Lebanon
Tel no. +961 1 660707/661795
Fax no. +961 1 429056

PALESTINE

Jad Isaac
Director General,
Applied Research Institute,
Jerusalem
Caritas St., Bethlehem
West Bank
Palestine
Tel no. +972 2 741889
Fax no. +972 2 741889

SYRIA

Mohiddin Issa
Deputy Minister
Ministry of Higher Education
Damascus, Syria
Tel no. +963 11 3335745
Fax no. +963 11 3327719

Ali Shehadeh
Ministry of Agriculture and
Agrarian Reform
Directorate of Agriculture -
Scientific Research
Douma, Damascus
Syria
Tel no. +963 11 5751401/2

TURKEY

Ismail Küsmenoglu
Ministry of Agriculture of Turkey
Central Research Institute for
Field Crops
P.O. Box 226
Ulus, Ankara
Turkey
Tel no. +90 4 312 2878957
Fax no. +90 4 312 2878958

Irfan Özberk
Director Southeastern Anatolian
Agricultural Research Institute,
P.O.Box 72
Diyarbakir 21110
Turkey

THE NETHERLANDS

Paul C. Struik
Prof. of Field Crops Science
(temperate regions)
Department of Agronomy
Field Crops Section
Wageningen Agricultural University,
Haarweg 333
6709 RZ Wageningen
The Netherlands
Tel no. +31 8370 84246
Private Tel no. +31 8880 53082
Fax no. +31 8370 84575
E-Mail:
Paul.Struik@AKKER.AGRO.WAU.NL

UNITED KINGDOM

Peter Caligari
Department of Agricultural Botany
School of Plant Sciences
University of Reading
Whiteknights,
P.O. Box 221
Reading RG6 2AS, UK
Tel no. +44 1734 318091/2
Fax no. +44 1734 316577

Harriet Gillett
World Conservation Monitoring Center
Senior Research Officer - Plants
219 Huntington RD
Cambridge CB3 0DL, UK
Tel no. +44 1223 277314
Fax no. +44 1223 277136
@mail:
harriet.gillett@wcmc.org.UK

Shaun Hobbs
Head of Department
Plant Breeding & Genetics
CAB INTERNATIONAL
Wallingford
Oxon OX10 8DE, UK
Tel no. +44 1491 832111
Fax no. +44 1491 833508
@mail: S.hobbs@cabi.org.UK

John D. MacArthur
Development and Project Planning Centre,
University of Bradford
Bradford BD7 1DP, UK
Tel no. +44 1274 385254
Fax no. +44 1274 385280

Nigel Maxted
School of Biological Sciences,
University of Birmingham
Birmingham BT15 2TT, UK
Tel no. +44 121 4145571
Fax no. +44 121 4145925
Email:
N.Maxted@Bham.ac.UK

USA

Keith Pike
Washington State University
Rtz, Box 29534
Prosser, WA 99350-9687
USA
Tel no. +1 509 786 2226
Fax no. +1 509 786 4635

Calvin Qualset
Director
Genetic Resources Conservation Program
University of California
Davis, CA 95616, USA
Tel no. +1 916 754 8501
Fax no. +1 916 754 8505

ACSAD

Youssef Barkoudah
ACSAD
P.O. Box 2440
Damascus, Syria
Tel no. +963 11 5755713/4
Fax no. +963 11 5755712

Mohamed Adel Gouda
Director of Plant Studies
Division
ACSAD
P.O. Box 2440
Damascus, Syria
Tel no. +963 11 5755713/4
Fax no. +963 11 5755712

Muhammad Wardeh
Director,
Department of Studies of Animal Wealth
ACSAD
P.O. Box 2440
Damascus, Syria
Tel no. +963 11 5755713/4
Fax no. +963 11 5755712

ESCWA

Mahmood Ahmad
c/o UN ESCWA
Amman, Jordan
Tel no. +962 6 606847 Ext. 119

Sunna J. Sami
ESCWA
Regional Adviser in Agriculture
Amman, Jordan
Tel no. +962 6606847

ICARDA

Salvatore Ceccarelli
ICARDA
P.O. Box 5466
Aleppo, Syria
Tel no. +963 21 213477
Fax no. +963 21 213490

Scott Christiansen
ICARDA
P.O. Box 5466
Aleppo, Syria
Tel no. +963 21 213477
Fax no. +963 21 213490

Morag Ferguson
ICARDA
P.O. Box 5466
Aleppo, Syria
Tel no. +963 21 213477
Fax no. +963 21 213490

Nasri Haddad
Regional Coordinator for
West Asia
ICARDA
P.O.Box 950764
Amman 11195
Jordan
Tel no. 962 6 825750
Fax no. 962 6 825930
Tlx no. 23278 ICARDA Jo

Jan Konopka
ICARDA
P.O. Box 5466
Aleppo, Syria
Tel no. +963 21 213477
Fax no. +963 21 213490

John Peacock
ICARDA
P.O. Box 5466
Aleppo, Syria
Tel no. +963 21 213477
Fax no. +963 21 213490

Larry Robertson
ICARDA/GRU
P.O. Box 5466
Aleppo, Syria
Tel no. +963 21 213477
Fax no. +963 21 213490

Richard Tutwiler
ICARDA
P.O. Box 5466
Aleppo, Syria
Tel no. +963 21 213477
Fax no. +963 21 213490

Jan Valkoun
ICARDA
P.O. Box 5466
Aleppo, Syria
Tel no. +963 21 213477
Fax no. +963 21 213490

Aart van Schoonhoven
Deputy Director General (Research)
ICARDA
P.O. Box 5466
Aleppo, Syria
Tel no. +963 21 213477
Fax no. +963 21 213490

IPGRI

Yawooz Adham
IPGRI
WANA Group Director
c/o ICARDA
P.O. Box 5466, Aleppo
Syria
Tel no. +963 21 213477
Fax no. +963 21 213490

Toby Hodgkin
IPGRI
Genetic Diversity Group
Via delle Sette Chiese, 142
00145 Rome
Italy
Tel no. +39 6 51892212
Fax no. +39 6 5750309

Masa Iwanaga
IPGRI
Deputy Director General (Programme)
Via delle Sette Chiese, 142
00145 Rome
Italy
Tel no. +39 6 51892200
Fax no. +39 6 5750309

Abdullah A. Jaradat
IPGRI
WANA Group
c/o ICARDA
P.O. Box 5466, Aleppo
Syria
Tel no. +963 21 213477
Fax no. +963 21 213490

Ruth Raymond
IPGRI
Public Awareness Officer
Via delle Sette Chiese, 142
00145 Rome
Italy
Tel no. +39 6 51892215
Fax no. +39 6 5750309

UNDP

Firas Gharaibeh
UNDP
Amman, Jordan
Tel no. +962 6 668171
Fax no. +962 6 668197

Opening Addresses

Introductory Remarks by the Chairman, Dr. Nasri Haddad

Regional Coordinator of ICARDA West Asia Program

Your Excellency, Mr. Ghaleb Abu Ourabi, Representative of His Excellency, Mansour Abu Tarif, Minister of Agriculture, Jordan, Dr. van Schoonhoven, Dr. Iwanaga, Dr. Wardeh, Ladies and Gentlemen,

The workshop focuses on the maintenance of biodiversity through sound management of natural resources. Since this region is considered to be the center of evolution and variation of an important set of field and forage crops, in addition to some trees and pasture plants, its biodiversity is very important. Due to the irrational use of soil and vegetation resources, erosion and degradation of these plants has become noticeable. If this trend continues, we will reach a stage in which it will be difficult for us to maintain the remaining plant species. The importance of such plant species is that they have unique genetic characteristics which make them adaptable and resistant to different environmental stresses. Therefore, they can contribute to the development of crops and, in turn, boost productivity. The greatest beneficiaries of this activity would be the peoples of this region.

The workshop will address this issue, and attempt to come up with recommendations for suitable practises that would make rational use of resources while ensuring their sustainability and maintaining the diversity.

An important aspect which we should not overlook is the role of individuals in maintaining the environment and biodiversity. It is a fundamental role. The participation of NGOs in this workshop on maintaining the environment, is to help focus on the role of the individual and his or her responsibility in guarding the national fortunes. The public need to be made aware of the situation. This is best done by involving individuals in the planning and implementation processes in conjunction with the concerned institutions and societies.

Opening Address by Dr. Muhammad Wardeh

Director of ACSAD's Livestock Studies Department
on behalf of
Dr. Hassan Seoud, *Director General, ACSAD*

Your Excellency, Mr. Ghaleb Abu Ourabi, Representative of His Excellency, Mansour Abu Tarif, Minister of Agriculture, Jordan; Dr van Schoonhoven, Deputy Director General, ICARDA; Dr Masa Iwanaga, Deputy Director General, the International Plant Genetic Resources Institute; Ladies and Gentlemen,

I am privileged to represent Dr Hassan Seoud, the Director General of the Arab League's 'Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD)', at this workshop on biodiversity conservation in the dryland zones through management of natural resources. As you know, the Arab World has an area of about 14 million km^2, of which 89% is dry and semi-dry lands. The remaining part is cultivated lands, in which the prevailing environments include field crops, fruit trees, vegetables, or forests. Topographical and ecological variation has produced wide biological diversity. There are dense wet forests, tropical dry forests, areas of Mediterranean vegetation, Savanna plains and various desert plants. There are a great number of species, sub-species and diverse ecosystems, as well as a number of domesticated and wild animals, settled and migratory birds and a large number of rodents and reptiles.

The dryland environments are fragile and particularly vulnerable to desertification if misused. This prompted the Arab League to establish ACSAD, in 1971. Its mandate is to conduct the studies required to develop the fragile and semi-arid lands, within the following four-pronged strategy:

i To monitor and evaluate forage resources and the effect of changes in their use.
ii To develop the strategies required for the conservation of natural resources and the protection and rehabilitation of degraded areas.
iii To develop human resources through the acquisition of technical skills and the transfer, to the region, of suitable technologies.
iv To document, disseminate and exchange information.

For these activities, the Arab Center provides the principal databases of water resources, soil, plants, animals and climatology. Ever since its establishment, the Center has been aware of the importance of plant and animal biodiversity in the development of arid and semi-arid areas. It has worked to develop high-yielding, drought-tolerant and disease-resistant wheat and barley varieties for such areas. Varieties developed by ACSAD are being sown over thousands of hectares in Morocco, Algeria, Tunisia, Libya, Syria, Jordan, Iraq, Kuwait and Yemen. More than 50 pasture species, suitable for the reclamation of degraded rangelands, have also been selected and evaluated. Every year this Arab Center distributes several tonnes of the seed to many centers and Arab ministries for re-planting degraded areas. It has also developed a genepool of pasture plants in collaboration with the University of Aleppo, and another is being developed in collaboration with the Ministry of Agriculture and Agrarian Reform. The Center's database has information on the

classification, geographical distribution and economic benefits of more than 1300 plant species.

A genepool of drought-tolerant fruit trees, namely, olives, pistachios, figs and almonds, has also been developed. More than 300 indigenous and introduced varieties have been collected and evaluated and the germplasm is distributed to Arab countries interested in improving the production of such trees. Assistance in establishing genepools and plant nurseries, is also offered.

With regard to forest species, ACSAD carries out evaluations of their respective economic benefits. In addition, it conducts geo-environmental studies and tests multiplication methods in order to provide the Arab national programs with information on afforestation, soil erosion control, reclamation of watersheds and sand-dune fixing.

Since carrying out a comprehensive survey of livestock resources, in the 1970s ACSAD has established stations serving as genebanks for collections of the important sheep and goat strains. The most important stations are Qaser Halabat and Shola in Syria, and the Fejej station in Jordan, for Awassi sheep; Weslatieh station for Tunisian sheep; Tagmout station in Algeria, for Algerian sheep; and the Ezzra Research Station in Syria, and Maan station in Jordan, for Chami goats. Animal germplasm is distributed to the interested countries. Currently, a number of other banks in different Arab countries are in the process of being established within the framework of ACSAD's project to maintain animal genetic resources in the Arab World.

Wildlife reserves have been established in several Arab countries for example, there is one at the al-Kuf national park in Libya.

Within its mandate to maintain plant and animal biodiversity, and to use it to boost productivity in general, the Arab Center has developed a specific program, for the maintenance and wise exploitation of biodiversity for sustainable development, and to halt desertification. This program aims to:

i Maintain biodiversity, particularly, that of economically-important species which are threatened.

ii Establish arboreta of trees, bushes, and parks for halophytes and desert plants.

iii Establish live genepools of the most important strains.

iv Introduce adaptable and economically-important varieties from different parts of the world to be used in the development programs to halt desertification.

v Utilize the available biodiversity in developing agricultural, pasture and forest productivity in the Arab countries.

vi Utilize the available biodiversity to maintain the Arab environments, watersheds, and reclaim saline soils, particularly in the dry and marginal lands.

vii Provide special units for the multiplication of threatened plant and livestock species.

viii Publish an illustrated atlas of plant genetic resources.

ix Update and publish the illustrated indexed reference encyclopaedia of the animal strains of the Arab world.

ACSAD always seeks to put the findings of its research work into practical use, in collaboration with the specialized national centers in the Arab world. It struggles, however, on both regional and international levels, to get the funding required to achieve its objectives. It would like to contribute its expertise, along with yours, to fulfil its objectives of developing plant and animal biodiversity in the Arab region.

In conclusion, I have the honor to convey to you the greetings of Dr Hassan Seoud, Director General of the Arab Center, and his best wishes for the success of the workshop in developing an integrated program involving all concerned parties to the benefit of the Arab region.

Thank you.

Opening Address by Dr. Aart van Schoonhoven,

Deputy Director General, ICARDA

Your Excellency, Mr. Ghaleb Abu Ourabi, Representative of His Excellency, Mansour Abu Tarif, Minister of Agriculture, Jordan, Dr Masa Iwanaga, Dr Wardeh, Ladies and Gentlemen,

Just over seven months ago the Government of Jordan and the Ministry of Agriculture hosted the first regional workshop on the subject of biodiversity and natural resource management. On that occasion, Dr Nasrat Fadda, the then Director General (DG), made the opening remarks on behalf of ICARDA. It was only last week he handed over to the new DG, Dr Adel El-Beltagy. Both of them would very much have liked to be here today. As they are not, however, I am now in the unusual position of being able to deliver messages from two DGs.

Dr Adel El-Beltagy, who is from Egypt, has been very active already in the development of biodiversity projects for the region. The National Agricultural Research program in Egypt has been extremely dynamic. Dr Beltagy is in Lucerne today, assisting with the formulation of a new and forward-thinking CGIAR. These are times when we have to respond to change - particularly in issues that effect us all - like those that were discussed at the World Summit in Rio de Janeiro and the conventions that arose out of it. He said that were it not for the Lucerne meeting he would be here.

Dr Fadda, as most of you know, intends to reside for part of his retirement in the Lebanon. Those who know him well, also know that his heart and energies will continue to underpin the main theme of his presentation at that first regional workshop last June. I shall now return to that presentation and repeat Dr Fadda's closing remarks, which are from a quotation by Anatole Krattiger of the International Academy of the Environment in Geneva.

> 'Nature is an essential partnership; essential because each species has its space and role, and performs a function essential to the whole; a partnership, because the living components of nature, the species, can only thrive and survive together, because together they create a dynamic equilibrium. Nature is a dynamic entity that is never the same, that changes, that adapts, that evolves; an equilibrium that remains, in essence, unchanged, because it always accommodates evolution and diversity.'

The theme of partnerships continued throughout the few days that followed. I am pleased to say that it is largely as a result of that gathering, and the project proposal that was subsequently developed, that we are here today. Most of you played an active part in the development of that project. Not only were linkages forged between, ICARDA, ACSAD, IPGRI and the national research institutes and NGOs, but our main sponsor, UNEP, immediately sought funds to ensure the continuity of this partnership. For this we are particularly indebted to Dr Hamdallah Zedan. We had hoped that he would be here with us today . In a FAX from him he says: 'I take this opportunity to wish you every success in this workshop'. In the few days of that workshop and the months since, many more active

partnerships have been forged, and during the course of this week more, I hope, will develop.

Central to this workshop, will be the identification of priority ecosystems. Ecosystems, rather than species are what really matter. Those delicately balanced, interlocking, four-dimensional assemblages of life, where each species has its place: the rainforests, the mountains, the savannas, etc. This week we will be focusing on the dryland ecosystems, particularly those of this region.

A major objective of the workshop is to provide guidelines for future land management training programs in the context of dryland biodiversity conservation. Over the next few days we will be addressing the issues of maintaining a balance between the utilisation of biodiversity and its conservation. To achieve this balance, knowledge is required and this, we know, is in short supply. The problems need to be identified first, then solutions put forward and then the training matched to the needs. I hope during the course of this week we can add to this knowledge. In addition, I hope that we can begin to formulate the future training programs on utilization of biodiversity and its conservation. Lets us ensure that, in our deliberations, we do not forget the training and teaching of the farmers' children; our children. I believe that it will be the 10-year-olds of today who will ensure that the objectives of the Convention on Biological Diversity will be brought to fruition.

Finally I hope that out of the brainstorming will come answers to some of the pressing questions to which we all have to find answers, if we are to be successful in attracting the all-important funds needed to achieve the objectives spelled out under the Convention of Biological Diversity. That convention is central to our future activities on biodiversity in the 21st century and I will leave it to my friend and partner, Dr Masa Iwanaga, to elaborate on this. Before doing so though, I would like to extend a warm welcome to all the delegates, especially to those of you who, at extremely short notice, have found the time and funds to be here and help in forging our way forward to arrest the degradation and conserve the biodiversity of the drylands of this very important region.

Opening Address by Dr. Masa Iwanaga

Deputy Director General, IPGRI

Excellencies, Ladies and Gentlemen,

On behalf of the International Plant Genetic Resources Institute (IPGRI) and its Director General, Dr Geoffrey Hawtin, I would like to welcome all of you to this Workshop. Unfortunately, Dr Hawtin is presently on duty travel and he is sorry that he could not attend this very important meeting.

IPGRI, in accordance with the Convention on Biological Diversity and Agenda 21 and in close cooperation with national programs and sister international centers, is committed to protecting biodiversity. We cannot over-emphasize the importance of dryland biodiversity and hence this workshop. Drylands are among the least developed areas on earth, yet they support 900 million people. Drylands of the Near East are home to many major food, forage and livestock species upon which the whole human population depends.

A key factor for sustainable development of the world's drylands is our ability to maintain and use their biodiversity. The drylands face, not just soil erosion, but also the potential genetic erosion of the plants, animals and micro-organisms that form the living elements of that environment.

IPGRI's involvement and participation in this workshop and any future outcome, is based on our objectives as an international center specialized in the subject of plant genetic resources. As an organization we have four major objectives which can be summarized as follows:

i to assist countries, particularly developing nations, to meet their needs for conservation of plant genetic resources and strengthen links with users of plant genetic resources;
ii to build international collaboration in the conservation and use of plant genetic resources;
iii to develop and promote input of strategies and technologies for integrated methods of conservation; and
iv to inform the world community of both the practical and scientific developments in this field.

To serve its clients and to assist collaboration with its partners, IPGRI has several regional offices. The regional office for West Asia and North Africa, which is hosted by ICARDA in Aleppo, is responsible for developing and arranging strategy for this part of the world along with the assisting national and regional programs. The office is also fostering links between the national programs under the West Asia and North Africa Plant Resources Network (WANANET).

In conclusion, IPGRI is looking forward to the success of the workshop and to working with our partners in this important field of biodiversity. Success of this workshop is important not only for this region but also other regions which face similar constraints and the challenge of management of dryland biodiversity.

Opening Address by Mr. Ghaleb Abou Orabi

General Secretary of the Minister of Agriculture, Jordan

Dr Aart van Schoonhoven, Deputy Director of ICARDA; Dr Masa Iwanaga, Deputy Director of IPGRI; Dr Muhammed Wardeh, Representative of the Director General of ACSAD; and Guests,

It's my great pleasure to be with you today, to open this workshop on 'Dryland Biodiversity Conservation through Natural Resources Management'. The subject of this workshop is one of the immediate issues which needs to be addressed without delay especially since the rapid degradation of genetic resources has become crucial. Without action, the dangerous consequences which may result in the future are difficult to predict.

The 'Fertile Crescent' is considered to be the center of origin for many important food crops such as cereals, legumes, fruit and forestry trees, and medicinal and ornamental plants. Although these plants have been exposed to a number of degradation and erosion processes over the years, there is still a remarkable variety of taxa which needs preservation to remain a sustainable source of valuable characters, resistant to biotic and abiotic stresses, for breeding and crop improvement.

In the early 'fifties, Jordan's Ministry of Agriculture realized the importance of biodiversity. It started to establish range and forestry reserves alongside similar efforts, to preserve Jordan's natural flora and fauna, that were being conducted by different governmental and non-governmental organizations such as the Royal Society for Nature Protection.

Preservation of biodiversity is part of the country's national strategy. As an expression of commitment to this subject, Jordan has signed the convention on preservation of biodiversity (Agenda 21) of the Earth Summit held in Rio de Janeiro in 1992. Jordan has also ratified the agreement of IPGRI.

The realization of the recommendations on these important issues of this workshop, requires the complementary efforts of national and international institutions. It needs, also, to increase the awareness of, and instruction in, the importance of genetic resources and the need for keen and rational use thereof in order to preserve them as valuable sources for the benefit of future generations.

When we study biodiversity and natural resources, we study their wise utilization in order to guarantee their sustainability as the demand for food increases. Any program for protection of biodiversity and natural resources must be connected with their rational use.

The presence of such an elite group of scientists, makes us hope that new horizons will open for the use of modern biotechnology and genetic engineering, to improve production and increase the productivity of field crops and fruit trees to meet the growing food demands of the area. The irrational use of resources is surely only of short-term benefit and will have bad consequences for generations to come.

Though the Jordanian experience is still young, it can help your efforts to succeed. Jordan welcomes your efforts and will participate in all the future activities recommended by this workshop and will support the project proposal submitted by you.

I look forward to the results and recommendations of this workshop and hope they will yield an applicable workplan.

Let me reassure you once more of the Government of Jordan's and that of the Ministry of Agriculture.

I would like to thank the organizers of this workshop and wish you a pleasant stay in Jordan.

Thank you.

Workshop Objectives, Expectations and Outputs

John Peacock

Chairman, Biodiversity Task Force, ICARDA

Distinguished Guests, Friends, Ladies and Gentlemen,

I also welcome you to this workshop and to Amman. Before I outline the workshop activities I would like to reiterate something that Dr. van Schoonhoven said in relation to Dr Hamdallah Zedan. Dr. Zedan, who is the biodiversity and biotechnology coordinator for UNEP in Nairobi, is sorry that he is not here today but wishes the workshop every success. It is largely due to him that we are here today. Hamdallah was an observer at the earlier workshop that we had here in Amman and I think many of you may remember that in summing up he made the following points:

> 'This initiative on biodiversity in the Near East is important for two very good reasons. First, it is a truly regional project. Second, it concerns areas possessing extremes of degradation.'

Biodiversity is clearly the central issue of this workshop. Although subject to debate, I have selected three definitions of biodiversity: one is the total variability within and among the species of living organisms and their habitats; another is, the variety of life forms and the genetic diversity they contain; and finally, all species of plants, animals and micro-organisms existing and interacting within an ecosystem.

I stress the final word 'ecosystem' because in the sessions we will be focusing on ecosystems as the unit of the GEF project. Our region is very much a dryland region and we must recognize that many of the region's ecosystems are fragile. Dryland species can be unique and narrowly distributed; therefore, if the habitat is degraded, the loss of biodiversity could be permanent.

In the simplest terms, we are attempting to enhance our knowledge about the ecosystems in this region. Many of them - as we will see from our visit to the Azraq protected area on Wednesday - are very degraded. We will be discussing solutions to the causes of this degradation and loss of biodiversity. I think many of the solutions attempt to maintain what is a delicate balance between utilization of biodiversity and conservation. We will be seeking biodiversity conservation methods which can be applied by farmers and which on the one hand are sustainable and on the other profitable.

In the third part of this workshop we will be discussing the training needs for matching the problems and solutions, with our partners from both within and outside of the region.

There are seven sessions which can be seen in three groups: the first session will be to prioritize the ecosystems of the region. The second session is to discuss the principles of sustainable ecosystem management. This naturally follows on to issues of development of appropriate conservation strategies for the region and how to utilize this biodiversity in both a profitable and sustainable way. When we come to the issue of the role of land use, we should discuss seriously the socioeconomic component.

We will then be going into greater detail about how to match the training to the needs of the region. We have representatives of institutions from Europe and North America who already have ongoing training programs in biodiversity and conservation. They have services and outputs which can assist us. Interact with these people while you are here. We need to know what sort of BSc- and PhD-level programs should be created within the region. We probably also need training in the development of participatory approaches and issues which are related to public awareness.

Each session will address a specific objective and we should attempt to achieve the suggested outputs. In Session One, the output should be recommendations for three priority ecosystems for each participating country. These outputs would be achieved by addressing specific questions posed during the discussion periods.

The project proposal has now been vetted by all the countries and a copy has gone officially to the Global Environment Facility UNDP Coordinator for the Arab Bureau in New York. We have a response to that document and one of the purposes of this workshop is to respond to the comments. We need to know much more about the roles of land users and farmers. The linkages between the farmers and the communities with the national research institutes and the other centers are not clear.

On issues relating to institutional strengthening, we have to address the importance of countries within the Near East ratifying the Convention on Biological Diversity. Jordan and Lebanon have ratified the convention and I think we will be hearing from our colleague, Dr. Mohiddin Issa on the progress being made in Syria.

WORKING SESSION 1

Ecosystem Selection

Introduction

'Our planet's essential good and services depend on the variety and variability of genes, species, populations and ecosystems. Biological resources feed and clothe us and provide housing, medicine and spiritual nourishment. . . . The current decline in biodiversity is largely the result of human activity and represents a serious threat to human development.'

Agenda 21, Chapter 15.2

Specific Objectives

i To select pilot ecosystems for natural resources and biodiversity management.
ii To target biodiversity components.
iii To propose management and conservation activities.

Abstract of the Keynote Paper

Fertile Crescent Biodiversity

Jan Valkoun

ICARDA

All human necessities are, ultimately, derived from our biosphere, so that threats to biodiversity are also threats to our development. Yet it is human activity that has lead to the current decline in biodiversity, particularly within agro-ecosystems.

In changing from hunter-gathering to agriculture, our ancestors found that only few species were suitable for domestication. Thus, only a small proportion of potentially useful plants have become crop species. More recently, we have developed agricultural practices that reduce biodiversity at a different level; within crop species. Heterogeneous landrace mixtures have been largely replaced by the genetically homogenous products of modern plant breeding. Farming methods which destroy the habitats of wild relatives of crop plants

also cause genetic erosion (i.e. reduce the genepool). Conserving the genetic variability that is being lost in this way is vital not only for our present needs but also for our future. Both archaeological evidence and the distribution of wild ancestors confirm that the Fertile Crescent is a major center of origin for wheat, barley and many other cultivated plants. Some of these (e.g. wheat, barley, lentil, chickpea and flax) spread out from there as primary crops. Others such as rye, oats and vetch were not domesticated in the Fertile Crescent but accompanied the primary crops as weeds and were domesticated elsewhere (secondary crops). Species usually exhibit great genetic variation in their centers of origin and in the Fertile Crescent region there are many forms adapted to harsh and variable environments. However, changes in agriculture are causing genetic erosion and it is important that conservation measures be taken.

In situ conservation of germplasm is complex and requires preparatory research. ICARDA, in collaboration with the national programs of Syria, Jordan, Lebanon, Iran and Iraq, has started surveys of geographical distribution of biodiversity in the Fertile Crescent, particularly of wild ancestors and relatives of wheat, barley, lentil, chickpea, vetch and chickling. In order to select areas for conservation in the natural habitat, it is necessary to identify areas of representative and/or genetically diverse populations, establish the degree of threat suffered by the populations and take into account socioeconomic factors. Suitable populations have already been identified for wheat, barley and lentils. Morphological, agronomic, biochemical and molecular characteristics have been used to identify genetic diversity.

ICARDA, IPGRI, ACSAD and other partners in the Fertile Crescent Consortium Initiative are determined to meet the challenge of conserving biodiversity in the region.

Summary of Discussion

After a lengthy discussion of whether or not it is 'ecosystems' or 'agrosystems' that need to be selected, it was agreed that what is actually sought is more correctly termed 'agroecosystems with high diversity'. It was recommended that the size of any selected site should be at least a few hundred square kilometers. Preferably, it should incorporate degraded areas and threatened biodiversity.

The selection criteria for the site and agroecosystems were discussed. Below is the list given by the keynote speaker:

i wild progenitors of globally important crops
ii other wild relatives
iii populations of high genetic diversity
iv presence of more target species
v endangered populations
vi species which are difficult to conserve *ex situ*
vii traditional agricultural systems
viii traditional germplasm (landraces, breeds)
ix linkage with agricultural development projects.

The grouping of criteria suggested for the selection of agroecosystems was summarized as follows:

- Ecoregions with high biodiversity
- Community involvement
- Endemism
- Resource degradation
- National /regional priorities
- Sustainability

The participants were then given the opportunity to name their preferred ecosystems accordingly. Each country could specify three different ecosystems arranged in order of priority. The results are shown on the map in the full paper.

Though their criteria for ecosystem selection were not spelled out, the reasoning of the country representatives clearly differed from one to another. Some, like those from Lebanon, concentrated on nature conservation, others preferred the conservation of agricultural biodiversity, while yet others were more concerned about agricultural development.

Conclusion: Future Activities

The ideal way of selecting ecosystems for the management of natural resources and biodiversity is from maps of the distribution of these natural resources and biodiversity components. Land-use maps are very helpful in this respect. It is also necessary to have maps depicting biodiversity components such as actual vegetation, genetic resources and endemic plants. Each of the countries concerned has its own strategy and national plan for resource management and biodiversity conservation. These strategies will define the national priorities from which the regional priorities will emerge. Activities relating to the socioeconomic aspects of the population concerned follow the defining of the ecosystems. These points deserve more attention.

WORKING SESSION 2

Ecosystem Management

Introduction

Agriculture is the dominant form of land management in the world. Since the early 'fifties, the intensity of land management has increased considerably. Today, it is one of the most important human activities adversely affecting the conservation of biological diversity. Little attention is being paid to how changes in agricultural practices might have beneficial consequences for conservation. Farms could be used as laboratories to provide conservation biology with systems to investigate many ecological processes; agricultural practices can be the key experimental variables.

The four papers in this session discuss current theory and practice and it is hoped that the resultant discussion will help to further a better understanding of how agricultural practices in the region can be modified to enhance the conservation of biological resources for the long term viability of agriculture and the productivity of land users.

Specific Objectives

i To discuss the principles of sustainable ecosystem management.
ii To draw on case studies from the region to illustrate some of these principles.
iii To determine the research and training needs for the future.

The Management of Protected Ecosystems

Myrna Semaan El-Haber

Friends of Nature, Horsh Ehden Nature Reserve, Ministerial Committee, Jounieh, Lebanon

Abstract

In many countries of the Mediterranean zone, particularly the Fertile Crescent, conservation strategies for protected areas are less effective, generally, than in the rest of the world. The failure to provide adequate conservation differs in degree both between and within countries and is caused by deficient or absent management plans. Poor management has resulted from lack of means, personnel and training. Management of conservation areas has been under the control of a diverse array of authorities, leading to confusion and unnecessary complexity. The author suggests placing conservation issues under the control of one appropriate ministry in each country of the region. Legislation and planning for conservation must be formulated at the national level and integrated into the framework of international conventions and treaties relevant to the region. Where exploitation of nature reserves is permitted, as in tourism, the managers should control these activities in order to ensure that they do not conflict with the primary, conservation role.

Although reserves will have their own unique and specific characteristics and problems, all will share elements of management: *administration* - a more holistic approach to legislation is needed; *personnel and training* - appropriate training for managers, directors and wardens at a permanent regional training center or network of centers is suggested; *equipment and infrastructure* - provision of adequate equipment and infrastructure is essential for proper management; *financial management* - funds are often inadequate (a source of funds could be fees from tourists); *education and awareness* - educational programs for the general public, local communities and tourists would promote understanding of the purpose of nature reserves and their importance to global and local welfare; *utilization and regulation* - division of protected areas into central and buffer zones would enable greater protection of the most fragile ecosystems and establish a basis for authorizing various types of human activity (ranging from research to tourism) in particular parts of reserves; *management plan* - development of plans is essential for effective management. Each protected area requires a plan that is flexible enough to change in response to research findings and which specifies: the legal status of the reserve, the resources necessary to ensure protection, management constraints such as pre-existing land-use or ownership, measures taken to integrate conservation into the activities of interested parties such as tourists and local communities, zoning and the authorization of exploitation of resources based on zones, the relationship of the protected area to analogous areas in the region, and a calendar of investment and other measures for future conservation.

Management of Variation in Agro-Ecosystems: The Potential Offered by Agrodiversity

Paul C. Struik, Louise O. Fresco, Conny J. M. Almekinders and Niels P. Louwaars

Department of Agronomy, Wageningen Agricultural University, The Netherlands

Abstract

Agro-ecosystems are characterized by a strong interaction between the abiotic environment, the biotic environment, the genetic composition of the species involved, the management of resources by the farmer and the variations in these factors. 'Agrodiversity' is defined as the variation resulting from the interaction between components that shape the agro-ecosystem. This variation has many different forms and manifests itself at various levels of aggregation, making agrodiversity a highly complex phenomenon. The scale or system level at which investigations are carried out is significant because variation is generally a function of scale. Variation evident in analyses of small groups or areas may vanish in analyses of large groups or areas. Because of the human factor in agro-ecosystems, purely ecological principals may not be relevant to management strategies. Farmers and other land users alter both the biotic and abiotic elements of the system and their farming styles may reflect social and ethnological preferences that are not related to improvement of yield or financial return. Proper management of variation can improve output, output stability, resource-use efficiency, the capacity of the agro-ecosystem to adapt to changing conditions, as well as other aspects of its sustainability. Therefore, the diversity in agro-ecosystems needs further attention in research. The aim of such research should be to integrate the management of resources and of variation in resources in a variable environment. Co-evolution of crop genetic resources may play a crucial role in this regard. The authors conclude that although the concept of agrodiversity needs further elaboration, it is possible to identify a number of basic research questions which must be addressed, and techniques and methods which must be developed. The following, they argue, are important: development of methodology for identification and quantification of variation at different levels within agro-ecosystems; development of knowledge and understanding of the interactions between factors determining variation at different levels of aggregation; research into effects of variation on output, stability, resource-use efficiency and sustainability; research into the possibilities of matching variation from different sources; assessment of the desirable level of genetic diversity as a function of variation in other components of the agro-ecosystem; research into the effects of variation in the environment and in farm management practices on genetic diversity; development of methods to maintain variation at different systems levels; analysis of (co-)evolution of genetic resources; and development of methods to steer evolution and co-evolution.

Integrated Management of Arid/Semi-Arid Ecosystems in Jordan

Awni Y. Taimeh

Soil and Irrigation Department, Faculty of Agriculture, University of Jordan, Amman, Jordan

Abstract

About ten to thirteen percent of Jordan is arid or semi-arid. Climatic changes have altered the agro-ecological conditions to form a fragile system characterized by extreme seasonal variation in rainfall and a high rate of soil erosion. Deterioration of soil qualities (such as water-holding capacity, depth, crust formation, nutrient availability and physical structure), have been inimical to many plant species. Consequently, plant density and composition have been adversely affected and this has accelerated soil erosion and plant cover deterioration. Over-grazing, cutting of shrubs for fuel, plowing of rangeland, use of inappropriate tools, over exploitation of ground water, use of saline water and inadequate enforcement of protective legislation have exacerbated degradation and resulted in plant extinctions.

By the turn of the century, Jordan will be able to produce no more than 14% of its food needs unless additional resources can be made available. Expansion of land use requires additional water resources but these are diminishing in quantity and quality and are subject to increasing demand for direct human use. Hence, it is essential to develop an ecosystem management strategy that maximizes non-traditional water resources and which integrates social, economic and environmental aspects of land use to ensure sustainability. Field trials conducted in this eco-region suggest that community-approved sustainable development and *in situ* conservation of biodiversity are possible, provided the following issues are addressed: the establishment of suitable farming systems based on non-traditional water resources; ecologically-sound, large scale *in situ* conservation of plant species; reduction or cessation of land degradation; integrated ecosystem management to ensure sustainability; the preservation and upgrading of agricultural productivity; socially acceptable management systems that allow rapid natural recovery of plant species in their natural habitats; establishment of a wide variety of farming systems to provide a greater chance for preserving genepools in natural settings; encouragement of several low-input farming system options to effect adoption and participation by local communities; utilization of a wide range of plant species within a given area; proposed farming systems based on modifications of traditional systems to ease transfer of technology.

Conservation of Animal Diversity

Muhammad F. Wardeh

Director, Department of Studies of Animal Wealth; Coordinator, Camel Applied Research and Development Network, ACSAD, Damascus, Syrian Arab Republic

Abstract

The author defines 'biodiversity' as a term referring to all living organisms and their inter-relationships; of equal importance in the interaction system are the characteristics and functions of the individuals. Biodiversity is seriously threatened world-wide. The term 'genetic resource' is defined as the biological materials, (genes, individuals, species) taken from biodiversity and used by man. Much genetic material has been lost this century. As a normal consequence of evolution, some genes are lost by sampling and natural selection and some are created by natural mutation. It is evident, however, that the pressures of increased human population and associated economic activity are causing animal diversity to diminish. Animal production is reported to contribute about 30% of global food value. In addition, animals provide fertilizer, draft power, transportation, and products that are used for industrial and medicinal purposes. Man has domesticated about 30 out of 15,000 mammal and bird species. Genetically-unique types or breeds have been developed to suit local climates and community requirements. As a result, about 4000 breeds form the animal genetic resources used for food and agriculture. The survival of many of these is threatened.

Conservation of domestic animals involves the sum total of management operations concerned with genetic resources. A basic requirement for management is to identify and characterize genetic resources. To facilitate and regionally coordinate conservation of domestic animal diversity, ideally would require an information system and a management entity. The Arab Center for the Studies of Arid Zones and Dry lands (ACSAD) created a database on three categories of mammal and avian species in each of the Arab countries. The categories are: animals that are economically important and distributed widely in one or more countries of the region; breeds that are decreasing in number and are of global economic use; and breeds that are becoming extinct due to severe eradication or cross breeding with exotic genetic materials. Examples of animals are given for each category.

Live genebanks for certain breeds of sheep, goats and camels have been established by ACSAD in six countries in the Near East and North Africa. Plans are to establish further genebanks in other countries for other breeds of animals. ACSAD has also developed an intensive training program, for the scientific and technical staff of the genebanks, covering theoretical and practical skills relating to animal diversity conservation.

Summary of Discussion

Concern was expressed about continuity of management of priority ecosystems after the end of projects. This aspect of sustainability is vital and should be an integral part of each country's national strategy for management of priority- or threatened ecosystems.

If farmers are to accept new technology, there is urgent need for training and initial high government input of strategies and subsidies to encourage acceptance. Governments should act as catalysts for technology. It is important, also, to target other land users, particularly those who use forests.

The question of how much genetic variability is needed and should be protected, was raised. Many argued that as not all the variability of any particular ecosystem can be protected, criteria have to be devised for determining which variability to select for protection. The desired quantity of variation will depend on the degree of variability in the environment, both now and in the future. It is not always possible, though, to predict future changes in ecosystems. Although the topic of selection of conservation criteria is of major importance, it could not be adequately discussed in the time available. It was suggested that the criteria for selecting variability be discussed for each of the ecosystems described, and in relation to relevance to farmers, tenants and agencies.

Concern was also expressed for the levels of variability within species. At the genetic level, variability can be assessed by population genetic theory. The frequency of individual alleles and of combinations of alleles can be assessed. RAPDs have been used to measure between- and within-population diversity. It will be necessary to choose achievement goals and to conserve aspects of variability that suit human needs. The degree of diversity required for breeding purposes is greater than that required by the domesticated species for survival.

Summary of Major Issues

Proper *in situ* management of agrodiversity (i.e. the variation resulting from the interaction between the abiotic environment, the biotic environment, the genetic composition of the species involved and the management of resources by the farmer) can improve output, output stability, resource-use efficiency and the capacity of agro-ecosystems to adapt to changes. It is only practicable when the agrodiversity interactions, on different time scales, are understood. Further investigations are needed.

Each protected area requires a management plan tailored to its unique requirements but flexible enough to take into account research findings. Such plans must be coordinated with national and international conservation requirements.

The most challenging management issue is the establishment of an acceptable farming system, which uses techniques based on non-traditional water sources. An integrated system of management that assures rapid natural recovery of a wide range of wild species in their natural habitats and which is socially acceptable, is a key measure for local community participation.

Animal diversity is an important aspect of biodiversity because animals contribute about 30% of global value in food and agriculture and also make other contributions to human existence.

Conclusion: Future Activities

None of the management options recommended for research are likely to provide more than a temporary solution to conservation problems unless stabilization and eventual decline of human populations is achieved. Already, about 40% of the terrestrial biological productivity of the world is being exploited and the percentage is steadily rising. Survival of many of the Earth's species is unlikely if this percentage rises or even remains at its present level.

Over the first five years of any project, communities of land users evaluate alternative land, soil, water and management strategies from their own perspectives. Scientists will have to evaluate the implementation of these alternate strategies and will have to make the necessary modifications to the 'best bet' choices that will have been tested. Together, land users and scientists will have to assess the potential production gains from the new methods and will have to establish preliminary estimates of potential cost benefits. Scientists will have to assess critically the potential for the methods to be adopted by other land users acting in a financially unsupported environment and will have to begin to monitor the impact of the new management strategies on the maintenance of diversity in natural populations. Not all biodiversity can be conserved. Criteria for selecting material for conservation need to be further researched with respect to the material's relevance in the particular ecosystem. In short, all concerned must carry out sound experiments and record the outcome.

Complementary Conservation Strategies

Introduction

Different strategies of genetic resources conservation are considered here. In developing an appropriate national genetic resources conservation strategy, the advantages and shortcomings of *ex situ* and *in situ* conservation are discussed. Although the former approach has proven value for immediate crop improvement, the latter may be essential for meeting future needs. Complementarity of the two methods in a holistic approach are advocated.

Specific Objectives

- To discuss different strategies in genetic resources conservation.
- To provide information on a national program strategy in biodiversity conservation and utilization.
- To review the current status of *ex situ* conservation of the Near East indigenous germplasm at International Centers and in national programs.
- To identify research needs for creating a scientific basis for *in situ* conservation.
- To review the potential for *in situ* conservation of the arid lands biodiversity in the Fertile Crescent.

Complementary Conservation Strategies

Nigel Maxted and Brian Ford-Lloyd

School of Biological Sciences, The University of Birmingham, U.K.

Abstract

A catastrophic loss of plant genetic diversity is taking place and is likely to have severe consequences for humanity if left unchecked. Many of the world's regions of highest plant diversity are ill equipped for bioconservation. There is an urgent need to clarify and enhance the methodologies that enable scientists to classify, conserve, utilize and manage their native flora.

The simplest model of plant genetic conservation involves conservation of the genepool for preservation or to be made available for future use. In practice, a more complex model is generally required. Because all genetic diversity, everywhere, cannot be conserved, particular species or aspects of plant diversity are selected by choice and these are usually put forward by some form of project commission. Conservationists must prioritize and select target taxa from within the wider 'genesea' of the plant kingdom. Target taxa may belong to: the primary genepool of cultivated and wild forms of a species; the secondary genepool of closely related species; or the tertiary genepool of more distantly related species. Ecogeographical surveys, in which ecological, geographical and taxonomic information are collated, enable researchers to identify priorities and strategies. If ecogeographical data is inadequate or absent, a preliminary survey mission to collect data is required. Clearly-formulated conservation objectives enable appropriate choices to be made. Field exploration is necessary to locate and identify the actual plants or populations to be conserved. There are a number of conservation strategies available. *Ex situ* conservation includes seed storage (commonly used for orthodox seeded plants); field genebanks and *in vitro* storage (both of which are commonly used for recalcitrant seeded species); pollen storage and DNA storage. *In situ* conservation (i.e. in natural habitats or in the surroundings in which cultivated species developed), includes genetic reserves (especially for wild species) and on-farm conservation (particularly of landraces). Extensive international debate about the relative merits of *in situ* and *ex situ* conservation has led to competition between proponents of the two strategies. A holistic approach reveals that they complement each other. Different species can best be conserved by different combinations of both methods. The end results of conservation (conservation products), include plants, plant parts and data. Duplicates of conservation products are held in relevant institutions to guard against loss. Preservation and utilization are the goals of conservation. Plant genetic diversity is conserved for the benefit of mankind, through plant breeding for particular conditions, development of new pharmaceuticals or for more diffuse purposes such as creating a pleasant *ambiance*.

The Importance of a Genebank in a National Program for the Conservation and Utilization of Biodiversity

Kamal Khairallah

NCARTT/GRU

Abstract

This paper addresses the questions of why Jordan needs a genebank, the type of genebank required and what should be the objectives and functions of such a genebank. The history of germplasm conservation is described, characterizing four phases of development from limited, early attempts, through periods of intensifying collection and growing awareness of genetic erosion, to the modern view that incorporates both *in situ* and *ex situ* methods in a wider program of natural resource management. Genebank types are defined in terms of their conservation methods, crop mandates, collection types and objectives. The functions of the various types are described and the advantages of genebanks set up nationally rather than internationally are set out. A national program would have wider understanding of the strengths and weaknesses of existing facilities, the conservation needs of the country and of the potential contribution of local, regional and international activities. Because of its more specific understanding of the attitudes of its rural populations, a national program could promote the most suitable methods for the country. Cooperation between national genebanks and regional and international institutions would maximize the impact of conservation work. Only a national program is capable of monitoring on a continual basis, instituting immediate measures to stop degradation, and able to revisit the same location at different times to observe and collect samples representing the greater variability within populations than between populations. Compared with present capabilities, it could evaluate more local accessions for a larger number of traits to maximize utilization of the genetic materials.

Jordan is particularly in need of a national genebank. Although it is a small country, it contains a great diversity of ecosystems and is one of the centers of origin for many important crop species. It harbors many landraces, old cultivars and wild forms of these species. Degradation of ecosystems has placed much of Jordan's biodiversity at risk. The best type of genebank to protect the country's biodiversity would be one that used both *ex situ* and *in situ* methods and which included all cultivated species. It would include working-, basic- , *in vitro* -, active- and field collections or natural reserves. This would enable Jordan to undertake all of the activities performed by genebanks, including: exploration, collection, characterization, multiplication, evaluation, data management, information service, distribution, research, utilization, monitoring of biodiversity and collaboration with other genebanks. It could develop and adapt comprehensive strategies to preserve biodiversity through the holistic approach of integration in natural resources management and would require appropriate scientific staff and equipment to meet all objectives.

Preliminary Project Description for a Multi-Donor Project Strengthening the Scientific Basis of *In Situ* Conservation

Toby Hodgkin

IPGRI

Abstract

The importance of *in situ* conservation is a major facet of the Convention on Biological Diversity. The involvement of social as well as biological factors makes this type of conservation more difficult to implement than conventional crop conservation. There is a pressing need to provide a scientific framework for it. IPGRI is developing a major project to support the design and implementation of *in situ* conservation. The purpose of the project is to strengthen the capacity of national programs in less developed countries to plan and implement on-farm conservation. The specific objectives of the program are: to build a base of theory, methods and practice for *in situ* programs; to develop scientific capacity through training and pilot research in a few countries; and to plan and implement national *in situ* conservation programs in these countries. A five year (1996-2000), multi-donor project is planned. It aims to train national scientists in conservation research, identify target areas for conservation, and build cooperation between scientists, land users and policy makers.

Program planning will include a technical work shop to assist the project development team and will be followed by visits to participating countries. A conference for participants is planned to ensure full collaboration in the development of the project. The project shall cover four areas of science and capacity building in national programs: crop population biology, socio-economic analysis of farmer selection and policy, conservation strategies, and information bases required for planning and implementation of programs. Topics of scientific study will include: crop population sizes and structures, gene flow between and within populations, impact of fragmentation and decreasing area, and adaptive capacity and local diversity. Socio-economic studies will include: cultural and production values of diversity, the impact of spatial integration on diversity, and the impact of demographic change on diversity. A broad information base must be assembled and include: molecular markers and plant characteristics for describing diversity; farm and ecogeographic survey methods and analysis; and geographic information systems. The pilot projects in a few counties will provide useful experience of on-farm conservation for future programs. Nine countries have been proposed on the basis of their being primary centers of diversity, having established programs of *ex situ* conservation, having governments interested in *in situ* conservation, having existing institutions working on *in situ* conservation and suffering a degree of threat to their biodiversity. A balance of crop types, ranging from outcrossing to selfing and annual to perennial species, is preferable.

The paper sets out a detailed prospectus of program activities and concludes with a timetable for project implementation.

In Situ Conservation of Arid-Land Biodiversity in the Middle East

Youssef Barkoudah

ACSAD, Damascus, Syria

Abstract

The arid lands of the Middle East have extremely diverse vegetation due to many factors, both biotic and abiotic. The flora comprises more than 15,000 species. The unique position of the Middle East, where the Mediterranean, Irano-Turanian, Saharo-Sindian and Sudano-Decanian phytogeographic regions meet, and the topographic diversity of the region, which creates a variety of ecological conditions within a limited area, contribute to the abundance of plant species. Another factor is paleogeoraphy of plants and the variations in the Tertiary geologic period. Agriculture has also had an influence. It introduced new segetal and ruderal species from remote parts of the world and species from adjacent regions invaded habitats disturbed or destroyed by man.

The following are totals of plant families, genera and species per country, respectively: Iraq - 92, 620, 1900; Palestine - 114, 718, 2250; Syria and Lebanon - 110, 870, 3000 (11% endemic); Turkey - *, 900, 9000 (25% endemic).

Botanists believe that today's phytogeographic regions have been present since the beginning of agriculture though their boundaries may have been a little different. The Near East is one of the most important Centers of Origin of agriculture and the Fertile Crescent is one of three nuclear centers of origin of globally important genetic resources. Most of the temperate-zone agricultural plants originated and were domesticated in the region and their wild relatives and landraces still grow there. It is an area of megadiversity of important food crops, pasture and rangeland species. These plant genetic resources are being eroded through degradation of natural habitats, intensification of cultivation of arable land, expansion of agriculture into marginal areas and remnants of forest, replacement of landraces by new cultivars and overgrazing of natural pastures and rangelands.

The paper provides a list and short description of wild relatives and progenitors of cereals, food legumes, forage and range plants, fruit trees, afforestation trees, ornamentals and spices and condiments. Threat to wild relatives, conservation of genetic resources and ecogeographic studies are briefly discussed. The paucity of ecogeographic data of wild relatives of cultivated plants in the Near East is noted. In 1984, an IBPGR task force was assembled to carry out ecogeographic surveys of existing nature reserves. They found that the protected areas were not adequate for conservation of wild relatives and noted that nature conservation and biodiversity conservation are not identical although they share some common features.

Summary of Discussion

The discussion that followed the presentation of the five keynote papers, related to different aspects of genetic resources conservation and resulted in consensus on the following points:

- Identification of priority genepools for conservation may be country-specific but the following should be taken into consideration: indigenous germplasm, global importance, threat of genetic erosion, and relevance to present and future needs of the country.

- The decision-making process in conservation, particularly in terms of what should be conserved, needs to be improved. It may help to put a value (economic?) on proposed subjects.

- The optimum size of *ex situ* collections cannot be fixed, as this depends on the target species diversity, mode of reproduction and cost of conservation.

- Experience in Ethiopia and Turkey can be used in on-farm conservation of landraces. On-farm conservation projects should start with farmers who are interested in biodiversity. Farmers, as a group should be represented on the national genetic resources committees.

- The negative impact of fragmentation on the genetic diversity of wild species populations may be limited if the isolated populations are inter-linked with a network of one-dimensional, 'linear', populations on field borders. Biological factors in the location of genetic reserves should be the first consideration. However, socio-economic factors (acceptance by the farmers) are also essential for successful implementation of on-farm or *in situ* conservation programs.

- Geographic Information System (GIS) is very useful in eco-geographic surveys.

- Genetic erosion does exist in genebanks and can be partially controlled by appropriate germplasm multiplication and rejuvenation techniques and germplasm storage.

- Utilization of genetic resources may be enhanced by an efficient information system, through national and international networking and 'core' collection development.

- Conservation of local breeds of animals should be included in national genetic resources programs.

Summary of Major Issues

- *Ex situ* and *in situ* techniques are valuable for genetic resources conservation in the Fertile Crescent.
- The two methods are complementary.
- *In situ* conservation in the natural habitat is essential for the conservation of highly diverse genetic populations of crop wild progenitors in the Fertile Crescent.
- *In situ* (including on-farm) conservation is a complex issue which requires the support of national and local authorities and acceptance by farmers.
- The priority setting and development of a national strategy in genetic resources conservation has to be done on a national basis. However, broader aspects, e.g. global importance of the germplasm and genetic erosion, should be considered.

Conclusion: Future Activities

In the Near East region, where many important crops originated some 10,000 years ago, extensive genetic diversity of crop wild relatives and landraces is affected by genetic erosion, which may even cause species extinction. The situation needs to be addressed by employing a holistic approach to conservation, i.e. both *ex situ* and *in situ* forms have to be followed, in a complementary manner in the Fertile Crescent.

SESSION 4

Utilization and Value of Biodiversity

Introduction

Biodiversity needs to be conserved because it is useful for maintaining life and productivity. This was the central issue of the session. By presenting case studies, examples were provided of the amount of biodiversity available in specific systems, its forms of utilization, and of the benefits which could be generated therefrom.

Specific Objective

The specific objective was to demonstrate the *value* of biodiversity and how this can be translated into practical benefits by its wise *utilization*.

Utilization of Landraces in Crop Improvement in Iraq

A.M. Al-Shamma, B.A. Al-Rawi and A.H. Adary

IPA Agricultural Research Center, Baghdad, Iraq

Abstract

In Iraq, as in other countries of the Fertile Crescent, landraces of wheat and barley have been cultivated extensively. With the introduction of high yielding varieties, however, the importance of these landraces has declined dramatically. The consequent decrease in area and diversity has been particularly severe in the basins of the Tigris and Euphrates rivers where crops are grown under irrigation. Prior to the introduction of new varieties, 'Ajeeba', a tall, low-yielding variety, was commonly grown as a bread wheat; it is no longer cultivated. Barley was usually cultivated using landraces composed of a range of unidentified mixed lines. Most lines were grown for green forage as well as for grain. Improved cultivars respond more to high inputs than do landraces. In rainfed areas, cereal production is concentrated within the 200-500 mm annual rainfall areas. Below 350 mm rainfall, landraces have a comparative advantage due to their relative salt- and drought-tolerance, especially to terminal drought. The best examples of landraces still used by farmers are the bread wheat 'Sabir Beg' and the two-rowed, black-seeded, local barley.

Between the 'fifties and 'seventies, several new cultivars were introduced from other countries. In recent years, and using local landraces, national research centers have developed some new improved lines of wheat and barley: two case studies of such work are presented. In the first, Sabir Beg wheat was used in crosses with material introduced from ICARDA to improve disease and lodging resistance, yield, adaptation and bread making quality. The second study concerns local barley landraces collected from three areas within the irrigated zone in Iraq, and their improvement with respect to increased salt tolerance and ability to withstand repeated clipping during the vegetative phase. The samples did not show high salt tolerance in field trials but did, however, show remarkable ability to withstand repeated clipping; three and four consecutive cuts, in some cases. This characteristic appears to be unique to landraces of this region and has not been found in introduced material. Because of their potential value for breeding, the landraces are being evaluated further at ICARDA. Both case studies have generated cultivars which have been either recently released or are already grown by farmers.

It was concluded that landraces of both wheat and barley have great value in national and international crop improvement programs as sources of genes for specific adaptation and other desirable traits. Also, mixtures of genotypes often perform better than do pure lines, particularly in the case of forage barley. Such mixtures should be included in national and international breeding schemes.

Aphids and Aphid-Parasitoids of the Fertile Crescent

Keith S. Pike

Research Entomologist, Washington State University, USA

Abstract

Aphids are one of the most important and abundant plant-infesting insect groups in the temperate and subtropical zones of the world. Within their lands of origin they exist in equilibrium with their native host plants. When introduced into new areas, however, or when their natural enemies are disrupted or destroyed (e.g., overuse of pesticides, loss in natural reserves), they often become pests.

The Fertile Crescent is the center of origin and diversity of many important plant species, such as wheat and barley. Within this region many aphid species and associated natural enemies (particularly aphid-parasitoids which feed internally in aphids to cause their death) have evolved in harmony with the wild and domesticated plant communities. Aphid -parasitoids are important in this respect. They are minute wasps whose immature stages feed internally in aphids to cause their death. Few aphid problems have been experienced within the Fertile Crescent because of the natural checks to aphid numbers but as plants have spread from the region so have their aphids. Some have caused extensive crop losses in their new environments. Biological control has been used to reduce their impact, in some cases. Only a few parasitoids from the Fertile Crescent, those of aphids problematic on agriculturally-important crops, have been identified and investigated.

Against this background, the results of studies conducted in Washington State, USA, in 1994, are reported: fifty species of aphid-parasitoids were found, 10 of which represented new species. The number of parasitoid species existing in the Fertile Crescent is yet unknown, but may be relatively high compared with other global areas. Recent exploration efforts to find parasitoids of the Russian wheat aphid, *Diuraphis noxia*, in Jordan, Syria, and Turkey, have provided new insights into these organisms, however, no comprehensive studies have been conducted across the full spectrum of aphids in the Fertile Crescent.

The author warns that habitat destruction through the overuse or misuse of pesticides, urbanization, changing agricultural practices, etc., is adversely affecting the incidence and seasonal abundance of the aphid-parasitoids. Their diversity and influence in the Fertile Crescent should be explored, and strategies developed to preserve them.

The paper concludes with the following recommendations for specific research activities: (i) determine, through comprehensive ecogeographical investigation, the spectrum of aphid-parasitoid species, their hosts, distributions, seasonal concentrations and activity levels, (ii) determine the plant habitats that support parasitoid-host aphids and/or serve as nectar reserves for the adult parasitoids, (iii) establish strategies to sustain the aphid-parasitoids, and (iv) develop educational and training materials (including sustaining strategies), concerning aphid-parasitoids.

Utilization of Biodiversity: The Case of Barley

Salvatore Ceccarelli

ICARDA

Abstract

The domestication of wheat and barley took place in the Fertile Crescent before 7000 BC and barley was probably the more important of the two cereals. Archeobotanical material shows that the first barleys were two rowed. The wild progenitor of cultivated barley, *Hordeum vulgare* ssp. *spontaneum*, is widely distributed in this region, particularly in drier areas. Barley is still one of the most important cereals of the region and is typical of marginal, low-input, drought-stressed environments.

In Syria, barley is the most important cereal crop in rainfed agriculture. It is a good example to use in discussions of the issues relating to biodiversity because almost all the barleys grown are landraces. Two main barley landraces are grown in Syria: 'Arabi Abiad' (white-seeded), is grown in relatively higher rainfall areas (250-400 mm), and 'Arabi Aswad' (black-seeded,) is grown in environments with less than 250 mm annual rainfall.

A large collection of pure lines derived from individual heads collected in farmers' fields were evaluated to reveal considerable variation, between and within fields, for traits such as plant height, cold resistance, grain yield under drought conditions, and resistance to yellow rust, powdery mildew, scald and covered smut. Compared with introduced cultivars, Syrian landraces are more cold tolerant, higher yielding under conditions of drought stress (around 200 mm rainfall), but lower yielding where rainfall is more than 400 mm per annum.

Based on the diversity existing within landraces, a program of pure-lines selection was initiated. Through this program, three cultivars (Arta, Tadmor and Zanbaka) were developed which have been adopted and are currently grown by Syrian farmers.

Despite the success of this work, the author underlines the danger of reducing the intraspecific variabilty of landraces through pure-line breeding. To counteract this, a long-term strategy based on the use of mixtures of pure lines, is also being implemented.

Field Genebank Management of Biodiversity

Mohamed Adel Gouda

ACSAD

Abstract

The paper addresses the biodiversity situation of dryland fruit trees and range species. For millennia, dynamic interaction between natural selection and agricultural preference has produced and preserved a wealth of genetic diversity in primitive varieties and/or clones of trees in this region. Coexisting wild relatives of those species are also known to abound in potentially useful genetic diversity. Despite this wealth of diversity, few cultivars, mostly imported from other countries, are actually grown. As a consequence of increased population and associated human activities, the genetic diversity in these species and their wild relatives is severely threatened. This creates a need for ecogeographic studies and diversity analyses of indigenous fruit trees and their wild relatives on a national and a regional scale.

The Arab Center for the Studies of Arid Zones and Dry Land (ACSAD) recognized the problem and, in 1985, established a field genebank of dry-land fruit trees (almond, pistachio, olive and fig). Genetic material of more than 326 cultivars of local and introduced origin have been evaluated, are monitored and, along with relevant information, are at the disposal of the region. ACSAD and IPGRI are cooperating in a survey/collection of wild relatives of almond in the region. IPGRI is also supporting relevant training. With funding, other countries in the region would collect genetic resources of almond, pomegranate, apricot and fig. Surveys of collections of each of the dryland fruit species would reveal gaps in collections. Location of places in which wild relatives are found and assessment of the threat of degradation to these areas, would be useful in proposing *in situ* conservation sites.

Range species too are endangered. Overgrazing, plowing and droughts have degraded rangelands thereby creating the need for adapted germplasm to re-vegetate watersheds, stabilize sand dunes and establish wind breaks. Such action is essential for sustainable agricultural development.

ACSAD has established three field genebanks in Syria, for these species: (i) Muslimeye - includes many varieties and ecotypes of *Atriplex halimus, A. nummularia, A. lentiformis, A. polycarpa, A. rhagadioids, Artemisia herba-alba,* and *Kochia prostrata*; (ii) Odeimi - has a gradient of different salinities and is especially used to maintain halophytes such as different accessions of *Atriplex, Haloxylon salicornicum* and *H. persicum*; and (iii) Izraa and Jjilline - is devoted to the conservation of perennial grasses (e.g. species of *Agropyrum, Oryzopsis, Stipa,* and *Dactylis*) and forage legumes (ecotypes of *Vicia sativa, V. ervilia, Pisum sativum, Vicia narbonensis, Astragalus guttatus, Vicia palaestina, V. mollis, Lathyrus sativus* and *Lathyrus aphaca*).

Summary of Discussion

A large part of the discussion that followed the presentation of the papers covered the role of women in the evaluation and conservation of local germplasm. Several examples were quoted, from different countries and with respect to the cultivation of different crops, showing the key role of women in handling biodiversity. It was stated repeatedly that, when the role of farmers is mentioned, it is useful to distinguish between men and women because there are documented cases of different perspectives in evaluation and conservation. It was recognized that the indigenous knowledge about local germplasm is often associated with elderly people. This makes the issue of its documentation an urgent one.

Though technical aspects of utilization of biodiversity were scarcely debated, it was stated that the technology needed is very basic and easily usable by National Agricultural Research Systems. That biodiversity is valuable was taken for granted (or perhaps the speakers presented very convincing arguments) and the discussion focused on how to measure this value and how to reward those who have conserved useful genes or genotypes. The issue of rewarding conservationists came up repeatedly during the discussions following other sessions.

It was recognized that while many countries in the Fertile Crescent have research programs on aphids, little is known concerning parasitoids; or for that matter, about other natural predators associated with the crops of the Fertile Crescent. This is unfortunate because it is documented that sources of resistance to pests have been found in the geographical area of origin of the host crop.

Summary of Major Issues

i Biodiversity is valuable for enhancing agricultural production, and can be used for such purposes in simple ways.

ii The biodiversity knowledge of different members of the farming communities must be documented.

iii The role of women in the evaluation and conservation of biodiversity must be fully acknowledged.

iv The value and the utilization of biodiversity in predators of crop pests has been neglected. Because of its potential value for sustainable development, research in this area needs to be strengthened.

Conclusion: Future Activities

Counteracting environmental degradation as a whole is necessary to maintain the value of all aspects of biodiversity. In the mean time, countries of the region need to develop genebanks as part of national programs.

Landraces have great potential value for crop improvement programs e.g. some have considerable resistance to diseases. This, and the fact that mixtures sometimes outperform their extracts, should be borne in mind in future improvement programs.

The diversity of aphid pasasitoids and relevant host plants needs to be explored further.

SESSION 5

Local Community Participation, Indigenous Technical Knowledge and Land Tenure

Introduction

The issues addressed in this session are paramount in any efforts to conserve and manage biodiversity *in situ*, whether they be located in protected areas (reserves) or on land managed and utilized by farmers for productive purposes. Local communities have stewardship over natural resources in space and time, and no efforts to conserve them will be successful unless these communities are active participants. The session was designed to address the specific issues of how local communities can become incorporated as partners in biodiversity conservation and utilization and how they will benefit from research.

Specific Objectives

The session had the following specific objectives:

1. Agreed definition of community participation
2. Review of alternative approaches to community participation in research strategies
3. A proposed strategy for community participation
4. Recognition of different approaches for different aspects of biodiversity conservation and utilization

Local Participation in Biodiversity and Resource Utilization

Richard Tutwiler

ICARDA

Abstract

Two fundamental points are stressed: (i) biodiversity conservation and utilization must involve local communities as full partners; and (ii) partnership is grounded in common objectives, responsibilities and benefits. To bring about the former, researchers and farmers need to find a common understanding of the term 'biodiversity' and of its importance.

Of the three models that researchers and development programs have followed within controlled conditions and used to increase production potential, the 'Transfer of Technology Model' has been successful only where farmers share the objectives of the researchers and have the means to adopt the innovations offered. It has been unsuccessful in marginal environments and among the poorest farmers. The 'Economic Incentive Model' targets populations with different environmental and socio-economic constraints (all of whom will respond to economic incentive) and tailors technologies to each group. Where land users have priorities other than economic gain, the model has not been satisfactory. A third model, the 'Sustainability' or 'Participatory Model' differs from the other models in that land users participate with researchers, defining the objectives, and carrying out the primary research on their lands with laboratory and research station support. Though relatively untested yet, it holds promise in situations in which higher productivity and economic gain are subordinate to biodiversity conservation. The Fertile Crescent, with its existing levels of environmental degradation and fragile, limited resources, is such a region.

Researchers must first identify potential partners, but their recruitment must be through a process of self-selection, and voluntary. Once established, the partnership assesses current biodiversity management and works on solutions to problems. *In situ* conservation of biodiversity in preserves concerns mainly wild species and wild relatives of crops. Since it entails the separation of land from some or all of its users, it is important to weigh up the disadvantages of this separation, to identify the conservation benefits, and establish how such benefits are to be distributed. *In situ* conservation on farms concerns crop species as well as wild species. Landraces are an indigenous source of biodiversity that is under threat and uncultivated species (including rangeland plants) are also important. Effective initiatives for developing partnerships would be improvement of landraces (through breeding and management) and rangeland (through grazing management and productivity enhancement). These are areas with obvious benefits to communities, and ones in which land tenure should be a constraint and indigenous knowledge could play a useful role.

Summary of Discussion

The discussion that followed the delivery of the keynote paper showed a clear consensus among workshop participants that a change in attitudes towards farmer participation is a must. Unfortunately, there are few role models of successful community participation. A point was raised that often successful community participation is an accidental outcome. Too often research is "top-down" and does not allow for "bottom-up" influences. There was a general consensus of the need to have farmers as partners and to involve other members of the community, such as women and children. The discussion of specifics focused mainly on the issue of farmers and landrace conservation and improvement, and how that might best be accomplished.

In terms of biodiversity in general, most of the comments linked the issue of community participation with those of public awareness and training. The need for promoting environmental citizenship was seen as a top priority for the countries of the region.

While the topic of indigenous knowledge received little attention in the discussion, it was clear that there is a wealth of indigenous knowledge that is threatened to disappear. Every attempt should be made to record this knowledge and utilize it for the benefit of its owners and the wider community.

A concrete example of community participation in biodiversity conservation and management was given by Dr Barkoudah with reference to the village of Deir Atiya, in Syria. In a situation of limited arable farming and heavily degraded rangeland, the people of the village decided to change their land use patterns. With the support of the government, they restricted grazing and planted almonds and pistachio trees instead. In areas protected from grazing, more than 55 plant species are now found, whereas in adjacent areas still used as open range there are only 10-12 species surviving. The success of this arrangement has resulted in its being copied by neighboring villages.

Another example was given by Drs Kairallah and Tadros from Jordan. Before the 1950s, rangeland was the domain of tribes and they followed an ancient system of rangeland conservation and utilization called the Hema system. When the system was abolished in the 1950s, the result was open access and no concern for conservation and sustainability. The rangelands are now heavily degraded. However, there is a move to reverse this trend through the establishment of range reserves, some of them being exclusion areas and others being cooperatively managed ranges with access restricted to cooperative members for limited grazing.

It was noted that farmers in Syria and Palestine do conserve landraces. Of particular note is the durum landrace Hourani which is still extensively cultivated because of its quality and adaptation characteristics. Moreover, farmers practice selection of next year's seeds based on desirable phenotype. Qualities such as taste, color, aroma, rather than productivity levels *per se*, seem to be the major reasons behind landrace conservation and persistence throughout the region. It is not clear what role market incentives play in landrace persistence. In Palestine, an key incentive for landrace conservation was the drive for self-provisioning through intensively managed home gardens and small farms.

Summary of Major Issues

i Serious deficiencies in the traditional approaches to research can be addressed by developing and implementing innovative approaches to ensure community participation.

ii Understanding, and perhaps changing or influencing, the attitudes of farmers with respect to biodiversity conservation is a must.

iii Local community participation in biodiversity conservation and management, in general, and participation in landrace maintenance specifically, may require different approaches.

iv Indigenous knowledge of biodiversity needs to be given more adequate attention.

Conclusions: Future Activities

Local community participation and the appropriate mechanisms for achieving this should be included in the next two workshops scheduled for October and November, 1995 in Izmir and Amman respectively.

SESSION 6

Training Issues of the Region

Introduction

With world-wide recognition of the need for conservation and sustainable use of biodiversity, is the realization of the concomitant need for relevant scientific and technical education and training. There is a dearth of skilled scientists and educators in the areas and levels where they are needed most. To clarify the current status of need, a case study of the situation in Lebanon, is presented. To meet the need, representatives of training institutes notably from outside the region) presented information on the types of training available now and how the expertise of these organizations is able to help build the within-country capacities to produce the skilled personnel required. The session comprised five papers, the abstracts of which are presented below.

Specific Objectives

i To assess current training needs throughout the region

ii To establish where and how to meet these needs both in the short- and long-terms

iii To outline priorities and possibilities for a timetable and funding to strengthen local training capabilities.

Training Needs for Biodiversity Conservation and Management: The Lebanese Perspective

S.K. Hamadeh, E. Barbour, M. Abi Said and R. Baalbaki

American University of Beirut and GreenLine Association, Beirut, Lebanon

Abstract

Lebanon's geographical position, varied topography and resultant non-uniformity of climate gave rise to a wide range of natural ecosystems. Its formerly renowned exceptional natural diversity has been eroded due to systematic destruction of these ecosystems. Mismanagement and misuse of natural resources are given as reasons. Because of deforestation, rapid urbanization, changes in farming systems and civil unrest, wild and native species are becoming extinct and land degradation is severe. The framework of institutional responsibility for environmental affairs is complex, involving at least six different ministries with little coordination between these authorities so that existing relevant legislation, though covering most aspects of nature conservation, is ineffective. However, the need for conservation is recognized: Lebanon is signatory to several international conventions on conservation. How the situation is being addressed by parliament and the roles of government, scientific institutes and non-governmental organizations in introducing environmental conservation education at school level and expanding it at higher levels, are explained.

There are no established and properly managed protected areas because of shortages of skilled staff. Technical training schemes do not exist. If accepted, a proposed GEF biodiversity conservation project in cooperation with the Ministry of the Environment, will set up conservation areas and provide research grants. UNDP is helping to strengthen the national capacities in terms of administration and training. At an international workshop on environmental research and education in the region, convened by the American University of Beirut in 1994, several Middle Eastern participants agreed to coordinate future environmental research and education in the region and combine the latter with training in economics and social sciences. Multidisciplinary research projects are investigating sustainability of different land-use systems. Research into biodiversity is supported by the National Council for Scientific Research. In close cooperation with ICARDA, scientific institutions are improving the productivity of field and forage crops.

In conclusion, the following recommendations for studying, protecting and using biodiversity, are offered: compilation of a national biological inventory; continuous assessment of biodiversity status; development of conservation strategies through research; a computerized database; and ecosystem monitoring by remote sensing. To maximize knowledge gained, the needs for taxonomic expertise and effective training programs (evaluated on site) for all levels of activities, are emphasized.

Biodiversity Conservation Training in the Countries of the Fertile Crescent

Nigel Maxted and Brian Ford-Lloyd

University of Birmingham, UK

Abstract

Much of the world's biodiversity is endemic in developing countries that yet have few conservation specialists, or training institutions to produce them. People from such regions (including the Fertile Crescent) have to travel to developed countries for training, particularly for obtaining higher degrees in specialized, ecology topics. The disadvantages of this system are elaborated, underlining the urgent need to establish and strengthen training throughout the world to provide scientists with the skills required to study and utilize their native flora.

Even in developed countries, few educational institutions offer courses that incorporate all aspects of genetic conservation and sustained utilization (including biosystematics, taxonomy and management). Reinforcing training capacity in all regions of the world will take time and requires careful research, planning and resource provision. The authors advocate the establishment of links with existing centers of excellence who could assist in curriculum development, identification of teaching resource requirements and, initially, participate in teaching and preparation of selected courses or modules. Different levels and types of professional conservation workers (researchers, managers and technicians) will require different training, appropriate to their roles. It is suggested, however, that basic principles of conservation be incorporated into all agricultural and natural science courses. Until regional institutions are established, some training of conservationists should continue in developed countries. Individual training placements in appropriate centers of excellence, and postgraduate vocational degrees, are more readily available in developed countries, though some are locally based: e.g. the University of Birmingham is involved in setting up plant genetic resources M.Sc. courses in Zambia, Kenya and the Philippines. Recently, small-group, certificate and diploma courses on specific aspects of conservation have been run within and outside relevant regions. Distance learning by correspondence or electronic media could be a cost-effective option but, to date, has a high drop-out rate.

In their training proposal for the Fertile Crescent, the authors list the following steps, *a priori*: review training needs and opportunities within the region; identify priority topics; identify personnel numbers and matched training; designate regional biodiversity training centers; establish different courses; train educators; develop a strong research base; fund specialist training within the region (and outside of the region when necessary); encourage public awareness of biodiversity issues; elucidate the extent of involvement in training of international bodies such as ICARDA, ACSAD, WANANET and IPGRI; and ensure adequate evaluation of training programs.

In-service Training on Planning Projects for Biodiversity Conservation: An Innovative Program at the University of Bradford

John D. MacArthur

University of Bradford, UK

Abstract

The University of Bradford concentrates on applied subjects. The Development and Project Planning Center (DPPC) was set up to provide in-service, practical training in project planning, appraisal and management for officials in developing countries. The department offers: five postgraduate degrees and a doctoral program, all with a development-planning emphasis and significant economics content; consultancy services of many kinds, particularly in relation to training, planning and evaluation; and in-service training courses, both supply- and demand-led. Because DPPC is self-funding and is run as a business, it has had to follow market forces and has shifted course emphasis from project appraisal to topics of interest to the development financing organizations. Conservation of biodiversity has become a priority in the development community.

A course, set up in 1993, aimed at planning officers and managers in government departments and agencies responsible for biodiversity conservation programs, is described. It aims to convey both issues and techniques relevant to biodiversity conservation projects. It covers: background material, such as a review of institutions and current status of biodiversity conservation in the student's region; basic project planning, including community relations and participation; commercial, financial, property, and informational aspects of conservation; visits to UK institutions involved in biodiversity conservation; management principles and practices; and individual study activity. The trainers found it necessary to introduce a computing component to the courses because use of databases is widespread in conservation activities. The teaching emphasis is on *in situ* conservation though aspects of *ex situ* conservation are touched upon and are observed in visits to UK institutions. All of the courses have been directed by the author, assisted by a rural sociologist and a zoologist. Support and funding has been provided by several international development organizations, particularly UNEP, the Darwin Initiative, GEF, ODA, GTZ, SIDA, Governments of participants and the UK Foreign Office. Study fellows have attended from; Bangladesh, India, Malaysia, Nepal, Burundi, Kenya, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe, Ecuador, Mexico, Venezuela, Brunei, Poland and Ukraine. India sent the largest group of trainees and after their evaluation of the program, DPPC has been commissioned to provide an annual, 12-week program for Indian Study Fellows, preferably incorporating a period of study in an Indian training institution. In the future, DPPC would like to see the development of local institutions for training. Initially these could work jointly with establishments in the developed world but, ultimately, would take on full responsibility for training in their regions.

The Role of CAB INTERNATIONAL in Protecting Biodiversity

Shaun Hobbs

CABI, Wallingford, UK

Abstract

CAB INTERNATIONAL (CABI), is a UK-based, 95% self-funding, not-for-profit organization, owned by 36 national governments, dedicated to supporting sustainable development thereby improving human welfare. For more than 80 years it has provided an international service for biodiversity through its Information Services Unit, four scientific institutes (the International Institute of Biological Control (IIBC), the International Mycological Institute (IMI), the International Institute of Entomology (IIE) and the International Institute of Parasitology (IIP)) and regional offices in Malaysia, Trinidad and Kenya. CABI's relevant capabilities, examined in relation to the articles set out in the *Convention on Biological Diversity* (1992) are described for the following fields: identification and monitoring, *in situ* and *ex situ* conservation, research and training, ecological impact assessment, minimizing adverse impacts (such as the effects of invasive species), provision of access to information on genetic resources, exchange of information (particularly biosystematic and bibliographic information), technical and scientific cooperation through the Bio-NET INTERNATIONAL network, sustainable use of components of biological diversity, cooperation with other international organizations, and public information and awareness. Examples of CABI's work are given.

The organization has expertise in the biosystematics of microorganisms, insects and nematodes and in the control and use of these organisms, particularly in biological control and integrated pest management. The importance of CABI's target organisms is often overlooked in studies of biodiversity but they have important roles in ecosystems. Many previously undescribed species with potential in biological control and bioindication of environmental damage have been discovered during scientific services projects. The Fertile Crescent region is the center of evolution of several major food crops. It harbors a diversity not only of plant genetic resources but also of co-evolved mycorrhizas, rhizobia, pathogens, pests, predators and pollinators, all of which are important contributors to its biodiversity.

CABI's Information Service has the expertise and experience in information management to have developed a database that is an enormous information resource pool providing data on literature covering agriculture and related topics, including biodiversity. Data is available by on-line inquiry and selected topics are published in journals, books and on CD-ROM. Information can be compiled in a wide range of formats tailored to the needs of individual users, world-wide.

Plant Data Management at the World Conservation Monitoring Center

Harriet Gillett

WCMC, Cambridge, UK

Abstract

The World Conservation Monitoring Center (WCMC) is a non-profit organization which, as a center of excellence in the management of information on conservation of biodiversity and sustainable use of species and ecosystems, provides advice and support for other organizations and agencies. The approximately 60 professional staff have wide international experience in sourcing, management and storage of information relating to biodiversity conservation and relevant agreements and programs. Expertise in systems analysis, map-based geographical information systems (GIS) and computer communications is also available. The Center's main aims are to provide information services (including via the international electronic communication systems, Internet and the World Wide Web), technical assistance in data management, and training. Details of data management courses, run for periods of a few days, several weeks or, if part of degree-level courses, one year are given.

The WCMC's biodiversity databases include a *Biodiversity Map Library* with mapped information on global and regional vegetation, tropical forests, wetlands, coral reefs, mangrove swamps, protected areas and threatened conservation sites. Datasets include the European Union's CORINE Biotopes and Designated Areas Register, BirdLife International's Important and Endemic Bird Areas, and the Africa Elephant Database UNEP/GRID. Linked to this is the *Protected Areas Database* which currently holds statistical information on some 37,000 protected areas. A *Threatened Plants Database* holds taxonomic, distribution (within a geopolitical area known as a Basic Recording Unit) and conservation information on 82,500 kinds of plants, including single-country endemics, tropical timber species, crop wild relatives, plants of ethnobotanical or pharmaceutical value and plants in protected areas. Details of the database design are given, as is a list of all the types of media from which data is gathered. The latter includes 'grey' literature difficult to obtain elsewhere.

Of particular relevance to planned conservation activity in the Fertile Crescent, is a description of a WCMC project on the conservation and sustainable use of plant genetic resources (PGR) of Mexico and Central America. It illustrates the importance of good networking to ensure project success. A well prepared workshop was held to discuss information requirements for *in situ* conservation planning, review existing information and to review data exchange mechanisms. The next phase will be to build in-country capacity to access, manage and exchange PGR information. Combining floral data, information related to habitat conservation and information from *in situ* collections, into computerized systems is recommended, as is the collection of more data on distribution. The need for taxonomic training is emphasized.

Summary of Discussion

The chairman opened the discussion with the observation that, though regional training is obviously needed, 'outside' training will be necessary until such time as regional institutions are able to offer the same high standards. While the participants were in general agreement, it was pointed out that there is also scope for exchange of information between the countries of the region to bring them all up to the same level. To facilitate this, communication and compatibility of approaches and techniques for data management are important. Difficulties that relate to communication are the language problems that arise in using the INTERNET system, and the lack of consensus regarding Latin names of plants. The situation with common names, of course, is even worse. These factors need to be considered in any training program.

The group were told of the range of training courses, of specific interest to the Fertile Crescent countries, offered by the University of Wageningen. Trainees would benefit from the 'sandwich' design whereby a first phase takes place at the University and is followed by a period of research in the home country. In a third and final phase at Wageningen, the information and experience gained is consolidated and documented. The courses are relatively inexpensive and grants are available from the University. The University of Reading too offers a range of courses; special emphasis is given to in-country courses.

Discussions followed on the amount of time needed to set up a training program at a regional university (e.g. AUB). Though experience in Kenya indicated that a minimum of three to four years was required, it was agreed that it is not possible to extrapolate from this to the present situation in that the prevailing conditions are different, as are the funds available to train trainers, etc. IPGRI's WANA office is currently preparing to set up degree courses at two regional universities; Lebanon and Morocco are being considered initially.

The importance of other levels of training was discussed and how to allocate funding. Priorities most often seem to be: firstly, policy-makers (who tend to favour short-term projects that can be executed within their term of office); secondly farmers; and thirdly, external training of a few professionals. It was suggested that if funding is to be cut anywhere it should be from that part allocated to the training of policy-makers. The 'informal sector' is playing an increasingly important role in conservation. Because NGOs are in more direct contact with this sector they should be involved in planning training programs. R. El-Haber, speaking from the point of view of an NGO's twenty years of experience in Lebanon, stressed the need to train large numbers of people, to build a network of environmentally-conscious (and cautious) people, and to mobilize funds from many different sources including the private sector. UNICEF supported their 'train the trainer' approach and, together with the Ministry of Education, had started training teachers. He added that training given to media personnel is well worth while because it enables them to properly report on environmental issues.

The participants were not agreed on which groups should be targeted to receive training first. Opinions of which groups rated highest priority included the need for personnel to carry out basic studies on floras and faunas (which has already been done for the flora of Turkey and Iraq), local communities (which may be better approached as public awareness) and school children (sound instruction at this level will lead to longer-term success).

Summary of Major Issues

i Regional capacity for training at all levels needs to be strengthened.

ii Countries should prioritize their training needs.

iii Regional partners are at different levels now; South-South exchange is needed.

iv In the short term, graduate and higher training should be done outside the region.

v Long-term benefits will be derived from educating school children now in matters of environmental conservation.

Conclusions: Future Activities

i Courses that are being set up at local universities should stress taxonomy and should include economics and other social sciences.

ii The rationale for biodiversity conservation should be taught at primary and secondary school level.

SESSION 7

Public Awareness

Introduction

Agricultural research and development must devote extraordinary effort to have its message heard by a distracted, preoccupied and often disinterested audience. The explosion of advances in telecommunications provides the tools necessary to accomplish the job at a lower cost than ever before but the creativity of agricultural research and development workers must compete with other disciplines for the attention of the reader, listener or viewer. Public awareness messages must be brief and reach the intended audience in a crisp, positive and attractive style. The receiver must be left with the impression that he or she can act in the way prescribed and do what the message recommends, and the persuasion to take this action.

Once the message is thought out and produced it must be delivered. The medium of delivery may be limited by funding; it is therefore essential that much attention is given to hitting the intended target audience, using the strategy that optimizes the impact of the message. This means impacting influential and energetic people, who, more often than not, might be children.

Specific Objectives

i To gain understanding of the concept of public awareness from a professional at IPGRI.

ii To hear what public awareness means from the point of view of an active national scientist.

iii To contrast this viewpoint with one from an NGO perspective.

iv To recommend an allocation of public-awareness energy and principles that will suit the region's needs.

Biodiversity Public Awareness in Palestine

Jad Isaac and Stephen Gasteyer

The Applied Research Institute-Jerusalem, Bethlehem, Palestine.

Abstract

Palestine, at the meeting point of Eurasia and Africa, is characterized by geographical and ecological divisions with tremendous diversity of climates and ecosystems. It hosts over 2,500 species of wild plants; approximately 800 are considered rare and around 140 are endemic. After centuries of ecological mismanagement, environmental rehabilitation is critically important. Agriculture, characterized by intensive irrigation, in the Jordan Valley and Gaza Strip, and rainfed farming in the rest of the areas, is vital. It accounts for approximately 30% of both GDP and employment. About 50% of Palestinians benefit directly from agricultural returns. Concern is expressed for the future of biodiversity in agricultural, pastoral and range lands Over-grazing, deforestation, forest fires, and land-use restrictions risk destroying the land most valuable for natural resources or agriculture. Of particular concern is the growth of population centers and associated infrastructure and security areas. Forty percent of the West Bank and 85% of the Eastern Slopes area continue to be in closed military zones.

The authors provide an overview of the potential for development of food production and indigenous knowledge, viewed against problems of water use, pollution and biocides. Local populations need to be involved in the management of biological heritage sites. Education and conservation programs are immediate needs. In certain areas, economic and development activities need to be restricted but only in full consultation with local residents. Initiatives to promote awareness are described. Conservation shortfalls need to be met with the development of centers for plant genetic conservation; GIS mapping of soils, flora, agricultural areas, weather data, topography and geology; a study and census of livestock in the West Bank; a plant breeding program to improve the production potential of rainfed farming; socio-economic work on the effects of conservation programs on the local population; and education programs for farmers and the general public. More sophisticated efforts are needed to inform policy makers and planners.

Palestinians need training in conservation and utilization of germplasm, seed technology and genebank organization, management and utilization. Specific areas of focus should be: food and forage legumes, cereals, pasture plants and stone fruits. Economists must be trained in short- and long-term environmental accounting. Without this, efforts at promoting biodiversity will always be competing with short-sighted cost-benefit analysis. Scientists and agriculturalists need to seek creative, ecologically-sound alternatives to present practices and promote *in situ* and *ex situ* genetic conservation. With the help of the international community, Palestinians can conserve their biodiversity and genetic resources, combat desertification and, ultimately improve living standards.

Development for the Future: A Policy for Public Awareness to Avoid Environmental Disasters

Richardus M. El-Haber

Friends of Nature, Beirut, Lebanon

Abstract

Ill-planned development is costing Lebanon its renowned landscape, its most fertile land, its beaches and marine life. Sea, land, air and ground water are heavily polluted. That Lebanon is an ecological disaster zone, deteriorating beyond its ability to recover, is generally unrecognized by the Lebanese. A massive public awareness campaign is needed to address their unconcern.

Environmental economics provide the most plausible working plans for environmentally-sound development policies. After 20 years of a stagnant economy and disruption of the country's basic infrastructure, economic growth should provide the means for a better life, but it shouldn't come at the expense of future generations. Further environmental destruction can be prevented if natural resources are valued rather than wasted due to blind economic impatience. Broad public participation in decision-making is advocated for achieving sustainable development. Individuals, groups and organizations should participate in environmental policy decisions. The key is to focus on both the impact and empowerment of people, with advocacy and initiatives for national and international economic efforts targeted at the school, household and community levels. Partnerships too are needed among NGOs, environmental researchers and the media to increase public awareness. Future generations face unprecedented challenges in increased population and concomitant food and energy requirements, hopefully with better environmental protection, cleaner air and the elimination of poverty. Policy choices will make the difference.

Environmental degradation has been exacerbated by 'development' based on over-exploitation of natural resources and a lack of proper legislation and enforcement. New models are needed. Though governments are inept in environmental stewardship the media can play a key role in building up new ways of thinking. Political will for change among national leaders is important, but creating the need for change among parents and children will do much more. Information and education must fuel new public awareness. Children and youth should be the vanguard of the environmental movement adopting conservation as their cause. Women, men, children, politicians and opinion leaders should be involved in planning, implementing and evaluating programs to improve living conditions. Communication is vital. Environmental information should be disseminated along with suggestions for possible action, to all groups and communities affected by the problems. Training of local communicators is essential to maintain interest and mobilize communities. If properly administered, integration of environmental education in the school system can change teachers, students and their parents. School activities should be teacher directed but child centered such that students feel empowered to do something, personally, to solve environmental problems.

Putting Public Awareness into Perspective

Ruth Raymond

IPGRI, Rome, Italy

Abstract

Public awareness concerns the public's broad and accurate general understanding of, in this case, conservation and sustainable use of biodiversity. Perhaps the most important accomplishment of the Earth Summit was its giant public awareness undertaking which placed biodiversity on the global agenda and indelibly printed in popular understanding the link between environment and development. Such understanding must help the pursuit of the public awareness goals which, in the context of this workshop, are to promote a better understanding of the role of plant genetic resources in development; to elicit a better response from donors; to influence government action through public opinion; to encourage better understanding in partner countries and to generate support for one's operational activities.

Key audiences fall into some, if not all, of the following categories: policy makers, NGOs, media, organizations and donors. NGOs often play a critical role in influencing policy-making decisions and they should be seen as potential partners, as well as targets of public awareness activity.

A good country information strategy should establish contact with the Ministry of Information, provide background material, provide counterpart agencies and NGOs with information, maintain a media contact list, issue press releases and have regular awareness-enhancing activities. The paper describes how a comprehensive understanding of the activities and orientation of the different forms of media available is essential to tailoring the message and its means of delivery to any particular audience. Guidelines are given on: choosing the delivery medium; taking the initiative to establish contacts and to create media events; relating to media personnel and dealing directly with decision-makers; and maintaining publicity momentum to keep in the public's eye

Information materials which can serve an important public awareness function are listed as: brochures, pamphlets, posters, reprints of published articles, and newsletters. Names which should be on the mailing list include government ministries, universities, institutes and schools, libraries, NGOs, journalists, UN agencies and individuals.

IPGRI's strategic activities are directed towards the development of a strong national basis for genetic resources conservation. This is seen as the foundation for any effective global genetic resources activity. To this end, a solid and sustained commitment to plant genetic resources at the national level is crucial, both to IPGRI's work and to the global effort.

Summary of Discussion

Lebanon and the Occupied Palestinian Territories (OPT) have suffered for too many years from civil unrest and concomitant deflection of government and popular attention away from the apparently less-immediate concerns of ecology and environmental conservation. The similarities between these two situations was touched on in discussions following presentation of the papers. The question was raised as to how an NGO, such as Friends of Nature, could operate, financially and logistically, given the unusually difficult conditions in Lebanon. Funding apparently comes from private donations and international organizations such as UNICEF, UNEP, YMCA and YWCA. It was precisely because of the absence or handicapped condition of government, and the pressing destruction of Lebanese natural resources, that NGOs sprang into action. Often, reconstruction in the aftermath of war is more destructive than are the immediate effects of the war when people are forced to stay at home.

On the subject of NGOs, the question of the negative publicity generated by them and how to counteract this sort of criticism, was raised. Vigilance, patience and using the media to counteract negative stories, was recommended. Another technique is to establish common ground by reaching agreement on at least some issues. Subsequent discussions relating to other areas of dispute are facilitated by the knowledge that the parties are not totally opposed in their ideals. IPGRI has successfully adopted this strategy with NGOs who champion biodiversity but who are critical of the CGIAR.

In reply to a question regarding the contribution of public awareness outreach to the adoption of new attitudes, an example relating to a war-torn society was given. The principle is the same for other situations. Getting people to believe in a cause is fundamental to change. If their minds are changed they will generally be willing to back their conviction with action. The former is public awareness; the latter impact. The example given is of clean-up campaigns. Cleaning up a site is a relatively easy task, but how is it kept clean? People will keep things clean when the majority of the community adopts a long-term change in attitude. The energies needed to overcome the jaded sentiments of war-torn societies are great and that is why it can most successfully be done through the younger generation. They won't remember the war, or may forget more easily. They often shame their parents into following their lead.

Summary of Major Issues

The difference between public awareness and public relations was explained. The participants recognized the validity of public awareness campaigns in a world in which personal short-term survival needs overshadow the requirements for long-term conservation of the environments from which people derive their sustenance. A starving population is newsworthy, environmental degradation is not.

i Awareness is needed at all levels of national and international society.

ii A strong national basis for genetic resources conservation is seen as being fundamental to any effective global strategy. To achieve such a basis there have to

be changes in attitude: policy-makers need to be informed; the public need to be educated; and scientists need to be trained.

iii Awareness in schoolchildren can have a snowballing effect. They have the greatest vested interest in saving the world. Their enthusiasm for a cause can inspire their parents who, as voters, can influence politicians.

iv International centers have the capability to target decision-makers, NGOs, the media, organizations and donors.

Conclusions: Future Activities

Clearly, the public awareness agenda for the future will call on a blend of approaches.

i For the purposes of funding the *Conservation, management and sustainable use of dryland biodiversity within priority ecosystems of the Near East* project, Ruth Raymond (IPGRI) suggested a strategy in which a good working relationship is established with NGOs, and a start is made on cultivating the interest of the media by identifying journalists in each country for an introduction and training program in biodiversity. Over time this would become a core group of media through which the consortium would work. Eventually they might even adopt the cause.

ii Much effort should be made to develop partnerships with schools in the region. 'Training the trainers' has become a popular approach in the international centers. 'Teaching the teacher' sounds just as appealing; however, it may be more expedient to train both the teacher and student leaders at the same time. Selection of the right people to be trained will be critical. They must be intelligent and proactive, able to transpose the information into modules acceptable at the local level. They must be the driving force in stimulating personal initiatives for environmental awareness.

Field Visits

Visits to the Azraq Oasis Conservation Project and the Al Shomari Wild Life Preserve gave participants an opportunity to observe current biodiversity conservation activities in Jordan.

Azraq Oasis Conservation Project

The philosophy that guides the activities of this project is:

> *Maintaining the equilibrium between the socio-economic needs of the people on one hand, and the available environmental opportunities of land and water on the other.*

Due to overuse of available environmental resources of water and fertile soil during the last decade, the Azraq area (basin) has suffered immense environmental degradation. The most outstanding form of this degradation has been the drying out of most of the Azraq Oasis and the deterioration of water and soil qualities in the area. With this general background, and through joint funding by the Global Environmental Fund (GEF), United Nations Development Program (UNDP), and the government of The Hashemite Kingdom of Jordan, the Azraq Project was initiated and it started its work officially at the beginning of 1994.

The main goal of the Project is to investigate (with a view to implementation thereof), the policies and activities needed to save Azraq from this current deterioration. This is to be achieved through extensive investigation of the environmental, agricultural, and water situations. To ensure the continuity of Azraq as a unique habitat and source of livelihood for local peoples and for Jordan as a whole, the most effective, technically feasible, and socio-economically applicable solutions are to be identified.

The Five Sub-Projects

To achieve the above-mentioned goals, a wide spectrum of issues needs to be addressed. This need is reflected in the design of the Project which includes five sub-projects each of which deals with one of the main developmental issues in Azraq. These sub-projects are:

Restoration and Management of the Azraq Wetlands Reserve
This is aimed primarily at rehabilitation of the Oasis as part of the preservation and rehabilitation of the wetlands in the area, and in Jordan as a whole.

Establishment of an Environmental Assessment Unit and Implementation of The Ramsar Convention (EIA sub-project)
An EIA unit is being established at the Department of Environment/Ministry of Municipal and Rural Affairs, and the Environment, to perform environmental impact studies of

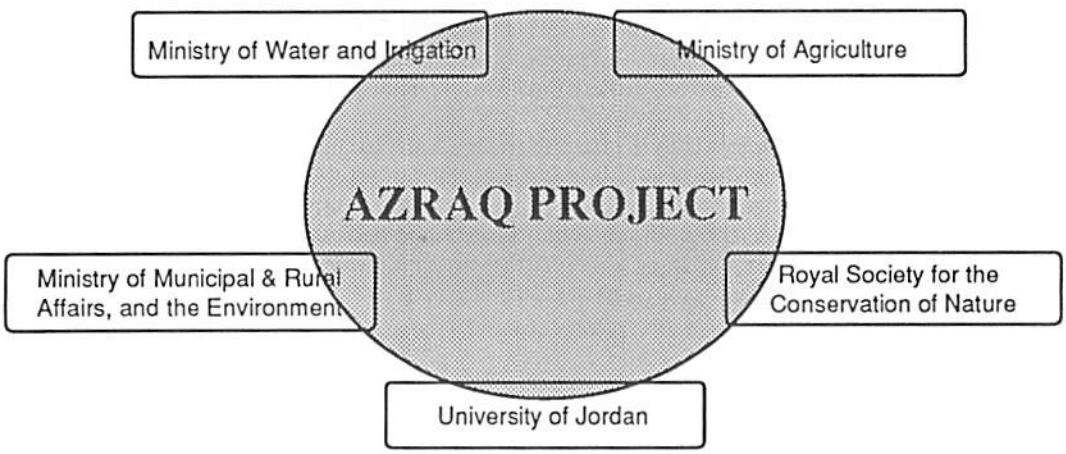
previous, ongoing, and planned projects. Socioeconomic studies will also be carried out in the Azraq area.

Guidelines for Agricultural Development in the Azraq Basin (Agricultural sub-project)
The results of studies concerning the agricultural conditions will be used to formulate and implement proper relevant policies. Activities include surveying of agricultural practices, soil status, irrigation conditions, and land-use patterns in the area.

Studies on the Water Resources of the Azraq Basin (Water sub-project)
Studies of the quality and quantity of water resources for the purpose of developing and implementing a water policy that balances the water demands with availability and supply.

Long-Term Studies on Water Conservation and Management
This sub-project explores methods and technologies that are potentially applicable to enhance the water status in the area in quantitative, qualitative and spatial terms.

Participating Organizations



Suggested Establishment of an 'Azraq Friends Society'

Issues addressed by the Project are of a comprehensive nature and extend to affect most of the people's interests and sources of living in the area. Based on this, it is suggested that a 'society' be established that will include the residents of the Basin, those who have socioeconomic interests in the region, involved officials and representatives of concerned organizations. Such a Society would provide support for all developmental activities in the area including The Azraq Project. It would provide the best framework and vehicle for

Azraq. Within the framework of sustainable and environmentally-sound development, such an involvement would reflect positively on the continuity and feasibility of applying any practices and/or policies that aim at straightening the relationship between the socioeconomic needs of region, on one hand, and the available environmental opportunities on the other.

Dryland Biodiversity Conservation through Natural Resource Management: Synthesis and Observations

Calvin O. Qualset

University of California, Davis, USA

Notwithstanding large areas of fertile, productive lands, the Fertile Crescent region of the Middle East is a complex agroecosystem that has experienced serious degradation of its soil, water, and biological resources and, on a local basis, unmeasured atmospheric deterioration. These effects are largely driven by a rapidly increasing human population whose demands for food and services have outweighed wise use of natural resources. The momentum of population growth will carry increased population size for several decades even if migration into the region and the birth rate are reduced. It is clear that the Fertile Crescent region, as are many other regions around the world, is on a disaster course with respect to environmental quality and quality of life for the inhabitants. Environmental degradation surely affects the agricultural productivity of the region, where there is already massive importation of foodstuffs from other areas.

The Fertile Crescent is one of the most important regions of the globe because of its past evolution of crop plants, domesticated animals, and human culture. For this region to continue to support a large human population there must be new paradigms for food production which are consistent with conservation of renewable and non-renewable natural resources. On the time scale of biological, agricultural and industrial evolution we are presently in an episodic phase when each crop cycle, each year, each season brings on greater need for change in human behavior in order to reverse trends in environmental degradation. Thus, there is urgency for action. The stage has been set with the recognition of these problems on a global basis in the recent Convention on Biological Diversity, the Desertification Convention, and Agenda 21.

This workshop has taken a bold step forward in proposing that the Fertile Crescent become the centerpiece for research on natural resources management, especially biological resources, in the face of rapidly increasing population and greater demand for water resources by the human population. Food production in the region is both intensive and extensive. There are important crop lands under irrigation, but more of the marginal and others lands depend on rainfall to produce crops. The region depends heavily on grazing lands and these are being degraded rapidly through over-grazing. Poor grazing land means poor water harvesting from watersheds and thereby contributes to the total environmental stress in the region. The Fertile Crescent includes great diversity in every respect - ethnic, political, economic, climatic, soils, and biological resources. Because several States must eventually

collaborate to effect changes that will preserve this important agroecosystem, an international effort is most appropriate, and it can start on a small scale as proposed here.

While conservation of natural resources must be a goal for this region, it cannot be divorced from research on the agricultural system, in particular, to increase food production. Research should be directed toward understanding the root causes of plateaued yields, the practices leading to degradation of soil, water and biological resources, and the socio-economic factors that prevail. It is a multidimensional problem requiring multdisciplinary approaches. The integration of natural resource management and agricultural production practices is the new paradigm for agricultural development. This is being recognized by national governments, international agricultural research centers, and the major donors of funds for research and development.

This workshop has focused on biodiversity and its conservation as a key element for sustaining the Fertile Crescent agroecosystem. It is highly appropriate to take this emphasis. We should remember what is meant by conservation. It is the wise and sustainable use of natural resources, in contrast to preservation which promotes the status quo. It has no time boundary - it is for now and forever and for everyone. It permits and encourages evolutionary change, including extinction of species. Since conservation is compatible with the use of resources, it involves both extraction and replacement. Restoration of biological resources to former habitats is appropriate. Thus natural resource conservation is an essential ingredient for sustainable food, fiber, and energy extraction from natural resources. In the presence of influence by the human population on biodiversity, conservation generally requires some interventions. Without interventions the present state of degradation will run its course to extinction.

The seven topics addressed during the workshop generated lively discussion and greatly aided progress toward common understanding of the issues, the philosophies, and methodologies for biodiversity conservation. Each of the topics has been summarized elsewhere in this report, so I will make some observations and comments which I hope will be useful in further deliberations.

Ecosystem Selection

The Fertile Crescent region represents an agroecosystem in and of itself. To be sure, there are great differences throughout the region, but the commonalities of climate and agricultural system prevail. To introduce new practices consistent with biological conservation throughout the region, it is necessary to select study areas that are representative of the region. Representatives of each country in the region identified areas and habitats that were relevant to their local needs. These should be assessed from a regional point of view as part of the process of establishing study areas. The criteria for selecting local ecosystems was well-discussed and included more than 25 wide-ranging factors. With respect to biological diversity issues, J. Valkoun's criteria were highly relevant. He concluded that a site selected for study should include the following:

i presence of wild progenitors and other wild relatives of globally-important crop plants;
ii presence of populations having high genetic diversity and those which are endangered by human-related activities;

iii presence of species that are difficult to conserve *ex situ*; and
iv inclusion of traditional agricultural systems, including landraces and local breeds of plants and animals.

From the logistical point of view, the study areas should be accessible for study and view by the general public.

In the development of a project, there is a point of concern that is meant to provide data and subsequent recommendations for application on a larger scale. It must be clear at the national government level that the designation of critical and representative sites for study does not constitute the solution to the biodiversity conservation problem. Certainly, the study areas can become permanent reserves that will achieve certain conservation goals. But the critical issue is that the lessons learned from the study sites will be transferred on a regional scale. The study sites are to be models, not a solution to conservation of biodiversity. There are also cautionary details to be considered. For example, the study areas may be small and fences can change the interactions between species and hence their reproductive characteristics.

Ecosystem Management

This topic was broadly interpreted from agricultural management points of view to the management of protected reserves. From the point of view of the whole agroecosystem of the Fertile Crescent, attention should be given to intensive agriculture which feeds the masses of people. If high productivity is sustained in these areas, there can be less demand on the marginal lands now extensively farmed and grazed. P. Struik made the important point that high external input agriculture provides inherent control on variation from season to season and place to place, but it leads to erosion of genetic resources and potential problems of environmental quality related to excessive use of nutrients and pesticides. On the other hand, low external input agriculture is inherently more variable in its output. Borlaug's concept of saving lands for nature through maximizing production on the good agricultural lands and leaving the marginal lands as watersheds, forested areas, and conservation of biodiversity is highly relevant to the Fertile Crescent. The problem of restoration (primarily by re-vegetation) of degraded habitats, is also a key element in developing an ecosystem management plan for the Fertile Crescent.

It is apparent that animal agriculture is a key element in the conservation of biodiversity in this region. Goats and sheep are traditionally an important, and often sole, means of support for rural people. Grazing practices must be closely examined and alternatives offered. This is an extremely important but difficult issue to address in view of time-honored grazing rights and land tenureship. Also to be considered are the endangerment of native animal genetic resources of cattle, sheep and poultry. Conservation plans are needed for the rare breeds of these animals.

Finally, if new management activities are proposed to policy-makers and farmers, there must be rationalization of the benefits to be derived. This can take the form of incentive payments, new markets for new products, or improved land value.

Complementary Conservation Strategies

There are many modes of biodiversity conservation: on site (*in situ*) conservation is the preferred choice for maintaining biota in their native habitats. It is recognized that this cannot be the only choice and that off-site (*ex situ*) conservation must also be used when habitat damage is great and the number of individuals remaining in a species becomes very low. Off-site conservation is then used to regenerate the numbers for re-entry into the native habitats. There are other reasons for resorting to *ex situ* conservation, such as having access to genetic resources for research and breeding purposes.

The workshop rightly emphasized the great need for inventories so that species distribution and abundance is known. Methods for inventorying include gross overview through GIS and detailed ground-level surveys. The latter are essential and result in an understanding of the diversity of habitats occupied by species and their associated species. Sensible biodiversity conservation plans can only be developed when a bioinventory has been completed for the entire the region. Fortunately, in the Fertile Crescent considerable information already is available, but not to the extent of local population data.

The most important message from this workshop is that both *in situ* and *ex situ* conservation must be integrated and complementary. Operationally, this requires that each participating nation should have its own seed banks, gardens, and reserves. A second message is that conservation cannot be planned or implemented without buy-in from the local level to national government level. With respect to on-site conservation of cultivated plants and domesticated animals, it is essential that farmers and communities become the practitioners of conservation activities and partners in sharing any derived benefits, as noted later in this report.

Utilization and Value of Biodiversity

The valuation of biodiversity is an intricate matter that requires some judgements with respect to economic, ecosystem, and social values. It is a researchable topic; one that should be a component of the proposed biodiversity project. One of the most pervading concepts to be remembered in conservation of biodiversity is that the landowners, farmers, and others must recognize some value or reason for undertaking conservation: if they do not, conservation will fail. Interventions are required and they generally have some cost. The fact that conservation practices can generate income (as with niche marketing of traditional food products to urban populations), must be fully explored. Conservation of the local genepools of agricultural species can be achieved by gene introgression so that the basic native genepool is retained and certain improvements are introduced (such as pest resistance), that improve or stabilize yields. Several examples of landrace utilization and improvement of crops were presented. They indicated that this means of conservation can be effective.

Native species of plants are hosts to many species that serve as biocontrol agents for crop plants. This was well-illustrated by a discussion of aphids which are parasitized by wasps. Conservation of native vegetation, therefore, can provide insurance that aphids, or other species, do not become devastating pests. Introduced species of pathogens and weedy plants are generally more damaging to crops than are indigenous species.

Local Community Participation, Indigenous Technical Knowledge, and Land Tenure

Engagement of farmers and rural communities is critical to any adoption of a modified conservation ethic. R. Tutwiler pointed out that the local community members must be full partners with shared objectives and benefits. Some case studies that emphasize these points have been carried out. He calls this his 'sustainability' model in contrast to the traditional technology transfer or economist's models. If *in situ* conservation is to take on new emphasis there must be behavioral changes. These changes are more likely to be successful if the local communities themselves discover and instigate the changes. All of this suggests that careful study of local knowledge and traditions is essential in order to effect participation and to build partnerships. Conservation of indigenous knowledge should be one of the ancillary goals of biodiversity conservation.

In this workshop, little consideration was given to land tenure and land use policies. Clearly, each area of the Fertile Crescent ecosystem must develop clear understanding of local and national land policy. Since these policies and local practices probably will be the most intractable changes to implement, conservation plans, compatible with local land tenure practice, must necessarily be designed. With sufficient community support, local reserves can be developed. While these may not be readily embraced to conserve a weedy crop relative, for example, they be more readily accepted if there is an aesthetically pleasing outcome, such as a recreational park or the conservation of a national or local treasure such as the cedar tree in Lebanon.

Community participation will be effective when the people who make farming decisions are directly involved. The role of women in farming and the conservation of local landraces, cannot be overstated. They can articulate their preferences for types of crop varieties and ensure that seeds are saved for the next crop cycle.

Finally, it is generally true that local communities prefer not to be directed by government policy, and locally-based conservation is more likely to be effective, with leadership provided by non-governmental organizations.

Training Issues in the Region

The basic ecology and conservation biology educational base within the Fertile Crescent countries was viewed as being very limited. There are few university courses directed toward conservation. Likewise, at elementary school levels, the instruction is limited because the teachers are not well-versed. This is not a feature unique to the Fertile Crescent region; the lack of curricula in conservation biology is prevalent throughout the world. N. Maxted pointed out that about 6% of the world's conservation scientists live in countries that have 80% of the world's biodiversity. Conservation biology is an emerging field of applied science. Linking conservation biology to agricultural production is another challenge that has not been extensively addressed except in rancor. This problem can be addressed from the start of this project (Conservation Management and Sustainable Use of Dryland Biodiversity within Priority Agro-Ecosystems of the Near East) and, hopefully, soil, water, and biological conservation can be integrated in educational programs.

Various levels of educational programs are required, including:

- a general education for the public;
- giving policy-makers an awareness of broad;
- educational modules for teachers of youths;
- professional training for managers of biodiversity programs and facilities; and
- professional training of graduate scientists for advanced teaching and research.

The workshop participants vigorously agreed with these multitudinal training needs. There is urgent need for specialized training as this project (Conservation Management and Sustainable Use of Dryland Biodiversity within Priority Agro-Ecosystems of the Near East) is implemented. On-site short courses should have high priority and external short courses or visits to other countries have great impact on those who participate. Long-term training for advanced degrees should be included in the project. Such training would include degree students attending external universities. Thesis research within the region should be encouraged. The study areas selected within each country can provide the focal point for training at the scientist and manager levels.

Public Awareness

The general public is the stakeholder for biodiversity conservation and, though awareness of progressive environmental degradations is increasing, conservation and economic advancement usually are not seen as being compatible. Biodiversity conservation is an esoteric subject that does not command the attention of the business community or most farmers. So the challenge is to make them aware of the message and the consequences of inaction. R. Raymond maintained that conservation is a social action and that public awareness of the issues is critical if there is to be influence on the social agenda. There are many media approaches for increasing public awareness. The key is to have good information that is believable and, with this, to promote activities that can be adopted by anyone, such as the purchase of fruits or vegetables from vendors of local landraces. Appealing to issues of national or local pride has effects beyond the conservation of a special plant or animal species.

Audiences must be targeted and approached differently depending on what is desired from them, viz. NGOs, policy-makers, print or audio/video media, and donors. These targeted groups must be addressed directly; it was pointed out that they will probably not make the initial contacts.

Summary

The Fertile Crescent region offers potential for an ideal international effort to address the management of biodiversity. Management of soil and water resources impacts positively on conservation of biodiversity and, conversely, biodiversity management is a key for protection of soil and water quality. The salient features of an such an international effort emerged during a most productive workshop. Some of them are mentioned here.

1 Productivity of agriculture remains a number one priority. Biodiversity conservation must be shown to be a positive aspect for increasing productivity.

2 Biological conservation is required for maintaining species richness (alpha diversity), habitat diversity (beta diversity), and diversity in landscapes (gamma diversity). Integrating various modes of conservation, from *in situ* to *ex situ*, is essential and requires careful analysis and planning.

3 Restoration and renovation are much greater issues for maintaining biodiversity than formerly believed, especially for the Fertile Crescent region.

4 Animal grazing and grazing-land management are critical features of biodiversity conservation in arid lands and alternative practices are needed if rangeland degradation is to be arrested.

5 Biodiversity conservation research is badly needed, but the research sites should not be seen as an end in themselves for meeting regional conservation needs.

6 Education and public awareness programs are badly needed in conservation biology at all levels throughout the Fertile Crescent region. An international project can assist all of the countries in developing educational programs.

7 National biodiversity conservation programs, including gene banks, are needed to meet the local needs within the region.

8 Biodiversity conservation is most effective when the people affected are stakeholders and can realize benefits of the activity.

9 Responsibility for biodiversity conservation resides in government agencies, but must be accepted by the total citizenry of each country.

10 Non-governmental organizations should be strongly encouraged to participate in education and implementation of biodiversity conservation programs.

Reprinted
ICARDA- 027/1000/July 1996