Sustainable Agricultural Development in the Dry Areas of West Asia and North Africa

Jose I. dos R. Furtado
Aart van Schoonhoven
Safei El-Deen Hamed

editors

Economic Development Institute of The World Bank (EDI)
International Center for Agricultural Research in the Dry Areas (ICARDA)
Arab Organization for Agricultural Development (AOAD)

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 18 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 enhance and sustain food production and, at the same time, improve socioeconomic conditions of people, through strengthening national research systems in developing countries.

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.

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.

Sustainable Agricultural Development in the Dry Areas of West Asia and North Africa[1]

Report based on a
Seminar on Natural Resources and Environmental Management
in the Dry Areas of West Asia and North Africa
Aleppo, Syria; 16-27 February 1992

Edited by
Jose I. dos R. Furtado
Aart van Schoonhoven
Safei El-Deen Hamed

Sponsored by
Economic Development Institute (EDI) of the World Bank
International Center for Agricultural Research in the Dry Areas (ICARDA)
and
Arab Organization for Agricultural Development (AOAD)

International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria

---

1 MENA, or Middle East and North Africa, is used synonymously with WANA or West Asia and North Africa

Citation: Jose I. dos R. Furtado, Aart van Schoonhoven and Safei El-Deen Hamed (eds.). 1995. Sustainable Agricultural Development in the Dry Areas of West Asia and North Africa. Report Based on a Seminar on Natural Resources and Environmental Management in the Dry Areas of West Asia and North Africa, 16-27 February 1992, Aleppo, Syria. viii + 110 pp. (The World Bank, Washington DC, USA/ICARDA, Aleppo, Syria)

AGROVOC descriptors: Middle East; North Africa; Australia; Japan; arid zones; dry farming; water resources; rainfed farming; supplemental irrigation; sustainability; agricultural development; natural resources; resource management; environmental protection; agricultural policies; socioeconomic development; sociocultural system; social institutions; development plans; development policies; financial policies; environmental policies; investment policies; regional development; social policies; development aid; development agencies; information management; extension activities; farming systems; land resources; desertification; production possibilities.

ISBN: 92-9127-032-6

The World Bank
1818 H Street, N.W.
Washington, DC 20433, USA
Phone: (202) 477-1234
Fax: (202) 477-6391

International Center for Agricultural
Research in the Dry Areas (ICARDA),
P.O. Box 5466, Aleppo Syria
Phone: (963-21) 213433/77
Fax: (963-21) 213490/225105

Preface

In late February 1992, a seminar took place on Natural Resources and Environmental Management in the Dry Areas of West Asia and North Africa (WANA). The Seminar focused on a variety of policy, managerial and technical issues relevant to sustainable agricultural development in the dry areas of that region. This report is based on the contributions of resource persons at the Seminar, and highlights the main issues discussed.

Held at the International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria, the seminar was organized by the Economic Development Institute (EDI) of the World Bank with the co-sponsorship of ICARDA and the Arab Organization for Agricultural Development (AOAD). It was attended by senior managers and technical advisers of agricultural development activities from WANA countries, besides staff of regional organizations.

The Seminar clarified complex issues on agricultural development and environmental and natural resources management in a water-scarce region; and about design and implementation of realistic policies achieving sustainable development under such conditions. The participants, who contributed actively to the discussions, drew up recommendations for follow-up actions in their own countries, and for the notice of development-assistance agencies and regional organizations. They enhanced their appreciation about new concepts, innovative approaches, and complex issues surrounding sustainable agricultural development and environmental management in water- scarce dry areas, with particular reference to:

- Linkages between policy, institutional and technical issues in relation to development and conservation at different levels of government;
- Strengthening of traditional socio-cultural institutions for natural resources management (e.g. community, producer or user groups) through a participatory approach;
- Valuiation of the environment as capital in National Accounting Systems;
- Integrated approaches to environmental and natural resources management;
- Regional cooperation in combatting desertification in fragile areas; and
- Opportunities for reviewing policies and plans in response to changing global and regional conditions.

respective WANA countries; and for attention of development-assistance agencies and regional organizations to the following areas:

a. An operational strategy for sustainable agricultural development, natural resources management and environmental protection;
b. Development investments to rectify environmental degradation, especially desertification threats;
c. Adequate land-use policies and plans for the rural areas;
d. Provision of subsidies and incentives for improving environmental quality;
e. Promoting public and private or community management of environmental and natural resources;
f. Initiation of farmer-government consultative mechanisms;
g. Adequate targeting of R&D efforts;
h. Evolution of integrated management systems for R&D and extension services;
i. Development of information collection, organization and dissemination systems for management; and
j. Diversifying the use of fallow lands.

EDI invests in people and ideas as the most powerful means of development. The Aleppo Seminar is a good example of EDI's emphasis on developing a dialogue on sustainable and equitable development. I hope that the publication of this report further stimulates this welcome trend.

April 1995

Hatsuya Azumi
Chief
Agriculture and Environment Division
Economic Development Institute
The World Bank

Contents

Tables

Figures

I. Introduction

Purpose

1. The Seminar on Natural Resources and Environmental Management in the Dry Areas of West Asia and North Africa (WANA) was held on a regional basis at Aleppo, Syria, from 16-27 February, 1992. The International Center for Agricultural Research in the Dry Areas (ICARDA) and the Arab Organization for Agricultural Development (AOAD) collaborated with the Economic Development Institute of the World Bank (EDI/WB) to realize this Seminar. The purpose of the Seminar was to develop understanding among senior agricultural managers and advisers about:

- the complex issues surrounding land and water resources and environmental management in dry areas, with particular reference to agricultural development; and
- the design and implementation of realistic policies, regulations and incentives for achieving sustainable development.

Only rainfed and supplemental irrigation issues were discussed under water resources. Each topical presentation addressed the issues of sustainable agricultural development and environmental and natural resources management in the dry areas of WANA.

Approach

2. Agricultural development, with reference to environmental and natural resources management in the dry areas of WANA, was discussed under six themes:

- Identification of key issues
- Farming systems issues
- Social and institutional issues
- Risk and incentive issues
- Case studies
- Future considerations for sustainable development.

Under these themes were clustered 21 topics; discussed in 18 sessions; and a significant proportion of them were of a technical nature because of the fragility of drylands. Simultaneous translations in Arabic and English at the plenary sessions assisted clear communication of the subject matter and plenary discussions. Topics were briefly presented; and some key questions were then discussed in small Working Groups to elicit country experiences, and in plenary where Working Group findings were reported. Some case studies, some lectures on new concepts and a field trip helped to illustrate the main issues. Participants were provided with a synopsis of each topic discussed, together with a few key discussion questions. They were also provided with required reading materials, and some supplementary reference materials.

Participants and Resource Persons

3. There were 15 participants representing 11 countries and regional organizations, together with at least eight ICARDA staff and several research students and visitors at ICARDA (Annex 1). Several participants from other WANA countries were unable to participate due to unusual weather conditions affecting air travel in the eastern Mediterranean. Participants had a rich mixture of technical and/or managerial experience in agricultural development, which enlivened the discussions of topical presentations. 20 staff members from EDI/WB, ICARDA, AOAD and external institutions (Annex 1) presented topics for consideration and discussion by the participants. Consultants and lecturers acted as facilitators and resource persons for discussions in small Working Groups.

Opening Remarks

4. Dr. Aart van Schoonhoven, Deputy Director-General (Research) of ICARDA, and Seminar Co-Director, convened the Seminar. He welcomed all participants, resource persons and guests to the International Center for Agricultural Research in the Dry Areas (ICARDA) at Tel Hadia, Aleppo; introduced participants to ICARDA staff responsible for logistical matters and those participating in the Seminar; and introduced participants to the research directions of ICARDA for agricultural management in the dry areas. Dr. Yahia Bakour, Regional Representative, AOAD welcomed participants and resource persons on behalf of the Arab Organization for Agricultural Development (AOAD); noted the Seminar's

importance for sustainable agricultural development in WANA countries; and thanked the resource persons for the training materials prepared, the Syrian Arab Republic for providing host country facilities to participants, resource persons and the organizers, and the co-sponsoring institutions, ICARDA and EDI/World Bank, for contributing to capacity-building in the region. Dr. Jose I. dos R. Furtado, Seminar Director, of the Economic Development Institute (EDI)/World Bank, thanked the co-sponsors for making this Seminar possible, welcomed participants and resource persons, and outlined the focus of the Seminar in dealing mainly with sustainable agricultural development in the arid areas of the WANA region. He noted that the Seminar dealt with the options available for managing environmental and natural resources in conditions of soil fragility and water scarcity, such as through different cropping patterns, land restoration techniques, controlled grazing and animal husbandry, soil conservation, watershed and water resources management, and research and extension services. Dr. Nasrat Fadda, Director-General, ICARDA, welcomed the participants and resource persons to ICARDA and Aleppo, and opened the Seminar.

Closing Remarks

5. Dr. Aart van Schoonhoven, ICARDA Deputy Director General for Research, Dr. Yahia Bakour, Regional Representative, AOAD, and Dr. Jose I. dos R. Furtado, EDI Seminar Director, closed the Seminar, commending the speakers for their excellent presentations, and the participants for stimulating, lively and productive discussions. Participants identified the following lessons they had learned for the WANA countries:

- The interdependence and sustainability of dryland agricultural development on ecological and systemic linkages with the environment, and the scarcity of natural resources which offered human communities the prospect of death from starvation (through nutrient exhaustion) or pollution (from their own toxic wastes);
- The need to train agricultural managers and technicians in the technical aspects of environmentally-sustainable agricultural development using case studies including international experience, such as the Australian Landcare program;
- The need to use water more efficiently, and to harness new sources of water through new technologies (such as water harvesting), since agriculture uses 80% of water resources;

- The need for senior agricultural managers to follow up with (a) better agricultural investment strategies, (b) multidisciplinary agricultural and extension research, and (c) documentation of case studies on sustainable agricultural development and conservation experiences in the drylands;
- The need to promote a growing awareness of the environmental limits to future agricultural development at the grass-roots level;
- The urgent need for international cooperation on common environmental problems affecting sustainable agricultural development, and for a review of finance for studying the linkages between dryland agriculture and global environmental changes, in view of the regional and international nature of desertification;
- The need to involve local communities and stakeholders at all levels of policy-making and decision-making so that they understand their responsibility for environmental protection, and the need to recognize the futility of "top-down" impositions of policies and programs;
- The need for training of government officials in social organization and participatory approaches for managing different resource-user groups;
- The need to promote the value of the environment among policy-makers and decision makers; not as an expendable source of income, but as natural capital; and
- The need to use educational systems to encourage a sense of national pride in valuing the environment and natural resources as national assets.

II. Key Issues for Sustainable Agricultural Developmentin the dry Areas

Overview

1. The Seminar identified the key issues for sustainable agricultural development and environmental conservation in the WANA region as falling into three areas: biophysical; resource transformation; and socio-economic issues (Table 2.1, Figure 1). From a biophysical viewpoint, the region lies in the transition between the tropical and boreal systems. Water and arable land are the principal factors limiting human livelihood and natural resource transformation in this region. Issues of resource transformation arise mainly from rural poverty, tenant farming, absentee landlords, and desertification of prime arable land due to uncontrolled irrigation and enhanced erosion. Socio-economic issues arise mainly from poor financial returns from drylands, non-recognition by government of local traditional community organizations, and excessive control by central government. Nevertheless, human factors surpass technical ones in managing agricultural development and environmental conservation in this fragile and dry region.

Climate and Soils

2. The WANA region has five climatic zones from north to south, between the temperate zone and the Tropic of Cancer[2]:

a. **Temperate climate** with winter rainfall (1.2% of the area): parts of Iran and Turkey
b. **Cool sub-tropical Mediterranean climate** with hot summers and winter rainfall (64% of the area): Morocco, Tunisia, Syria, Lebanon, Jordan, Iraq, Kuwait, Bahrain, Qatar, and Afghanistan, and parts of Algeria, Libya, Egypt, Saudi Arabia, the United Arab Emirates, Iran and Turkey

---

[2] Kassam, A. 1992. An Overview of Land and Water Resources in the WANA Region. Paper presented at EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992

c. **Warm sub-tropical climate** with hot summers and summer rainfall (8% of the area): parts of Mauritania, Algeria, Libya, Egypt, Sudan and Pakistan
d. **Warm tropical climate** (25% of the area): Somalia, Djibouti, Oman, and the United Arab Emirates, and parts of Mauritania, Algeria, Egypt, Sudan, Saudi Arabia, Yemen, Iran, and Pakistan
e. **Cool tropical climate** (1.4% of the area): parts of Sudan, Yemen and Saudi Arabia

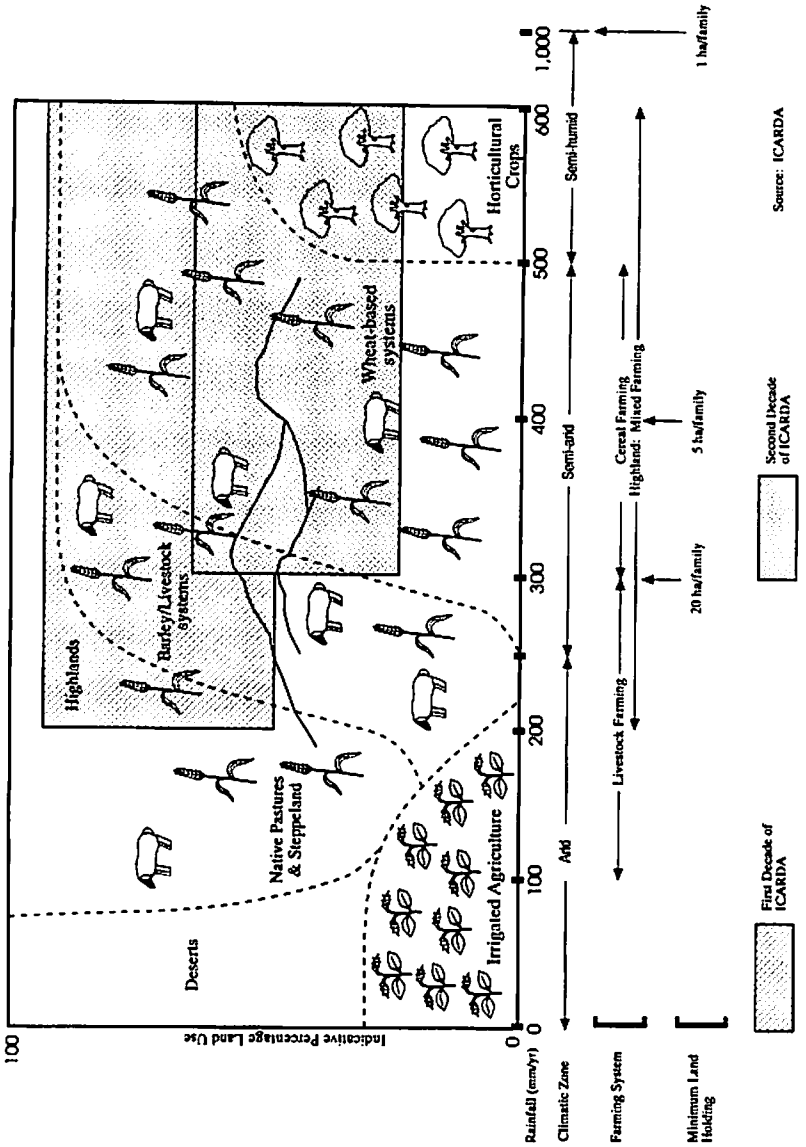


Figure 1: Land Use for Agriculture and Rainfall in the WANA Region

Table 2.1: Key Issues for Managing Agricultural Development and the Environment

Areas	Key Issues
BIOPHYSICAL	* **Irregular climatic fluctuations** in this transition zone * **Fragile topsoils and lands**, especially on hillsides, due to wind erosion and historically intensive land use * **Water scarcity** in transitional zone between the Tropical and Temperate Zones
RESOURCE TRANSFORMATIONAL	* **Intensive land use** especially overstocking with livestock * **Lack of land title** or stake among tenant farmers * **Open access to fragile lands** buffering the arable lands * **Migration of poor farmers** to marginal lands * **Weak agricultural extension** services * **Poor access to markets** for farmers and their products * **Careless conversion of marginal forest lands** for agriculture and human settlement
SOCIO-ECONOMIC	* **High population growth** rates especially in the rural areas * **High livelihood expectations** among the rural population * **Poor political awareness** of resource management problems * **Poor communication** about resource management between farmers and government officials * **Non-recognition of traditional community organizations** and their role in resource management, and their replacement by artificial organizations under government control * **Weak local government authorities** * **Weak linkages** between different levels of government * **Inadequate legal protection** of rural communities * **Lack of long-term investment** in fragile marginal lands * **Inadequate reliable data** for agricultural planning and management at all levels of government * **Poor public participation** in decision-making, especially at local level * **Lack of local specificity** of land use * **Inadequate employment and security** among the rural population * **Inadequate education of technicians** (or "blue-collar" workers) for generating development alternatives * **Inadequate private sector development** for rural development * **Excessive central government control** of enterprises * **Inadequate political stability** to enable the government a key role in development planning

SOURCE: Aleppo Seminar Discussions, 1992

Only 30% of the region is suitable for agriculture; 61% of it is hyperarid with no growing period and 8% is too cold for agriculture. Of the land suitable for agriculture, 13% is arid with an average growing period of <75 days, 13% is semi-arid with a growing period of 75-180 days and 5% is sub-humid and humid with an average growing period of >180 days. Nearly all the arable land in the Mediterranean-type environments is in the semi-arid moisture zone, with a mean annual precipitation of 200-600 mm. Robust, fertile soils are limited, and only 30% of the soils have no major limitations for agriculture. The rest of the soils are very shallow or coarse, or have other limitations, due largely to their calcareous origin. Wind erosion affects 35% of the soils in the region and 17% are subject to water erosion. Soil degradation eventually leads to desertification or the almost complete loss of land productivity.

Land Resources

3. Conserving and developing the finite land resources for agriculture is an imperative for WANA countries, if they are to meet their challenges of feeding a rapidly growing population[3] (Annex 2). Only one-third of these lands are usable for agriculture (see above), compared to two-thirds worldwide (Table 2.2; Annex 3). These countries cannot rely on any major expansion into new land to increase food supply. Available arable lands are already declining through urbanization, salinization and modern intensive cropping; and the average cropland area per person worldwide will decline to 0.13 ha by the year 2000 compared to 0.24 ha in 1950. Food production increases in the WANA region will thus have to come from increased agricultural productivity per unit area. The main challenges for land resources management lie in five areas: land classification, land valuation, development planning, land use diversification, and monitoring of land quality (Table 2.3). This is especially so since already 40% of the irrigated land, 70-85% of the rainfed cropland and 85% of the rangelands are affected by desertification to varying degrees[4].

---

[3] Fadda, Nasrat R., 1992. Key research issues in developing land and water resources. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria. 16-27 February 1992

[4] Kassam, Amir, 1992. An overview of land and water resources in the WANA region. Paper presented to the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992

Table 2.2: Land Area (x1000 ha) and Uses (1985-87)

Regions:	World		WANA		WANA/World	
Land uses:	Area	%	Area	%	%	Ratio
CROP LAND	1473.0	11.3	137.7	8.2	9.3	0.72
PERMANENT PASTURE	3215.4	24.6	330.4	19.7	10.3	0.42
FOREST & WOODLANDS	4074.4	31.2	118.1	7.0	2.9	0.22
OTHER LANDS	4313.8	33.0	1 091.5	65.1	25.3	1.97
TOTAL:	**13,076.5**	**100.0**	**1677.7**	**100.0**	**12.8**	-
POPULATION DENSITY: ($N/10^3$ ha Arable)	398		304		0.76	

SOURCE: WRI. 1990. World Resources 1990-91. Washington, DC: World Resources Institute.

Table 2.3: Challenges for Dryland Resources Management

Areas	Management Challenges
CLASSIFICATION	* **Classify dryland use and capability** using the Holdridge ecological life-zones concept * **Incorporate traditional knowledge** and perceptions about uses through local community participation * **Base land "marginality" on use** rather than capability
VALUATION	* **Consider drylands "central"** and not "marginal" to national economies * Base land value on the **scarcity of useable land**
DEVELOPMENT PLANNING	* Manage drylands **carefully and flexibly** * **Allow for natural regeneration** of drylands * **Use high edaphic and micro-climatic variability** of drylands * **Protect the critical buffering role** of drylands between the arable lands and deserts * **Prevent susceptibility of drylands to degradation** during demographic transitions and social disruptions — as in the Gum Arabica belt of Sudan, where human populations were forced to migrate into already overcrowded urban areas
DIVERSIFIED USES	* **Undertake high quality and sustained agricultural R&D** * **Diversify dryland agriculture**, especially by selecting drought-resistant varieties
MONITORING	* **Monitor environmental degradation and pollution** caused by agricultural intensification * **Prevent irreversible changes** to drylands since their restoration costs exceed management costs

SOURCE: Aleppo Seminar Discussions, 1992.

Urbanization and Food Imports

4. WANA countries have human populations at different stages of socio-economic development (Annex 2). Nevertheless, a common feature of the region is the high rate of urbanization (50-80%)[5], which removes agricultural land from production. While urbanization and its associated industries and commerce contributed to the projected average growth in GNP of 5% per annum, loss of agricultural land through urbanization contributed to a significant food deficit. In the 1960s, the WANA region was self-sufficient in food production, with a ratio of 1.11 for annual growth in agricultural production to that in human population. However, this ratio fell to 0.82 in the mid-1980s, and to 0.72 in 1990 (Annex 3). WANA countries now have the most rapidly growing food deficit in the world, due mainly to population growth, rising income and urbanization, and to low productivity in the agricultural sector relative to its potential. According to the prevailing growth in food deficit, the WANA region will import 40% of its food needs by the year 2000. It already constitutes the largest food-importing region in the world.

Water Resources

5. Besides land, water resources have been progressively exploited and exhausted in the WANA region in order to meet two major challenges: high population growth, and low returns on enterprises in rainfed farming[6]. Land degradation has increased due to the encroachment of cultivation onto marginal lands, water scarcity, and diminishing options for inexpensive expansion of agricultural land or clean and reliable water supply. More than 80% of the water resources in WANA countries are used in agriculture, with the irrigated area constituting 32% of the arable land (Table 2.4; Annex 5). Over-exploitation of groundwater for irrigation is a major concern, especially in some Mashreq and Arabian Peninsular countries (Table 2.5). Countries in the WANA region may be classified into four groups on

---

[5] Kassam, A. 1992. An overview of land and water resources in the WANA region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992

[6] Barghouti, S. and Hayward, J. 1992. Land and water resources in the Middle East and North Africa: issues and challenges. Paper Presented to the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992. See also Footnote 3

the basis of Falkenmark's water-stress codes (Table 2.6; Figure 2.2)[7]: water adequacy, water stress, water scarcity and water deficit.

Table 2.4: Water Resources and Withdrawals in the WANA Region

Regions:	Water Resources			Water Withdrawals		
	Total		Per Caput	Amount	% of	% Used in
	(km^3)	%	(m^3)	(km^3)	Resource	Agriculture
MAHGREB	52.57	4.5	899	16.30	30.9	86
C-N. AFRICA	242.50	20.5	2,142	77.68	32.0	90
MASHREQ	111.45	9.4	2,828	47.88	43.0	91
ARABIAN PENINSULA	7.02	0.6	228	6.83	97.3	72
W. ASIA	769.50	65.0	3,060	240.51	31.3	93
TOTAL:	1,183.22	100.0	2,316	389.20	32.9	91

Table 2.5: Non-Renewable (Fossil) Water Resources in Arab Countries

Non-renewable Water: Regions:	Water Resources	
	Amount (km^3)	%
MAHGREB	920.0	11.9
C. NORTH AFRICA	6,439.0	83.2
MASHREQ	13.3	0.2
ARABIAN PENINSULA	361.6	4.7
TOTAL:	7,733.9	100.0

SOURCE: Khouri, J., Rasoul Agha, W. and Droubi, A. 1986. Water resources of the Arab homeland and their prospects. *In* Proceedings of the Seminar on Water Resources and their Use. Kuwait. (in Arabic)

[7] Kassam, A. 1992. An overview of land and water resources in the WANA region. Paper presented to the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992

Table 2.6: Water Stress Code Classification of WANA Countries

Status	Countries / Water Management Strategies
WATER ADEQUACY	**Countries with Adequate Water for the Foreseeable Future:** Afghanistan, Pakistan, Iraq, Syria, Turkey, Sudan, and Mauritania **Water Management Strategies:** Some water management action is needed in view of increasing demands
WATER STRESS	**Countries Close to or Already in a Stress Condition:** Iran, Oman, Lebanon, Egypt, Somalia, Cyprus, and Morocco **Water Management Strategies:** Rigorous water-management activities will have to be implemented, including increasing the efficiency of water utilization, and reducing water consumption per capita
WATER SCARCITY	**Countries Already Experiencing Chronic Water Scarcity:** Djibouti, Tunisia, and Algeria **Water Management Strategies:** Non-conventional measures have to be increasingly introduced, such as desalinization, water imports and wastewater reclamation
WATER DEFICIT	**Countries Beyond the "Water Barrier":** Bahrain, Jordan, Kuwait, Qatar, the United Arab Emirates, Saudi Arabia, and Libya **Water Management Strategies:** Non-conventional measures have to be introduced increasingly and urgently

SOURCE: Adapted from Kassam A. 1992. An overview of land and water resources in the WANA Region. Aleppo Seminar paper

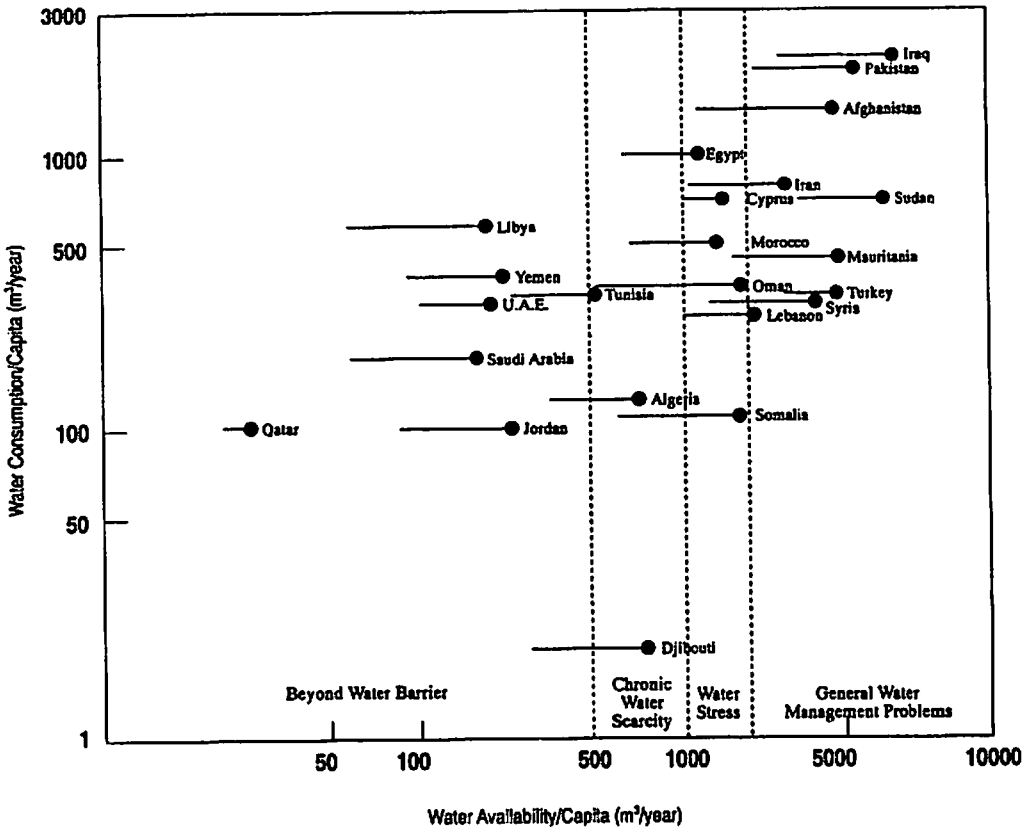


Figure 2: Water Resources Availability and Needs in the WANA Region

6. Water is the principal resource limiting human livelihood and the transformation of natural resources into economic products. Its scarcity in the WANA region is exacerbated by human and livestock population growth, by the removal of vegetation cover on fragile lands, and by competing demands from tourism especially along the Mediterranean coast. Its shortage in several WANA countries constitutes the greatest constraint to their agricultural and rural development (Annex 5). The main challenges for managing scarce water resources in the WANA region lie in five areas (Table 2.7): water allocation and delivery; water

losses and conservation; water charges; agricultural extension systems, farmers' consultations and political credibility; and reliable agricultural information.[8]

Table 2.7: Challenges for Managing Water Resources in Dry Areas

Challenges	Conditions / Prescriptions
WATER ALLOCATION AND DELIVERY	**Supply and Demand:** Water demand far exceeds its supply; hence, its delivery to users must be equitable **Delivery:** Delivery to farmers is especially problematic in large systems **Timely Allocation:** When water is diverted from large canals, farmers often do not get it at the times and in the amounts needed **Allocation Rules:** Water delivery is usually determined by the proximity of farm to the canal
WATER LOSSES AND CONSERVATION	**Water Losses:** Significant water losses occur due to improper building and lining of distribution systems **Lining Costs:** Costs of lining irrigation canals are high **Salinization:** Soil salinization occurs due to water leakage and evaporation **Conservation:** Water conservation is generally lacking **Usage:** Water use is wasteful because it is perceived as a free good without any charge **Wastage:** Water wastage is greatest in large irrigation systems
WATER CHARGES	**"Gift of God":** Water is considered a "gift of God", and is thus provided almost cost-free in many Islamic countries **Maintenance Costs:** Although difficult, metering of supply together with a pricing system would provide adequate immediate financial returns for maintaining the water supply system **Pricing:** Since water has always been provided free, governments find it politically sensitive to introduce a water pricing system
EXTENSION SYSTEMS, FARMERS' CONSULTATIONS, AND POLITICAL CREDIBILITY	**Extension:** Extension systems are inefficient and inadequate for water resources management **Consultations:** Farmers are rarely consulted when central governments undertake water conservation measures **Political Credibility:** Even when consulted, farmers' opinions are often ignored, thus affecting the credibility of the political system
RELIABLE WATER INFORMATION	**Reliable Data:** Reliable data on water resources are usually lacking for management at the local and provincial levels

SOURCE: Aleppo Seminar Discussions, 1992

[8] Kassam, A. 1992. An overview of land and water resources in the WANA region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992

Farming Technologies and Management Information

7. Agriculture technologies currently used in WANA countries were originally developed for intensive agriculture in the temperate region where the environment is more resilient to perturbations. They should be re-examined and adapted to suit the environmental fragility and resource limitations of the dry areas[9]. Inappropriate land and water resources and environmental management in the WANA region is due largely to the non-availability of an adequate management information system (MIS) for drylands agriculture. An MIS has to be developed on geographical information systems (GIS), due to marked biogeographic and edaphic variations; and should include information on local natural resources and the environment, local farm management practices, and on the local effects of agricultural and trade policies on productivity and sustainability.

Production Potential

8. With the exception of Egypt, rainfed and irrigated agricultural productivity is low throughout the WANA region, being below 2 t/ha in most countries (Table 2.8); and irrigated agriculture contributes 50-60% of the production[10] (Annex 4). Excessive and inefficient irrigation has caused serious soil modification in the form of waterlogging, salinization and sodification. Of the rangelands, 60% are in the arid areas; have a low productivity which is declining further due to over-grazing; and provide forage for about 478 million head of livestock (cattle, buffalo, camels, sheep and goats). Deforestation has been going on for centuries; and over-exploitation of vegetation has led to desertification. The significant removal of prime arable lands, through desertification processes to varying degrees, is affecting the livelihoods of about 20 million people. Productivity increases from present land-use patterns alone cannot achieve the long-term goal of food self-sufficiency, because of increased incomes from diversified economies, rapid urbanization, transnational migration of labor, and of increasing opportunity costs of labor in agriculture. There will thus be a need for considerable agricultural imports due to the narrow agricultural resource base. Nevertheless, significant

---

[9] Sayegh, A. 1992. Land resources surveys and land use and development. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992

[10] Kassam, A. 1992. An Overview of Land and Water Resources in the WANA Region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992

increases in agricultural productivity and land use are possible in WANA countries, both in areas under irrigation which are inefficient and have a low productivity and, especially, in areas of lower production potential, such as marginal soils, steep lands, fragile environments and rainfed areas. The main challenges for increased agricultural production lie in two areas (Table 2.9; Figure 2.3): commercialization, intensification and mechanization of agriculture; and improved natural resources management. In view of the limited agricultural production potential of this region, the opportunities for trade should be fully exploited for achieving food security in the medium-term — by provision of incentives, and through positive government practices and policies.

Table 2.8: Crop Yields and Productivity in the WANA Region

		Rainfed	
Yield: (t/ha) Crops/Features	Irrigation	Prime Land >300 mm	Marginal Land <300 mm
Wheat	4.42	2.15	0.65
Barley	2.85	1.65	0.93
Sorghum	4.20	1.90	0.72
Legumes	3.80	2.70	0.40
Growing Season:	All Year	180 days	110 days
Farming Intensity:	200% +	90%	60%

SOURCE: Barghouti, S. and Hayward, J. 1992. Land and water resources in the Middle East and North Africa: Issues and challenges. Aleppo Seminar paper.

Risk Management

9. Increased agricultural production in these fragile WANA areas aggravates the threat, and hence the risk, to environmental health and biodiversity conservation. Already 30% of the world's agricultural land is being lost by erosion and desertification, 20% by toxification and 50% by non-agricultural uses[11]. Risk

[11] See Footnotes 2 and 3

management thus has to become central to successful and sustained agricultural production in the dry areas. New approaches to risk management need to be incorporated into farming systems — by ICARDA, for example — which adopt strategies for the conservation and efficient management of land and water resources. Risk management strategies for water include retaining soil moisture, reducing evaporation and transpiration, and developing drought-resistant crop varieties that use water efficiently. For land management, these strategies include the control of erosion and salinization, the judicious use of chemical inputs, sustainable rotation of crops and livestock, appropriate cropping practices and the control of over-grazing.

Table 2.9: Challenges for Increased Agricultural Production on Drylands

Challenges	Measures
Commercialization, Itensification and Mechanization of Agriculture	**Agricultural intensification and commercialization (28%) such as:** * Mechanization and commercialization of farms * Diversified production of commodities with high added value for urban needs and markets (e.g. vegetables, red meat) * Decreased importance of small, resource-poor small-scale farms * Integration of livestock production and agro-forestry with settled farming
Natural Resources Mangement	**Improved management of natural resources (72%) such as:** * Soil and water conservation * Crop and fallow management (including fallow replacement) * Nutrient and water-use efficiencies * Irrigation system management

SOURCE: Aleppo Seminar Discussions, 1992

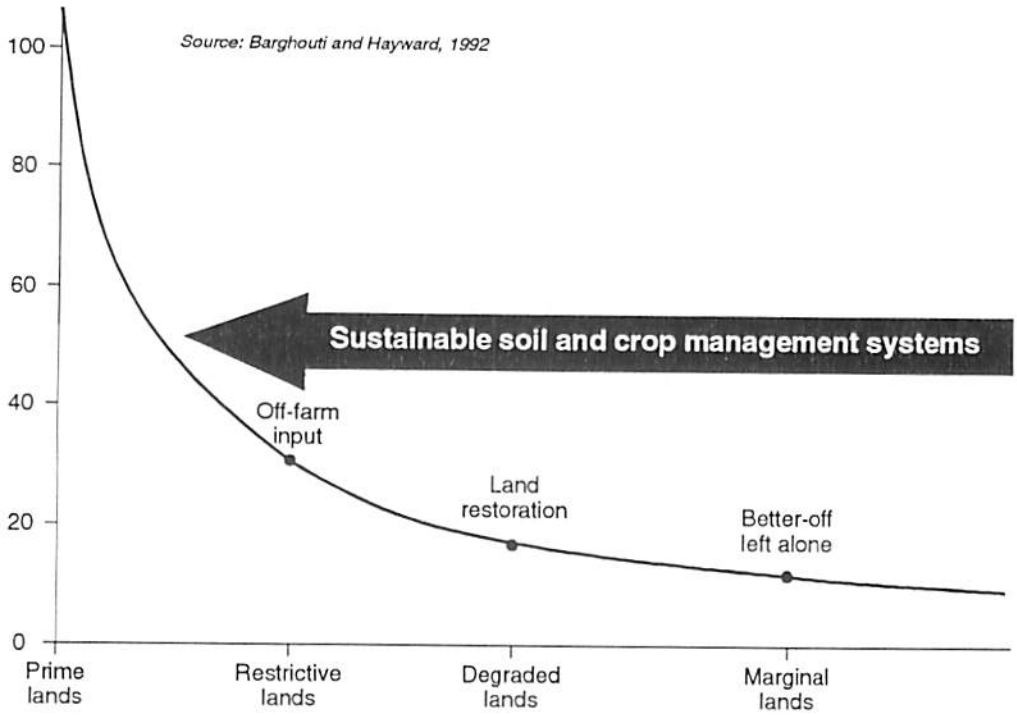


Figure 3: Productivity Potential and Land Quality

Agricultural and Environmental Policies

10. The role of government in regulating the efficient and sustainable use of natural resources and the environment is critical for increasing production from dryland agriculture in the WANA region[12]. However, both policymakers and farmers face major constraints in addressing this dual challenge, including high population

[12] See Footnotes 2, 3 and 4

growth, low returns on investment, high risk of drought, low-yielding cropping systems, and high variability in rainfall and crop yields. These constraints are aggravated when a government's policies encourage development of land and water resources based on a project-by-project approach without a comprehensive sector development and environmental management policy. Furthermore, most arable land in this region is marginal; and the people who farm and manage it, although resourceful and resilient, are generally poor and attract little interest from private entrepreneurs for financial and market services. In order to remedy these investment constraints in the WANA region, government policies and regulations should be fashioned flexibly for developing locally-scarce land and water resources. These should target nine areas (Table 2.10): "sustainable development"; sectoral linkages; information transparency; research and development; land use and agricultural diversification; land policy and tenure; participatory management; government institutions; and investment in human resources. In summary, land and water policies should be responsive to the technological, socio-economic and legal dimensions of allocation and management of these scarce and marginal resources in the WANA region.

Table 2.10: Targeting of Agricultural and Environmental Policies for Drylands

Area	Policy Elements
"SUSTAINABLE DEVELOPMENT"	**Conservation and protection** of scarce land and water resources **Proper care and sustainable use** of natural resources, especially in fragile areas, over the long term **Environmental regeneration** of degraded dryland areas for sustainable agricultural production **Adaptation and incorporation of appropriate technologies** already available into suitable extension packages for sustainable agricultural development **Investments in R&D** for developing new technologies for sustainable agricultural development **Inter-temporal balance** between short-term needs for agricultural investment returns and long-term costs incurred by environmental degradation **Management information system** for choosing between different agricultural development alternatives **Efficient extension system** to help farmers choose between different sustainable agricultural development alternatives
SECTORAL LINKAGES	**Linkage of agricultural development to water policies** because of water scarcity **Full understanding *ex-ante* of the implications** of proposed agricultural development policies and projects demanding water resources

Table 2.10 (*contd.*)

Area	Policy Elements
INFORMATION TRANSPARENCY	**Better information transparency** to the public to enable careful management of scarce water and fragile drylands **Long-term economic viability and investments** for agricultural development and environmental management **Access to reliable information** on natural resources for resolving differences in understanding among managers at different spatial and sectoral levels **Declassifying the secrecy** of reliable information about natural resources and their degradation status **Acquisition of relevant information** for meaningful development and conservation policy initiatives
RESEARCH & DEVELOPMENT	**Revised R&D priorities** for developing and managing drylands for increased urbanization and intensive agriculture **Strengthening R&D and legal institutions** for the delivery of appropriate development and conservation management technologies **Integrated multidisciplinary approach to R&D** for managing agricultural development and environmental management at different spatial scales **Land capability and soil suitability classification maps** to convey dryland use information, where needed **Changes in development planning and legislation** to accompany revisions of land use based on indicators of land degradation and water deficit **Achieving and maintaining a balance** between managing marginal drylands and highly productive agricultural areas
LAND USE AND AGRICULTURAL DIVERSIFICATION	**Using land quality** as the basis of agricultural land use, especially in view of the limited area of prime lands **Reducing subsequent use of degraded and marginal lands** since it affects their regeneration **Considering land and water scarcity**, especially in allocating marginal lands **Diversifying land use for agriculture** to include intensive cropping, crop diversification, mechanization and livestock production **Focusing on specific crop yield and productivity characteristics** related to land and water resources scarcity and sustainability, and their investment options **Mobilizing agricultural investments** to ensure the economic and ecological viability of rural development **Accounting for the economic and social costs** incurred by rural-urban migrations when drylands are degraded

Table 2.10 (*contd.*)

Area	Policy Elements
LAND POLICY AND TENURE	**Considering the nature of land holding and use** in national planning, especially since prime lands for agriculture are limited **Basing land management** in central planning on differences in land type, quality and potential **Considering the consequences of land and environmental degradation** in the rural areas in terms of social disruption and population migration to overcrowded urban areas **Allocating land for productive uses** on the basis of previous traditional communal land holding systems
PARTICIPATORY MANAGEMENT	**Promoting joint management and balance** of productive and protected uses of drylands by government and private sectors **Ensuring government support to local communities** with socio-economic constraints affecting farming **Providing a responsive legal framework** designed to protect traditional users' rights and the welfare of future generations **Improving the organization and infrastructure** of farmers for effective community participation **Consulting and/or involving local communities** in resource planning to overcome their resistance to change and deal with the high maintenance costs of supply systems **Diminishing public sector role** and increasing farmer participation in agricultural management **Strengthening local community involvement** in rural agriculture, industries and commerce **Strengthening local government capacity** for the long-term protection of fragile environments **Evolving responsible managerial partnerships** between the public and private sectors at all levels **Improving coordination between different government agencies** and levels through the devolution of power from the center **Providing proper incentives** for changes in management systems, including education and training of rural communities, provision of agricultural credit, and assessment of farmer's risk management

Table 2.10 (*contd.*)

Area	Policy Elements
GOVERNMENT INSTITUTIONS	**Training public servants** in participatory approaches **Reforming the civil service structure** where needed **Promoting inter-agency coordination** within and between the countries of the region **Strengthening government institutions** responsible for managing the dry areas **Removing the prevailing misguided perceptions of "marginal" lands** in relation to national needs **Strengthening agricultural extension services** for rural development **Encouraging farmers to adopt appropriate technologies** for restoring degraded drylands **Promoting social, economic and political structural changes** to enable farmers to adopt farming innovations **Providing individuals basic freedom** for a greater popular role in policy formulation, governance and legislative reform
INVESTMENT IN HUMAN RESOURCES	**Strengthening human resources capability** through education and training, since human factors surpass technical ones in dryland management **Overcoming shortages in technical and managerial skills** needed for improving the standards of natural resources and environmental management, e.g. agroclimatology **Improving the standard of equipment** available for natural resources and environmental management **Acquiring equipment systems** appropriate for training technicians in the complexities of dryland management

SOURCE: Aleppo Seminar Discussions, 1992.

III. Farming Systems Issues

Agro-ecological Zones

11. The WANA region experiences significant climatic variations between the Tropic of Cancer and the northern Temperate Zone, both from east to west, and from north to south. Its characteristic climate is one of hot, mainly or totally dry summers and cooler winters, with limited precipitation largely concentrated in the winter season. Lack of adequate rainfall is a primary constraint to increased agricultural production; and soils are not. In some areas, particularly West Asia, salinity is a major problem. A rich variety of sub-climates has been identified in this region. Nevertheless, the region embodies four main agro-ecological zones on the Koppen and Geiger scale based on mean temperature and precipitation (Table 3.1)[13]: cool and cold sub-tropical zones, and cool and warm tropical zones. The cool sub-tropical Mediterranean Zone is the major agricultural production zone in this region. The principal farming system in each major agroecological zone has evolved in recent years in response to changing socio-economic pressures, and resulted in economic and environmental problems.

Arable Lands in the WANA Region

12. Permanent arable lands form only 6.84% of the WANA region, with another 6.2% being arable and the rest being either too arid or too mountainous for use[14]. The cultivated area declined by about 0.5% between 1973 and 1989, placing a binding constraint on the availability of new land for farming. About 80% of the arable land receiving winter rainfall in the cool sub-tropical and temperate zones is cultivated for cereals, with wheat and barley occupying 85% of the cereal area. The rest of the arable land is cultivated for pulses (6%), potatoes (1%), industrial crops such as oilseeds, cotton, tobacco and sugar cane or sugar beet (8%), and vegetables and forage crops. Six main farming systems may be discerned in these

---

[13] Oram, P. 1992. Identification of the main farming systems and their ustainability. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992. See also Footnote 3

[14] See Footnote 9

agro-ecological zones: three in the cool sub-tropical and temperate zones (bread wheat, oilseeds, pulses and vegetables; durum wheat barley and pulses; and extensive sheep and goat husbandry), and three in cool and warm tropical zones (rainfed wheat and barley; sorghum and pearl millet; and rice and maize) (Table 3.2).

Table 3.1: Main Agro-ecological Zones of the WANA Region

Zone	Characteristics
COOL SUB-TROPICAL (MEDITERRANEAN) (Csa)	**Coastal littoral around the Mediterranean, Black and Caspian Seas:** * Hot dry summers and cool wet winters * Agriculturally important rainfed cropping systems of winter cereals (wheat and barley) * Short growing periods * High variability of rainfall (20-50%) and temperature, making rainfed agriculture risky * Poor management of irrigation systems * Poor soils
COLD SUB-TROPICAL (HIGH PLATEAU) (Bsk)	**Semi-arid climate in parts of Turkey, Iraq and Iran:** * Hot dry summers and cold winters with precipitation * Short growing periods * Rainfed agriculture (cereals) * High variability of precipitation and temperature, making rainfed agriculture risky * Shallow soils prone to erosion
COOL TROPICAL (Bshs)	**Upland areas in the Arabian Peninsula:** * Hot wet summers and cool winters * Inadequate and uncertain rainfall * Rainfed agriculture (sorghum and millet)
WARM TROPICAL (Bwh)	**Most of the Arabian Peninsula and Sudan:** * Hot wet summers with sparse rainfall * Cropping only feasible with irrigation

SOURCE: Adapted from Oram, P. 1992. Identification of the Main Farming Systems and their Sustainability. Aleppo Seminar Paper

Table 3.2: Main Farming Systems in the WANA Region

Physical Factors	Main Farming Systems
(A) COOL TEMPERATE AND SUB-TROPICAL (MEDITERRANEAN) ZONES	
Reliable Rainfall > 400 mm	**Bread wheat, Oilseeds, Pulses and Vegetables**
Rainfall 200-400 mm	**Durum wheat, Barley and Pulses** (often with a fallow break in the rotation) with:
Higher range > 300 mm > 200 mm	* Wheat and Chickpeas commonly cultivated * Barley and Lentils with or without a fallow * Barley alone
Rainfall < 200 mm	**Extensive Sheep and Goat husbandry** (on steppelands and semi-arid lands)
(B) COOL AND WARM TROPICAL ZONES (Upper Nile and Arabian Peninsula)	
Cool Uplands	**Rainfed Wheat and Barley** (Yemen and Saudi Arabia)
Most Areas	**Sorghum and Pearl Millet**
Especially in Egypt	**Maize and Rice**

SOURCE: Adapted from Oram, P. 1992. Identification of the main farming systems and their sustainability. Aleppo Seminar Paper.

Demographic and Socio-economic Impacts on Farming Systems

13. Rapid population growth of about 2.8% per annum in the WANA region is inducing increasing urbanization and out-migration from agriculture. There will be increasing competition for natural resources, especially land and water, both between sectors and especially within the agricultural sector. The rapid growth in incomes in the 1970s, especially in the oil-producing and labor-exporting countries in comparison to the food-producing countries, resulted in the accumulation of large trade deficits through the import of staple foods. There has been an expansion of tourism especially in the Mediterranean countries. All these factors contribute significantly to increasing demands on agricultural production, especially for staple foods, oilseeds, tobacco, sugar and cotton. With the exception of Turkey, the goal of self-sufficiency in agricultural production is economically unattainable for most countries. Some effects of these demands are already

becoming apparent in 12 areas (Table 3.3)[15]: cropping intensity and diversity; pasture reductions; mechanization; rainfed barley; food legumes; small ruminant livestock; annual forage crops; fodder prices; poultry production; horticultural production; competition for labor; and competition for scarce land and water.

Table 3.3: Socio-economic Impacts on Farming Systems in Dry Areas

Farming Sectors	Socio-Economic Impacts and Trends
CROPPING INTENSITY & DIVERSITY	**Increasing rainfed areas**, especially with higher rainfall **Decreasing fallow**, and increase in annual and perennial food crop area
PASTURE REDUCTION	**Decreasing pasture areas** due to the expansion of cultivation, especially into low rainfall areas
MECHANIZATION	**Rapid expansion of mechanization** in cultivation and harvesting for intensification, diversification and pasture farming changes
RAINFED BARLEY	**Increasing barley production** at the expense of wheat in the higher rainfall zone, in place of steppeland grazing, through development of continuous cereal systems eliminating fallow **Increasing wheat production** under irrigation or in higher rainfall areas
FOOD LEGUMES	**Modestly increasing food legume areas** with limited yield improvement
SMALL RUMINANT LIVESTOCK	**Increasing livestock husbandry** without parallel increase in food supply, due to increasing urban and export demand and prices for red meat
ANNUAL FORAGE CROPS	**Increasing forage crop production** but inadequate compensation for loss of natural grazing lands
FODDER PRICES	**Increased fodder prices** for cereal and legume straw
POULTRY MEAT & EGG PRODUCTION	**Rapid poultry and egg expansion** for urban and tourism demand, needing increased feed imports
HORTICULTURAL PRODUCTION	**Rapid horticultural expansion** for urban, tourism and export demands
LABOR SCARCITY	**Increasing labor competition** between sectors, and within the agriculture sector
WATER & LAND SCARCITY	**Increasing natural resources competition** especially for scarce water and land resources

SOURCE: Aleppo Seminar Discussions, 1992

[15] See Footnote 9

Sustainability of Farming Systems

14. The sustainability of the two main farming systems is threatened by increases in demand for agricultural production[16]. Firstly, the expansion of barley production has occurred through the development of integrated barley-livestock systems in lower rainfall areas (200-300 mm), with the barley serving as fodder for sheep. There has been a rapid expansion of livestock products with an increase in meat prices relative to cereal prices. Two trends affect the sustainability of this farming system:

a. Progressive decline in fallow even on marginal steppelands under continuous cropping; and
b. Continuous increase in ruminant livestock on a shrinking and deteriorating steppeland.

Secondly, the sustainability of natural grazing on steppelands has been affected by changes in ownership of land and animals due to former nomads adopting a settled life. Other factors include deterioration of the steppelands, unavailability of lands outside the range for grazing by semi-nomadic flocks, and the expansion of barley cultivation into these marginal areas. Several countries in the region are attempting to rehabilitate degraded steppelands. The pressure of livestock on these lands may be relieved by the development of a transportation system for live animals to the distant markets.

Agricultural Intensification and Diversification

15. The potential for agricultural diversification without irrigation is still limited in the WANA region by aridity generally, and by cold winters in the upland areas[17]. However, there is scope for agricultural diversification through the intensification of land use in the more favorable rainfed zones and in the irrigated areas, where current levels of farming intensity are generally low (about 0.65 on rainfed lands, and 1.30 in irrigated areas) (Table 2.8). Agricultural intensification could be achieved in several ways:

---

[16] See Footnote 9

[17] See Footnote 9

a. **Growing Season:** Shortening the growing season of the main crops through varietal selection or mechanization, to allow for double-cropping and the release of lands under these crops for other productive uses;
b. **Crop Substitution:** Substituting another annual crop for fallow in the rotation;
c. **High-Value Crops:** Introducing higher-value crops into the farming system;
d. **Livestock:** Introducing livestock into the farming system, based on the cultivation of annual or perennial forage crops; and/or
e. **Tree Crops:** Planting tree crops which occupy the land year-round and technically raise the index of land use intensity to 200%.

When looking at these different measures for intensification and diversification, it is essential to evaluate the trade-offs in terms of product value instead of volume across the rotation over time.

16. The scope for agricultural intensification and diversification of farming systems (Table 3.4) appears best in regions outside the dryland marginal areas[18], through a variety of appropriate specific measures:

a. **Mediterranean Coastal Littoral Zone** with favorable rainfall (<400 mm), mild winters and with relatively level terrain:

   - The coastal littoral of North Africa except Egypt, Turkey, northern Syria, Lebanon, and parts of Iran and Iraq south of the Caucasus and Zagras Ranges;
   - Agricultural diversification and intensification through improved cereal production with inputs, better weed control and mechanization, the substitution of fallow by food or legume crops, the inclusion of crops with higher value (such as vegetables, oilseeds, tobacco, melons and green beans and, where there is summer rainfall, sugar beet and cotton), the use of supplementary irrigation and plastics for wider choice and improved yields and quality, and through the growing of olives, almonds and deciduous and stone fruits where soils are mediocre or stony and land sloping.

b. **Upland Plateau Zones** with adequate or limited precipitation (400-600 mm), cool or cold winters and with a 120-180 day growing season:

   - Anatolia, north-central Iran and Algeria;
   - Agricultural diversification limited to fallow substitution by food legumes,

[18] See Footnote 9

livestock farming, and better cereal and forage production (since these lands form 40% of the agricultural lands of WANA and contribute 30% of its production).

c. **Upland Plateau Zones** with adequate precipitation, strongly dissected and remote terrain, fairly mild, cool or cold winters, and with poor infrastructure:

- Turkey, Iran, Jordan, Cyprus, Afghanistan, Algeria, Morocco and the southwest Arabian Peninsula;
- Agricultural diversification severely limited to integrated watershed management, stratified upland-lowland production, and special crops depending on their ecological and/or economic advantage; and through a combination of incentives and legislation in view of traditional small holdings, remote location and poor infrastructure.

d. **Rainfed Agriculture Zones** within the cool tropics at various altitudes, and with a 90-150 day growing season:

- Sudan, Saudi Arabia, and Yemen;
- Agricultural diversification in irrigated systems, in view of small total area of arable crops and food importation by most countries.

e. **Irrigated Agricultural Zones** where moisture availability is not limiting, but temperature or distance from markets is:

- Long history of irrigation in the WANA region added to the net area cultivated, facilitated intensive cropping, increased productivity and value by diversification;
- Agricultural diversification and intensification in irrigated areas to overcome production constraints (since production is well below potential); such as water shortages, inadequacies of water delivery, waterlogging and poor drainage of irrigated lands, farmer's inability to cultivate the whole area, planting of low-value crops without a comparative market advantage (e.g. sugar beets, rice, some oilseeds, low-yielding maize), poor market access, and lack of market information.

Table 3.4: Scope for Agricultural Intensification and Diversification of Farming Systems in Non-Marginal Dry Areas of WANA

Zones	Annual Precipitation	Temperature	Countries	Agricultural Diversification and Intensification Measures
MEDITERRANEAN COASTAL LITTORAL ZONE (with level terrain and favorable rainfall)	<400 mm	Mild winter	Most of N. Africa except Egypt, Turkey, northern Syria, Lebanon, parts of Iran and Iraq	* Intensify cereal production with inputs * Improve mechanization and weed control * Substitute fallow by food or legume crops * Include crops with higher market value * Grow olives, almonds, and deciduous and stone fruits where soils mediocre or stony
UPLAND PLATEAU ZONE (with 120-180 day growing season an adequate rainfall)	400-600 mm	Cool/cold winter	Anatolia, N-C Iran, Algeria	* Replace fallow with food or legume crops * Replace fallow with livestock farming or better cereal and forage production
UPLAND PLATEAU ZONE (with dissected terrain)	Adequate	Mild to cold winters	Afghanistan, Iran, Turkey, Jordan, S-W Arabia, Cyprus, Algeria, Morocco	* Introduce integrated watershed management * Stratify upland-lowland production
RAINFED AGRICULTURE ZONE (with 90-150 day growing season)	Adequate	Cool tropics at various altitudes	Sudan, Saudi Arabia, Yemen	* Small total area of arable crops * Diversify throughout the irrigated system

Table 3.4 (*contd.*)

Zones	Annual Precipitation	Temperature	Countries	Agricultural Diversification and Intensification Measures
IRRIGATED ZONE (with soil moisture not limiting)	Soil moisture not limiting	Temperatures sometimes limiting	Various WANA countries	* Expand the net area cultivated under irrigation * Facilitate intensive cropping * Increase crop productivity * Plant with high-value crops with a comparative market advantage * Improve market access * Improve communication of market information

SOURCE: Adapted from Peter Oram, 1992. Identification of the main farming systems and their sustainability. Aleppo Seminar Paper.

Multi-disciplinary Approach to Farming

17. In view of the great variety of agroclimatic zones in the WANA region, an integrated multi-disciplinary farming systems approach to research and development is needed. This will help provide more systematic and critical information on marginal land and scarce water resources management, for practical application to increasing agricultural production. Although discipline and commodity-based approaches may generate quick results — such as the development of high-yielding varieties for use by farmers — they do not address the wider issues of environmental and socio-economic sustainability. Achievement of greater benefits from the use of high-yielding varieties through improved, integrated resources management is being impeded somewhat by bureaucratic inertia. Government departments and agencies were usually created on a disciplinary or sectoral basis for execution. They tend to have considerable difficulties in the inter-disciplinary and sectoral coordination needed for planning and implementing integrated resources management. A possible solution to this constraint is the creation of more effective coordinating structures in central government agencies. International research organizations could develop and disseminate innovative approaches for conducting integrated resource management research and development. This could have a significant impact in the countries of the region.

Priorities for Research and Extension

18. Allocation of resources for research and extension in sustainable use and management of marginal land and water resources has often been too imprecise. Governments should target scarce resources available for research and extension towards a comprehensive approach on priorities for:

- Increasing agricultural production in low-rainfall and marginal upland zones;
- Strengthening extension services where they are weak or practically non-existent;
- Examining comprehensively the overall costs of marginal land degradation, beyond the fairly simplistic short-term input/output analysis;
- Studying the economics of farming systems in dry areas — including the cost of degradation, social disruption, etc., both in the long term (20-25 years) and the short term (3-5 years).

In order to obtain environmentally sustainable agricultural development, there is a need for international organizations, including the World Bank, to consider

long-term perspectives when addressing development issues; and to endorse the CGIAR's shift in research priorities towards sustainable farming systems and, thus, provide important leadership to national agricultural research systems (NARS) on the central importance of balanced planning and sustainability.

19. Governments and donor agencies have tended to invest in dryland agriculture in sectors where returns are most immediate. Agricultural development of these marginal lands requires substantial and judicious investments, especially where yields are less reliable. Governments, therefore, must take a long-term view, investing in extensive research and extension, and paying more attention to rural development in these areas for sustainable agricultural and environmental management. Monies spent here are an investment in the country's future. A balance must be struck when allocating financial resources, between rural and urban planning and development.

Enhancing Farming Systems

20. In addition to the above, farming systems in the WANA region may be enhanced by implementing one or more of the recommendations listed in Table 3.5.

Fallow Replacement

21. The introduction of alternative crops in rotation to replace fallow in the dry areas of the WANA region provides a stable cereal yield as well as a variety of crops for human and livestock consumption. This has been useful due to a marked increase in human settlements, a subsequent rise in small ruminant numbers, and the degradation and loss of much natural grazing on hill slopes and at the edge of the steppe. The following features of fallow replacement are discernible:

a. **Fallow Substitution in Low Rainfall Areas:** Fallow is not economically efficient in dry marginal lands with <250 mm rainfall, and is of little importance to agricultural production since their pastures do not provide enough food or animal feed. In these dry conditions, weedy fallows are poor in composition and nutrition, and contain a high proportion of poisonous plants. Fallow replacement thus has a positive effect on overall agricultural production. Barley is by far the most suitable substitute crop compared to wheat or other crops in this agroclimatic zone. The use of oil crops in rotation instead of

fallow improves water-use efficiency, and provides protein-rich animal feed after extraction of the oil. Threshed stems returned to the soil improves its physical and chemical conditions fallow replacement in this zone thus improves both agricultural productivity and environmental sustainability[19] in the long run. Fallow replacement with food, forage or leguminous pasture crops enhances water and nitrogen balance in comparison to fallow-cereal or continuous cereal systems. This is due to the low moisture conservation efficiency of fallow under low rainfall and in shallow soils, and the more efficient use of water by a second crop.

Table 3.5: Specific Measures for Enhancing the Farming Systems in the WANA Region

Areas	Enhancement Measures
	(A) INCREASING AGRICULTURAL PRODUCTION
Barley Farming	Improve barley production on lands with low rainfall by developing integrated farming systems profoundly sensitive to local conditions
Fallow Replacement	Replace fallow, wherever possible, with forage crops and/or pasture legumes, with oil-seed or industrial crops as an alternative
Wheat-based Farming	Improve wheat-based farming in marginal to intermediate rainfall zones (300-500 mm), the most promising for sustainable yield increases, by management practices such as zero or minimal tillage, better timing of production operations, appropriate fertilizer use, integrated pest management, partial mechanization, etc., besides the introduction of high-yielding varieties which have brought significant benefits
Crop Rotations	Replace monocultures by crop rotations including food and forage legumes, and lye farming
Livestock Integration	Integrate pasture livestock management and fattening in integrated rangeland management schemes in the dry areas
Private Sector Role	Expand crop diversification by increasingly involving the private sector in the production of high-value horticultural crops, and in thedevelopment of their extension and marketing systems

[19] Pala, M. 1992. Sustainability of fallow replacement. Lecture notes of a presentation at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992

Table 3.5 (*contd.*)

Areas	Enhancement Measures
(B) MANAGING WATER AND LAND RESOURCES	
Soil & Water Conservation	Prioritize research on soil and water conservation on an integrated watershed basis, since watershed degradation adversely affects agricultural production and rural development
Irrigation Alternatives	Rehabilitate existing irrigation systems rather than initiating new ones, particularly where drainage and lining problems prevail
Water Consumption	Rationalize water resources consumption by establishing water users' associations and water use charges
Drainage & Irrigation	Initiate new irrigation and drainage projects where land and water resources are abundant and existing irrigation and drainage systems work efficiently
Water Harvesting & Supplementary Irrigation	Promote water harvesting and make use of erratic rainfall in marginal areas through supplementary irrigation. A cubic meter of water under irrigation yields 0.5 kg wheat; under supplementary irrigation, it yields 2.5 kg of wheat. Facilitate research to make supplementary irrigation a viable option
Minimum Tillage	Introduce minimum tillage practices to help prevent land degradation, and the use of seed drills to reduce seed requirements
(C) IMPROVING SOCIAL ORGANIZATIONS AND INSTITUTIONS	
Infrastructure & Employment	Develop rural industries to foster infrastructure development, and create off-farm sources of employment in marginal areas
Land Reform	Promote effective legislation for land tenure reform in order to contribute to further agricultural development in marginal areas
Decentralized Rangeland Improvements	Avoid centrally-imposed changes for improving rangeland management by mechanisms such as land tenure and market structure, because of their disappointing failure in the past
Local Community Empowerment	Empower local communities to control natural resources, improve rangeland management, and conserve the environment in view of the importance of understanding the views of local cultures toward the environment
Local Social Structure	Account for the social structure of local communities when changing cropping systems for improving agricultural production in marginal areas
Farmers' Preference	Examine and address local social problems and farmers' preferences when endeavoring to improve dryland agriculture

SOURCE: Aleppo Seminar Discussions, 1992.

b. **Leguminous Crops:** The inclusion of legumes in the cropping system reduces the system's dependence on nitrogen fertilizers through nitrogen fixation from the atmosphere. A legume-based pasture (e.g. lye farming) rotation, coupled with an increase in livestock numbers, restores soil fertility through recycling of nitrogen by grazing. A significant increase in crop productivity after the pasture phase occurs in the long run. Leguminous crops are an appropriate alternative to fallow, but their constraint for building soil nitrogen reserves and improving overall agricultural production lies in the lack of well-adapted *Rhizobium* bacteria species.

c. **Successful Fallow Substitution Programs:** The success of fallow substitution in countries such as Turkey has been due not to the introduction of a new technology, but to the transfer of site-specific technology adapted to the resources of farmers, and to the modification of technology already in use. For example, farmers without the necessary resources have been advised to cover the seed after hand broadcasting, whereas farmers with the necessary resources have been advised to use a seed drill. Farmers were offered a technology package incorporating such elements as seed rate, planting date, soil preparation, etc., taking into account diversity in natural resources. Government extension services do not usually take such a site-specific adaptive approach, and therefore induce significant environmental and social disruption.

d. **Turkey's Experience in Fallow Reduction:** Agriculture has always been an important component of the Turkish economy, and contributed 16% to GNP and about 21% to export earnings for the period 1985-88. Almost half the labor force is engaged in agriculture[20]. In order to increase land use intensity and diversify the arable land use patterns, efforts were made to substitute a crop for fallow in the rotation; and to introduce livestock production into the farming system based on the production of forage crops and by-products. Fallow has traditionally been practised, partly because of the limited and variable annual precipitation, resulting in low cropping intensities on dry lands. The initial attempt to substitute leguminous crops for fallow was very successful; farmers were attracted to the use of unimproved legume varieties, and there was provision of fertilizers, mechanization and supporting credit. This success led to further research and extension to determine the most suitable ecological conditions and crop rotations for fallow replacement without depressing wheat yields. Wheat and barley have been the traditional crops grown in almost every region of Turkey. Most of the wheat crop is produced in the winter, where it

[20] Durutan, N. 1992. Sustainability of fallow reduction. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992

alternates with fallow in the rotation. Research efforts in crop improvement, crop rotations, and crop management relied on analyses of previous research data, meteorological data and farmers' practices. Provision of financial incentives and substantial extension efforts contributed to an overall decrease of 37.6% in fallow area in 10 years (1979-89).

e. **Incentives for Fallow Replacement in Turkey:** The encouragement for farmers to replace fallow with leguminous crops in Turkey relied on several incentives and measures[21]:

- A mass media campaign on the nutritional and culinary values of legumes, which increased demand;
- Freedom of choice for farmers;
- Initial provision to farmers of security measures such as buying guarantees, to ensure that they did not risk their livelihood in adopting the fallow replacement option;
- Development of a market for the newly-introduced leguminous crops, with the Turkish government facilitating the export market.

f. **Demand for Legumes:** Market demand for legumes provided the strongest incentive to farmers to replace fallow. In Lebanon, for example, the local poultry industry became an important consumer of domestically-produced vetch, thereby creating a demand for a crop which had little commercial value prior to its use as a fallow substitute.

g. **Economy of Scale in Fallow Substitution:** Decision makers are often concerned about funding constraints and sustainability for large-scale research and extension projects on alternative fallow cropping systems. However, initiating small-scale pilot projects is far less costly, does not involve significant risks, and provides a more attractive solution for a site-specific situation.

Livestock, Grazing and Environmental Effects

22. Evidence of soil degradation caused primarily by livestock appears somewhat contradictory. Where livestock plays a minor role, soil degradation could be overcome by better rangeland management practices. Where livestock plays an important or central role, soil degradation is caused by managing large numbers at high densities and the sheer physical impact of their hooves (e.g. hundreds of sheep) on soil structure. Grazing sheep on barley or wheat stubble

[21] See Footnote 17

returns little organic matter to the soil; nevertheless grazing appears a better treatment for stubble than burning. No soil can afford to have its stubble grazed or burned, without some of it recycling back into the soil. Interruption of this decomposition and recycling process by grazing or burning tends to break down the soil's structure; and neither burning nor grazing interrupt disease transmission, weed infestation, etc. Some soils in the WANA region cannot be grazed at all. Grazing increases the risk of soil degradation and dependence of livestock on barley. Continuous dependence of livestock on barley is unsustainable in the long-run; and is usually associated with a high probability of declining profit margins caused by disease build-up and deteriorating soil fertility. Range and livestock production systems are important components of agricultural systems in the dry areas of WANA. These systems are subject to growing stress due to crop encroachment and livestock population increase. The degree of soil degradation caused by livestock increase is difficult to establish. The World Bank estimates that 50-80 percent of the rangelands in North Africa, Eastern Turkey, Yemen and Pakistan are degraded, but are probably still in a state where the damage can be reversed[22]. Relevant factors in soil degradation include:

a. **Farm Size:** Size of land holding compounds soil degradation in dryland agricultural practices where farm fields are split up into narrow strips running downhill, and, thus exposed to severe erosion.
b. **Causes of Soil Degradation:** Soil degradation is caused mainly by inappropriate policies and technologies (Table 3.7), such as:

- Provision of feed grain subsidies, and free grain during droughts;
- Increased transportation of herds to barely recuperated rangelands;
- Introduction of large subsidies on rangeland and veterinary services;
- Encouragement of previously nomadic producers to settle and concentrate production around population centers;
- Protection of locally-produced meat;
- Undermining traditional communal grazing systems, without replacing them with ecologically sound alternatives;
- Introduction of inappropriate new technology;
- Focusing research effort only on animal health and dairy cattle issues.

[22] de Haan, C. 1992. Sustainability of changing rangeland management and livestock production systems. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992

c. **Improving Rangeland Productivity:** Several policies and techniques have been used in rangeland management and livestock production systems of the MENA region. Their sustainability should be assessed before applying them locally. Since the rangelands in these countries are unable to support the increase in livestock populations, future growth in production must be sought through increased productivity per unit of land and animal. Future developments should include a phasing out of feed grain subsidies, increased attention to land tenure issues, increased emphasis on better grazing management techniques, increased producer participation in government services, enhanced livestock stratification, continued emphasis on the development of low-input and sustainable range and fallow improvement techniques, and fortified genetic improvement programs for local livestock breeds with particular emphasis on sheep.

d. **Subsidies:** Subsidies and high meat prices promote an increase in livestock populations which, in turn, cause soil degradation. Subsidies indirectly linked to soil degradation should be phased out with feed grain prices determined by the market system. Eliminating subsidies encourages forage production, but their overall effects are unclear over the long-term. Some government support should be provided to livestock owners during or after periods of drought, so as to enable them to restock; however, feed grain subsidies should be monitored carefully since they tend to increase livestock populations and threatens the quality of soil. Under traditional pastoral practices, droughts tend to reduce herds to a level comparable to the rangeland's carrying capacity, and are considered a natural rangeland mechanism. The sustainability of rangelands is possible, especially if funds currently allocated for subsidies are anyway invested instead in improved fodder production and rangeland conservation. Subsidies are not sustainable under financial constraints faced by WANA governments. Continuing these policies, therefore, could lead to the failure of the entire agricultural system. Funds allocated for subsidies could be better spent to develop agricultural infrastructure, extension services, and farmers' education.

Table 3.6: Existing Patterns of Land Use in the WANA Region (x1000 ha) (FAO, 1989)

Landuse: Country:	Arable Land	Irrigate Land	Rainfed Land	Cereals	Wheat	Barley	Pulses	Chick-peas	Lentil	Sun Flower	Rape Seed	Sesame
Algeria	6970	365	6605	2523	1420	1000	148	60	6	---	---	---
Libya	1800	240	1560	430	290	135	10	1	---	---	---	---
Morocco	8250	1260	6990	5542	2630	2399	503	62	58	115	1	---
Tunisia	3301	280	3021	982	557	387	121	45	2	4	---	---
Egypt	2410	2580	---	1862	630	50	185	11	10	15	---	15
Ethiopia	13200	162	13038	5017	666	900	855	120	50	---	53	64
Sudan	12450	1880	10570	5448	165	---	84	2	---	---	---	1000
Saudi Arabia	1110	430	680	804	645	120	4	---	---	---	---	4
Yemen	1376	310	1066	917	86	47	30	---	---	---	---	17
Cyprus	104	33	71	59	5	54	2	---	---	---	---	---
Iraq	5220	2538	2667	1313	500	700	26	3	2	12	---	20
Jordan	308	57	251	185	117	63	14	1	9	---	---	---
Lebanon	208	86	122	15	10	3	11	2	4	---	---	---
Syria	4947	650	4297	1802	871	859	291	34	188	10	---	14
Afghanistan	7910	2660	5250	2583	1619	245	25	---	---	3	---	37
Pakistan	20473	15680	4793	11831	7730	159	1421	---	---	---	334	25
Iran	14100	5750	8350	8980	6000	2500	551	110	105	19	---	3
Turkey	24750	2200	22550	13013	9300	2800	1973	780	715	830	1	95

SOURCE: FAO, 1989.

Table 3.7: Impacts of Policies and Technologies on Range and Livestock Production Systems in the WANA Region

Policies and Technologies	Short-Range Impacts	Long-Range Impacts
HIGH PROTECTION LEVELS FOR LOCALLY-PRODUCED CEREALS	Encourages investors to plow up marginal lands for cereal cultivation	Soil exhaustion
FEED GRAIN SUBSIDIES	Discourages investments in fodder production or range conservation	Exceeds the range's carrying capacity
PROVISION OF FREE FEED GRAIN DURING DROUGHTS	Constitutes a disincentive to stocking rate adjustments in times of such natural disasters	Interferes with the necessary recuperation period after a drought
LARGE SUBSIDIES ON RANGELAND AND VETERINARY SERVICES	Reduces producers' need to sell surplus stock	Keeps many traditional producers out of the cash economy
HIGH PROTECTION LEVELS FOR LOCALLY-PRODUCED MEATS	Leads to favorable feed/meat price ratios and makes sheep production financially attractive	Increases animal population and, thus, range degradation
INCREASED SETTLEMENT OF NOMADIC PASTORAL PRODUCERS	Concentrates livestock pasturing around the population centers	Deteriorates surrounding rangelands
LAND-TENURE POLICIES ADOPTED BY SEVERAL WANA COUNTRY GOVERNMENTS	Undermines traditional communal grazing systems with well-their defined grazing rights	Transforms the traditional communal grazing systems into open access areas which discourage the adoption of even simple technologies
INTRODUCTION OF NEW, MOSTLY INAPPROPRIATE TECHNOLOGIES FOR WANA COUNTRIES	Results in the lack of widespread adoption of crop systems that are recommended by many years of research and development	Degrades range and livestock production systems
CONCENTRATION OF LIVESTOCK RESEARCH ON ANIMAL HEALTH AND DAIRY CATTLE PROBLEMS	Neglected rangelands and small ruminants	Degrades range and livestock production systems

SOURCE: Adapted from de Haan, C. 1992. Sustainability of changing rangeland management and livestock production systems. Aleppo Seminar Paper.

e. **Forage Production:** Any incentive to grow and diversify forage crops should be supported by research on forage production in the region.
f. **Food Self-Sufficiency:** Although agricultural subsidies in the WANA region are based partly on the objective of attaining food self-sufficiency, such an

objective is unattainable if a country achieves self-sufficiency in livestock but relies on import of grain feed or, at the expense of rangeland degradation, damages its natural resources and/or environmental assets.

g. **Land-User's Rights:** The issues of land tenure and users' rights for livestock production are uniquely different in the WANA region. The Islamic inheritance laws, for example, have resulted in land fragmentation into small and often non-viable pieces of land. It is possible to attain a balance between efficiently operating the rangeland and respecting traditional customs. This could be achieved by introducing exclusive land users' rights on a group basis by forming social organizations (such as cooperatives) among range livestock owners, with limited participation by government in terms of education and extension. Such organizations should have exclusive rights to that part of the range inhabited by their members, and, as they gradually develop management and marketing skills, these members should run the organization[23]. Where the government decides to control the rangelands, it must play an active role in their management and regulation.

h. **Grazing Rights:** The issue of grazing rights should be a priority, since it is controversial. One belief suggests that users' charges for rangelands would enhance a sense of belonging and cooperation, while another predicts that charging livestock producers for use of commonly-held rangelands would probably be unsuccessful. Establishment of users' cooperatives or associations to collect such charges for sustaining and improving the range may resolve these conflicting views. In any case, governments should not be involved in revenue collection.

i. **Livestock Stratification:** Stratification of livestock production has its advantages and disadvantages in a policy of rangeland management. On the one hand, it is thought to improve the efficiency and profitability of the pasture system; on the other, it could increase overgrazing and lead to further herd intensification. A constraint to livestock stratification is local consumer dislike for large animals, and preference for small animals that are slaughtered off the range.

j. **Large Livestock:** For a livestock stratification strategy to succeed, it has to meet the needs of both consumers and producers. Consumers need education on the nutritional and economic value of large animals. Producers need assistance, such as price incentives, improved transportation, slaughterhouses, refrigeration facilities, marketing, information, and extension services. More

---

[23] de Haan, C. 1990. Low input sustainable field systems: implications for the world's rangelands. Proceedings of the 1990 International Rangeland Development Symposium, Reno, Nevada, USA, 1 February, 1990

research is also needed to determine optimum slaughter weight, feed conversion ratios and required forage crops for large animals, since the most important factor for the strategy's success is a high meat/feed price ratio.

k. **Veterinary Services:** The prevailing monopoly of government veterinary services in many WANA countries results in a very poor service. Livestock owners are usually willing to pay for good veterinary services; privatization would improve their services and enhance existing animal husbandry practices. There is need for central control of semen, and a national program for controlling infectious diseases — perhaps on a private network basis.

Soil Erosion

23. Soil erosion is a major constraint to the expansion of agriculture in most WANA countries since it causes a reduction in arable land and grazing areas, accelerates the sedimentation of reservoirs, and reduces forestry and livestock production. Erosion thus poses a serious threat to sustainable agricultural production.

24. **Water and Soil Conservation in Tunisia:** Soils in Tunisia are particularly subject to degradation due to activities such as fuelwood harvesting, overgrazing, abusive cultivation techniques and exposure of topsoil to wind and water erosion[24]. In view of their socio-economic implications, Tunisia has made water and soil conservation essential components of rural development projects. A national soil conservation program with a budget of 567 million dinars has been proposed to cover the cost of all needed interventions between 1990 and 2000. It deals with the management of 600,000 ha in watersheds and 400,000 ha in cereal production regions. Water and soil conservation generate rural employment, and all soil conservation actions have been considered as production factors contributing benefits such as:

- Improving hydrological resources;
- Protecting dams and other infrastructure facilities from siltation;
- Consolidating the water table;
- Controlling floods and loss of topsoil.

---

[24] Hizem, H. 1992. Land resource management policy in Tunisia. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992

Water and soil conservation programs follow a policy guided by the national agricultural objectives (Table 3.8), under the Department of Water and Soil Conservation. This agency approaches the issue at three levels — technical, economic and sociological; and gives special importance to improvement of organization and coordination among local communities, technicians and the private and public sectors (Table 3.9). Particular emphasis has been given to agriculture extension services and training at all levels.

Table 3.8: National Policies for Water and Soil Conservation in Tunisia

National Strategies
(1) Conserve Soil Resources
(2) Protect Hydraulic Infrastructure
National Agricultural Goals
• Increase agricultural production in order to reach food self-sufficiency
• Improve revenue and standard of living of the rural population
• Create job opportunities in the countryside
• Reduce the rural-urban migration

SOURCE: Adapted from Habib H. 1992. Land resource management policy in Tunisia. Aleppo Seminar Paper.

Table 3.9: Approaches to Water and Soil Conservation in Tunisia

Level of Application	Objective
TECHNICAL	• Fight soil erosion • Maintain the fertility of the soil • Reduce the transport of sediments to dams and reservoirs
ECONOMIC	• Require all land-users to participate in all conservation efforts
SOCIOLOGICAL	• Support local communities on a priority basis in all conservation actions • Improve the conditions of local communitie, especially in the most seriously affected areas where unemployment and underemployment prevail

SOURCE: Adapted from Habib H. 1992. Land resource management policy in Tunisia. Aleppo Seminar Paper.

Watershed Management

25. Watershed management is multidisciplinary and includes land and water resources conservation, and the management of range and pasture, forests, wildlife, fisheries, and flood control. Effective and integrated watershed management contributes to improved and sustainable agricultural production for a range of uses: for consumption (i.e. crops, livestock and their by-products), energy and firewood, building materials, irrigation water and industrial products. It also contributes to biodiversity conservation[25]. Several disciplines relate to and make use of watershed management, including agricultural sciences (agronomy, animal husbandry, soil sciences, agroecology, forestry), hydrology, natural resource management, ecology, systems analysis, sociology, anthropology, land use planning, and economics (Figure 4). The judicious involvement of all disciplines in watershed management results in improved and sustainable agricultural production, economic growth, social harmony and culturally-accepted development. Poor watershed management leads to natural resources depletion, environmental degradation, lower agricultural productivity and quality of life, social disintegration and conflict, and decline of civilization (Table 3.10). Selecting the appropriate technological option (Table 3.11) is critical for the effective management and protection of watersheds. Some aspects of watershed management are elaborated below:

Table 3.10: Contrasting Watershed Management Practices

Criteria	Good practices	Poor practices
BIOMASS PRODUCTION	Increasing	Decreasing or Zero
SOCIAL ORGANIZATION	Harmonious	Disintegrative, Conflicts
QUALITY OF LIFE	Improving	Decreasing
CULTURAL LIFE STYLES	Innovative, Adaptive	Declining, Non-adaptive
ECONOMIC GROWTH	Sustainable	Non-Sustainable
ENVIRONMENTAL QUALITY	Sustainable	Degrading

SOURCE: Adapted from Farvar, M. Taghi, 1992. Watershed management for rainfed agriculture. Aleppo Seminar Paper.

[25] Farvar, M. Taghi. 1992. Watershed management for rainfed agriculture. Lecture notes of a presentation at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992

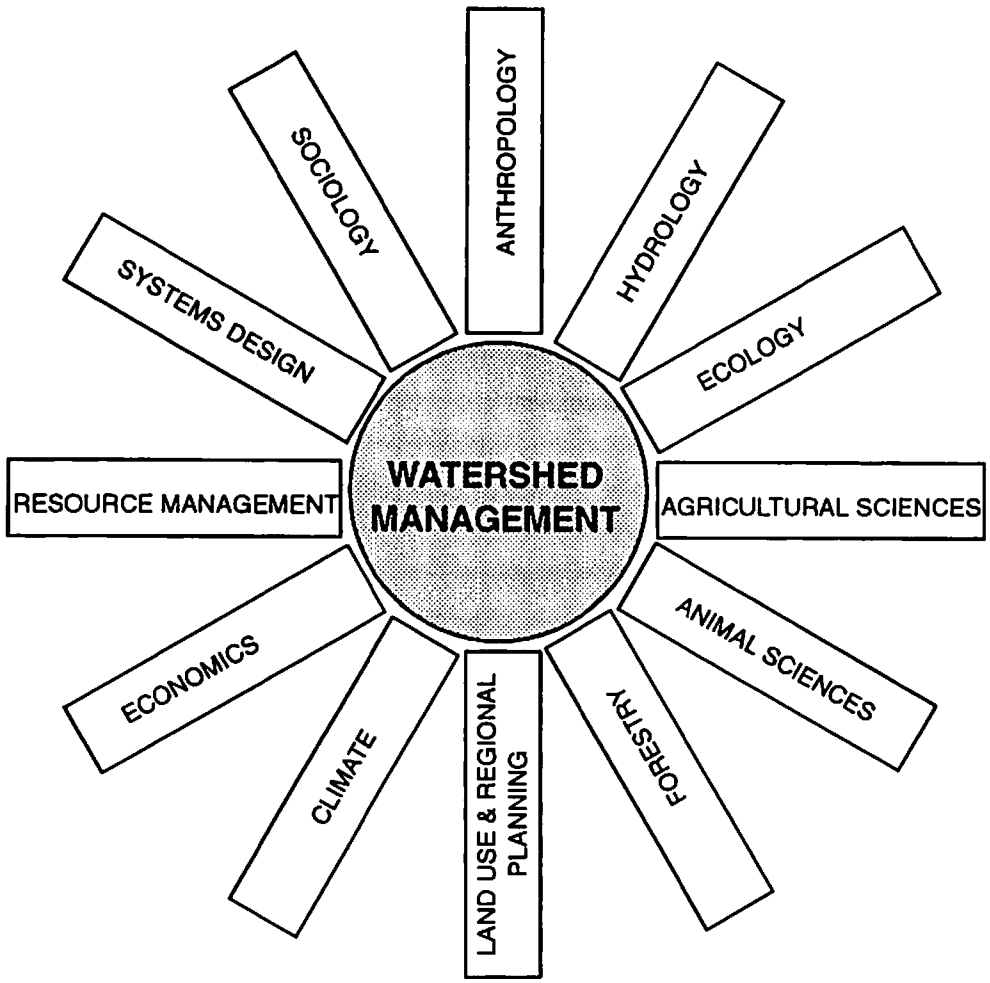


Figure 4: Interdisciplinary Approach in Watershed Management

Table 3.11: Technology Choice Determining Watershed Protection

Agriculture	Pastoralism	Energy	Water Resources	Others
Ploughing	Pasture Rotation	Rotational Cutting	Qanats	Harvesting/ Hunting Fish or Wildlife
Planting/Fallow	Seasonal Mobility	Woodlot	Contouring	
Irrigation	Pasture Reseeding	Communal Control	Bunds, Dams and Reservoirs	
Contouring/ Leveling	Buffer Zones	Forest/Bush Management	Plant cover	
Soil Cover	"Hemma" Systems		Flood management	
Windbreaks	Flock/Herd Composition			

SOURCE: Adapted from Farvar M. Taghi. 1992. Watershed management for rainfed agriculture. Aleppo Seminar Paper.

a. **Community Participation:** Community participation is crucial for achieving successful water resources management on a watershed basis. Strategies for community or popular participation in management include identifying and strengthening the traditional resource management structures, using locally-trusted extension agents, combining indigenous knowledge with modern solutions, and involving and cooperating closely with local communities in planning and implementing water resources projects (Table 3.12).
b. **Social Animation:** Social animation involves the assembly of a local community in one place to develop a consensus. It comprises four steps:

(1) Prompting the local community to list its problems;
(2) Classifying these problems under general categories;
(3) Requesting the local community to assign relative importance to each general problem category; and
(4) Listing the various problems within each category, in order of their gravity or significance.

There is some controversy about the progressiveness and universal applicability of such a social animation strategy since it may favor local elites to the detriment of emerging groups, such as the youth and the educated; and may not take into account competition among individual community members for leadership.

c. **Successful Programs:** Watershed management strategies have been used positively and effectively in Latin America, Sudan, and Iran. Most of these strategies have included common approaches, such as:

- Identifying traditional resource management systems;
- Promoting community participation (Table 3.12);
- Making use of the local community members as extension agents;
- Combining traditional knowledge with modern solutions; and
- Using participatory techniques such as "social animation".

Table 3.12: Principles for Promoting Community Participation in Watershed Management

Areas	Strategic Actions
TRADITIONAL RESOURCE SYSTEMS	Identify, enable and help strengthen traditional resource management structures, usually common property or common pool management systems, which are often vested in the community elders
	Use traditional resources as the main mechanism for promoting community participatio
EXTENSION AGENTS	Use local community "animators" as extension agents
SOLUTION MIX	Combine traditional knowledge with modern solutions, leaving management to the indigenous community system as much as possible
PLANNING AND IMPLEMENTATION	Use social animation or similar methods for community control of planning and implementation

SOURCE: Adapted from Farvar, M. Taghi. 1992. Watershed management for rainfed agriculture. Aleppo Seminar Paper.

Information Management Issues

26. The availability of information on physical resources (soil properties, weather, etc.) is perhaps the most important factor for efficient agricultural planning. Standard physical resources data is generally collected and archived in WANA countries[26]. However, common data constraints encountered in them

[26] Walker, G. 1992. Understanding physical resources for agricultural planning: importance of data, information, and technology. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992

include a paucity of adequate data for drier in comparison to wetter areas, the lack of non-standard data, and limited data dissemination. These constraints may be surmounted by addressing the following factors:

a. **Appropriate Data and Technology:** Appropriate data and technology are prerequisites for intelligent agricultural development, as are inexpensive low-technology solutions. Low-technology solutions often use minimal data collection, and tend to capitalize on the availability of human labor for the manual collection of data, as in Turkey and Iran. Remotely-sensed and meteorological data and technology have been well-used in agricultural resources management. Examples include fallow replacement, resource mapping and crop area estimation in Turkey, and in annual planning for agriculturally stable zones and systems in Syria. Nevertheless, physical resources data collection in WANA countries is a lesser constraint to agricultural planning and development than the downstream activities such as data access, processing, analysis, etc. that ultimately lead to the formulation and implementation of agricultural plans (Figure 5). Better use of physical resources data should help solve a wide range of agricultural production problems in WANA countries. Making effective use of available data presents a developmental challenge since it could address agricultural problems including yield prediction, runoff calculation for watershed management, identification of drainage problems, and detection of wind and water erosion patterns.
b. **Data Gathering:** Physical resources data is lacking, particularly at the local level; this creates a database constraint for specifically local use. Most data is presently generated by large central government agencies in WANA countries, and include macro-factors that may not be applicable to specific local conditions. A community-based information system should be established for gathering supplementary data relevant to local applications. However, the farmer is frequently reluctant to volunteer information useful for local agricultural development for fear of self-incrimination, such as in tax evasion; and there is a need for national and international investments in WANA countries to promote greater awareness the value of local information for designing new farming systems or adapting traditional ones.
c. **Data Use:** Most constraints encountered in data collection and analysis could be solved by the use of skilled human resources available in WANA countries. The complexity of agricultural development in the region also requires the effective use of science and technology. For example, although the meteorological services in all WANA countries provide useful information, the data generated is sometimes not used properly, and often requires further analysis prior to its application for resolving specific local agricultural problems.

d. **Data Access:** Aerial photographs and topographical maps are usually difficult to obtain in WANA countries due to local political, military and security concerns. Obtaining such information using legal channels takes much time and effort, and involves bureaucratic and security clearances. Furthermore, technologies to access and disseminate the world's information pool at various levels in WANA countries are either too expensive, or are firmly restricted to central governmental authorities for political and security reasons. Physical resources data are collected by different governmental agencies, but there is often a reluctance among these to share and coordinate their information because of bureaucratic and institutional constraints. Tight controls by the central governments of WANA countries of data collection, analysis, and management has had many adverse impacts. For example, the exclusion of local researchers from the data access and analysis process has made them "second-class" citizens compared to overseas researchers. Furthermore, current decisions about agricultural development and environmental protection are based on incomplete and/or outdated information. The ultimate losers and greatest sufferers from all this are the farmers, who feel like "third-class" citizens in their own country.

e. **Human Resources for Data Management:** There is a wide gap among WANA countries in data management capability. It is related to the scarcity of technical skills and scientific knowledge needed for collecting physical resources data; and for generating useful information for agricultural planning and development. There is a need for national and international investment in filling this data management gap, and in establishing the technological hardware needed for easily accessing information from a data bank. Training and information system development efforts will eventually help narrow the gap between agricultural planning and land use. New technologies such as remote sensing, geographic information systems (GIS), agro-ecological characterization and/or zoning information should enhance agricultural and environmental planning at the national and regional levels. At present, the low morale and lack of adequate skills among technical staff pose a serious constraint to the efficient use of such new technologies.

f. **Managing Data Banks:** International centers such as ICARDA should serve as information clearing houses and/or agricultural data banks for the WANA countries, even though many of them cannot yet assume such responsibilities. WANA countries themselves may be better equipped to collect data and organize the information they need for agricultural planning and land use. While there is a need to compile a comprehensive and relevant data base for natural resources and environmental management in WANA countries, there is a danger of too much information causing needless complication — and ultimately paralyzing the decision-making process.

g. **Cultural Resources Data:** While there is good potential for increasing the quantity and improving the quality of the physical resources database, social and cultural resources data remains relatively scarce. Excessive attention to the need for physical data should not obscure the continued need for human and cultural resources data for land use decisions.

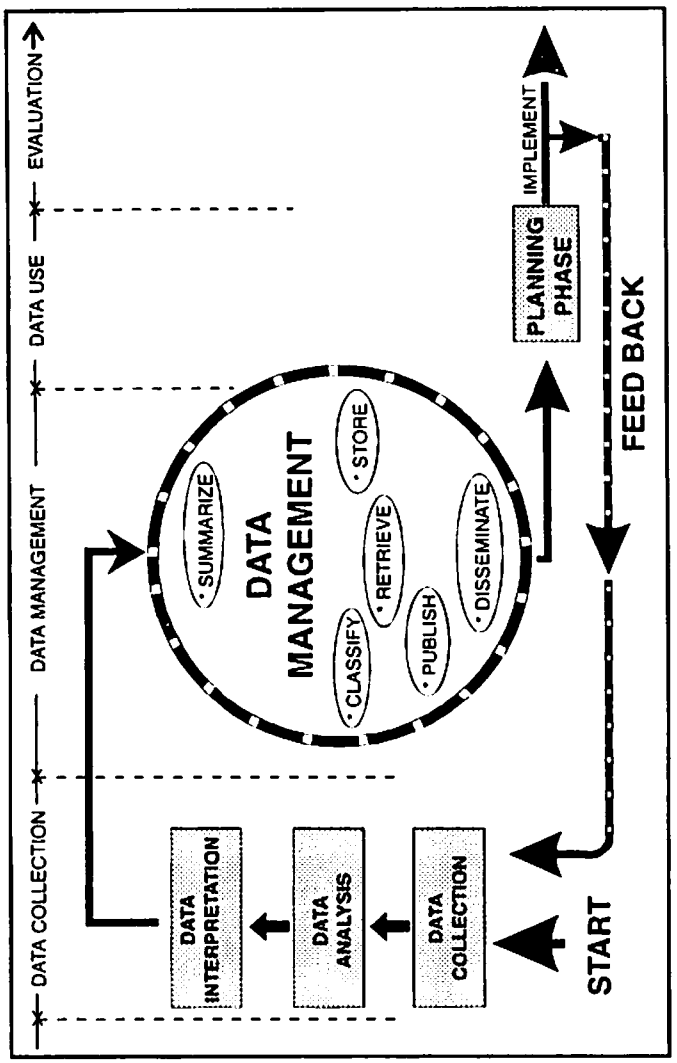


Figure 5: Agricultural Data, Information, and Planning

IV. Social and Institutional Issues

Social and Institutional Roles in Natural Resources Management

27. Natural resources and environmental management in WANA countries involve a diversity of social and institutional roles, which often pose constraints to development:

a. **Users' Role:** Rural development in most WANA countries involves tension between accelerating agricultural production and the need for environmental protection. Finding a practical developmental solution lies not in stopping economic development, but in improving the use and management of natural resources. A key factor in this is encouraging and enabling resource users themselves to form emerging environmental and natural resources management systems[27]. Since natural resources are scarce and threatened in the dry areas of WANA countries, better social organizations and institutions should be encouraged so that they may lead to better use, protection and management of these limited resources.

b. **Rural Social Organizations:** Development of formal community organizations in rural areas currently lags far behind that in urban areas of WANA countries. This organizational differential accounts for the vulnerability of rural communities to powerful external forces, including the state, the market and other extractive agents. It is imperative therefore to increase, diversify, and strengthen the various types of formal organizations prevailing among rural communities for modern agricultural development. The forms of social organization prevailing in rural areas vary according to culture, and to the kinds of natural resources used and managed locally. A single organization is often unable to represent and mobilize an entire village community for collective action due to its inherent heterogeneity and competing interests. Weak nation states and ineffective governmental agencies have advocated the potential of modernizing traditional institutions' effective for today's challenges. These revised organizations have been only partially successful. There is a need to distinguish between users' organizations possessing adequate access to natural

[27] Cernea, M. 1992. Users' organizations for resource use and environmental management. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992

resources for sustaining human and livestock populations, and those with inadequate access (Table 4.1). When human and livestock population levels exceed the carrying capacity of the land, the productivity and quality of the environment deteriorates. Farmers could protect or abuse natural resources and the environment depending on their management practices.

c. **Users' Organizations in Senegal:** There have been some instances where social organizations have successfully overcome the difficulties experienced elsewhere, such as the users' organization in the Senegal Livestock Development Project. This project involved the creation of a user-based system for managing natural resources in a semi-arid area of West Senegal[28]. It covered an area of about 1.3 million hectares of grasslands, and focused on improving rangeland and water management in developing animal husbandry and farming (Table 4.2). Two successive World Bank-financed projects assisted the country's agro-pastoral population in this zone over the periods 1976-82 and 1983-89. The project succeeded in combining production, environmental, social and institutional programs; in introducing the establishment of users' organizations; in ensuring the state's protection of tenurial rights; in improving technology for sustainable resource use; and in developing a human-resource base (Table 4.3).

d. **Government's Role:** When governments assume responsibility for managing rangelands and natural resources in the dry areas of many WANA countries, traditional management systems for natural resources conservation tend to break down, and farmers lose their traditional commitment to the local community. This situation needs to be reversed so that governments provide a climate for local management of natural resources.

e. **Farmers' Role:** When farmers have control over the natural resources they use, they are far more likely to play an active role in their management, conservation and sustainability. Land users usually act as protectors when they are actively involved in the use of natural resources and environment, and can feel the immediate impact of their activities. The farmer should not be viewed as a liability or nonentity by the government in natural resources management, but as a source for investment in education and training; this will strengthen the structure and dynamics of their local community and users' organizations in the agricultural production process. The creation of a negative perception about farmers being a liability at the local level has considerable impact among farmers at the provincial and national levels. Farmers in the WANA drylands try to earn a livelihood under harsh biophysical and socio-economic conditions.

---

[28] Cernea, M. (Ed.) 1985. Putting people first: sociological variables in rural development. New York: Oxford University Press

They should, therefore, be educated and trained on issues of natural resources management and conservation — and not coerced into conservation without their tacit approval and active cooperation.

f. **Farmers' Participation:** While efforts to enhance farmers' participation in natural resources management through the creation of users' organizations may work on a small and local scale, such groups often meet with little success on a provincial or national scale because of a diversity of interests, both internal and external. In Syria, for example, owners of livestock on rangelands were organized into cooperatives which received free veterinary services, subsidized feed grains, and other forms of support. While the participating local cooperatives were well-managed and productive, this strategy failed when extended to cover the entire country due to the diverse interests of individual groups.

g. **Role of Urban Dwellers:** Awareness of the problems of dryland agricultural and environmental management in WANA countries should be extended to urban dwellers, who usually have little regard for the rural areas and their populations, and their central role in providing food.

h. **Role of Indigenous Groups:** Indigenous knowledge about the local environment, and about agricultural production and management techniques, should be fully considered when searching for the most appropriate technology for local use in WANA countries. Indigenous groups and organizations are a resource, and are more likely to be effective than user associations created by external forces. In many WANA countries, traditional organizations have collapsed or no longer exist due to the enforced dislocation of human populations.

Table 4.1: Steps Taken Locally for Sustainable Resource Use in the Semi-Arid Zones of Western Senegal

Areas of Action	Steps
PLANNING	* Map the forage and water resources available within each pastoral association
	* Map the habitual routes of herd movements during the dry and wet seasons
	* Identify and analyze with herders the problems and potential of grazing and water resources
	* Produce a rational grazing management plan for each pastoral association
IMPLEMENTATION	* Build a series of new wells and ponds for herders
	* Provide pastoralists with animal health services
	* Assist pastoralists in livestock marketing

SOURCE: Adapted from Cernea, M. 1992. Users' organizations for resource use and environmental management. Aleppo Seminar Paper.

Table 4.2: Macro-Factors Contributing to Improved and Sustainable Natural Resource Use in the Semi-Arid Zones of Western Senegal

Factors	Detailed Specifications
GOVERNMENT INTERVENTION	* Clarify tenurial arrangements over land and water resources * Ensure responsibility of all tenurial arrangements to users' interests
LEGAL INSTRUMENTS	* Design and institute legal instruments to protect rangelands and water resources from use and abuse by outsiders * Provide adequate administrative power for enforcing legal instruments for land and water resources
FINANCIAL INSTRUMENTS	* Encourage resource users to mobilize their own financial resources by providing official credit at below market rates to organized groups of users only
PUBLIC SECTOR INTERVENTION	* Invest in developing water resources in the local area * Ensure a more balanced use of alternative grazing areas
TECHNICAL ASSISTANCE	* Provide grazing management plans and techniques to rangeland users * Train and motivate resource users to manage pastoral production in an environmentally-sound manner

SOURCE: Adapted from Cernea, M. 1992. Users' organizations for resource use and environmental management. Aleppo Seminar Paper.

Table 4.3: Criteria for Successful Organization of Grazing Systems in Rangelands

Area	Criteria
SOCIO-ECONOMIC	* Yield maximum possible grazing products per year on a sustainable basis * Maintain an economic balance between the number of animals per unit area and its vegetation or carrying capacity * Minimize all undue social dislocation of human populations or their herds * Minimize inequities between different rangeland users
ECOLOGICAL	* Maximize and stabilize vegetation composition and structure * Maximize and stabilize soil structure and properties * Maximize and stabilize land productivity

SOURCE: Adapted from Cernea, M. 1992. Users' organizations for resource use and environmental management. Aleppo Seminar Paper.

Existing Conditions of WANA Rangelands

28. Rangelands in the WANA countries cover an area of about 510 million hectares, and are threatened by overgrazing. Animal feed shortage is about 25 million tonnes in these countries, and may double by the end of the century if no steps are taken to improve rangeland management and combat desertification[29]. Effective management and conservation of rangelands in WANA countries requires the creation of popular institutions to mobilize all range users. Such institutions should encourage the adoption of low-cost systems which maintain the natural resource base, and blend practical and appropriate technology with traditional practices and organization. Ideally, an ecologically-sound but acceptable grazing system should maximize the annual yield of grazing products or feed on a sustainable basis without changing vegetation composition, structure and productivity, without altering the soil structure and properties, and without causing undue social dislocation and/or inequities among rangeland users (Table 4.3). Achieving these multiple objectives requires dynamically adjustable human and grazing pressures. An equilibrium between livestock populations per unit area and vegetation cover is needed, varying according to natural, social, and cultural practices and traditions in WANA countries. Key variables for successfully managing rangelands in WANA countries include:

a. **Traditional Land Institutions:** An important traditional institution for land management in WANA countries is the *Hemma* tribal rangeland management system with a long history in Arabia, Syria, and Iraq. With the advent of Islam, rangelands, water, salt, and mineral deposits became public resources, and some new *Hemma* systems including the governmental, the welfare, and the *Ihya al-Ard al-Muat* (Barren Land Reclamation/Rehabilitation) *hemmas* were superimposed on land types in WANA countries (Table 4.4). Many changes have occurred between the 7th and the 20th centuries as a consequence of interactions affecting natural resources management in the WANA countries (Figure 6). Negotiated and imposed organizational systems were introduced around the 1950s as a consequence of population pressures and political changes in the WANA countries. These new systems have clashed occasionally with the traditional *Hemma* systems.

---

[29] Sankary, M. 1992. Local participation and the organization for natural resources conservation and development in the WANA region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992

b. **Public Participation:** In terms of local participation in rangeland management, various kinds of interactions exist between a rangeman and an organization (Table 4.5) in WANA countries, which differ from one activity to another, and from one country to another. Most range management systems in WANA countries face a number of challenges and constraints including the lack of inputs, poor participation by the local community in resource conservation and revegetation, weak or non-enforced legislation, lack of community leadership, erosion of traditional knowledge and democratic structures, and unchecked livestock herd size and movements.

Table 4.4: The Ottoman Land Classification in WANA Countries

Land type	Definition
Mulk	Absolutely freehold land governed by provisions of sacred law (Shariah) and not by those of civil statue law
Miri	Absolute ownership of land belongs to the State, but usufruct rights belong to the individual
Waqf	Land dedicated to religious and benevolent purposes such as mosques, schools and hospitals
Matruka	Land reserved for public purposes such as roads, rivers, public buildings, market places and village threshing floors
Mawat (or *Mubah*)	Dead or unreclaimed lands, desert or empty lands, absolutely owned by the State, with individual persons bringing such land under cultivation over a fixed period able to acquire *miri* ownership or usufruct rights

SOURCE: Adapted from Nordblom, T. 1992. Land tenure, social systems, and institutions for dryland farming. Aleppo Seminar Paper.

c. **Historical Changes in Rangeland Systems:** Historically, the organization of Arabian rangelands from traditional tribal *hemmas* has evolved through seven phases (Figure 6), reflecting governmental and religious interventions. Each change in the pattern has involved interactions between a rangeman and his organization, on and off the range, which could have positive, neutral or negative impacts (Table 4.5). While loose organizations favored low population densities and livestock stocking rates, participation made organizations cohesive and effective for managing scarce resources. However, external factors have often contributed to domineering patterns in and ineffectiveness of organizations. The nature of participation in range management activities varies between WANA countries (Table 4.6). Social change in general generates various other impacts on the rangelands (Table 4.7). The major task confronting rangeland management organizations in WANA countries is to rationalize grazing and non-grazing uses according to seasonal and annual

variations in vegetation and natural resources, and to promote participation so as to improve group cohesion, reduce over-dominance of a group by individuals, and reduce environmental degradation.

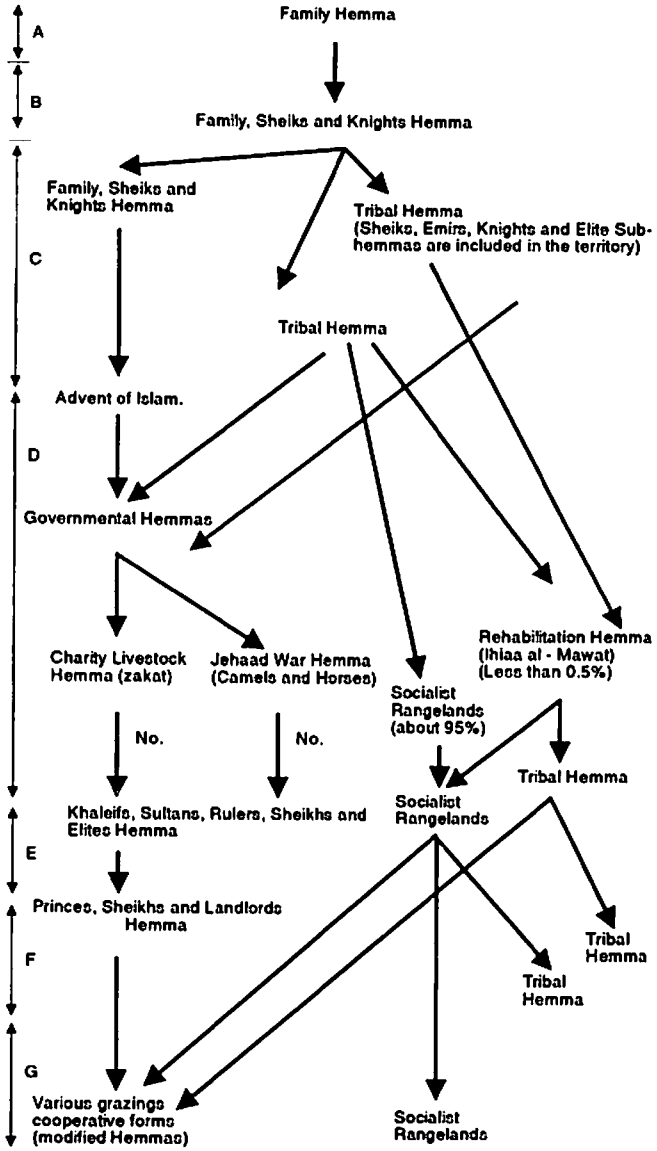


Figure 6: Evolution of Organization Systems of Rangemen and Rangelands in Arab countries

Table 4.5: Types of Interactions between a Rangeman (R) and his Organization (O) (Symbols: + Benefits, 0 No effect, and - Loss)

Organization Type	Interaction Type	On Range		Off Range		Local Participation	Remarks
		R	O	R	O		
1. FREE or LOOSE	NEUTRAL	0	0	0	0	0	Low population and stocking rates
2. CRUSHY LOOSE	COMPETITIVE	-	-	0	0	0	Due to failed domestic policies; causes desertification, social unrest
3. INCOHERENT	INCOHERENT	+	-	0	0	0	Adapted to buffer of ample oil revenues
4. TRIBAL SHEIKHDOM	CONSOLIDATION	+	+	0	-	+	Weaker tribes migrate to poor rangelands
5. AUXILIARY	COMMENSAL	+	0	-	0	+	Result in relief and subsidy systems
6. COOPERATIVE	COOPERATION	+	+	0	0	+	Shapes organization and hierarchy
7. UNIONS	MUTUALISTIC	+	+	-	-	+	Zealous leadership and devoted followers
8. DEGRADED COOPERATIVE (1)	AMENSALISTIC	0	-	0	0	-	Inverted pyramidal system
9. DEGRADED COOPERATIVE (2)	DOMINEERING	+	-	-	+	+	Strong hierarchical organization of semi-enforced cooperatives
10. DEGRADED COOPERATIVE (3)	DOMINEERING	-	+	0	-	-	Strong hierarchical organization of semi-enforced cooperatives
11. DEGRADED COOPERATIVE (4)	OPPORTUNISTIC	+	-	0	0	+	?

Table 4.5 (*contd.*)

Organization Type	Interaction Type	On Range R	On Range O	Off Range R	Off Range O	Local Participation	Remarks
12. FALSE	DESTRUCTIVE	–	–	–	–	–	Cause desertification
13. UTOPIAN	IDEALISTIC	+	+	+	+	+	Unknown

SOURCE: Sankary, M. 1992. Local participation and organization for natural resources conservation and development in the WANA region. Aleppo Seminar Paper.

Table 4.6: Participatory Activities in Dryland Range Management in Selected WANA Countries

Range Activities	Countries								
	Syria	Jordan	S. Arabia	Oman	Libya	Tunisia	Algeria	Morocco	Mauritania
WATER POINTS DEVELOPMENT:									
Wells	IGP	IG	IG	GIP	GPI	GPI	GPI	IPG	GIP
Cisterns	IP	IP	IP	IP	IPG	IPG	IPG	IPG	IGP
WATER HARVESTING & EROSION CONTROL:									
Earth Dams	G	G	G		G	IPG	GP	GP	IPG
Dikes		G	G	P	G	PG	GP	G	GP
Gabions		G	G		G	GP	GP	G	
Soil Ripping	GP	GP	G		GPI	GP	GP	GP	G
TRANSPLANTING & SEEDING:	GPI	GP	G		G	GP	GP	GP	GP
FEED RESERVES:									
Food Acquisition	GI-	GI-->PI	GI-->I	GI-->I	GI-->PI	GI-->PI	GI-->PI	GI-->PI	GI-->PI
Food Storage	>PI	GIP	GI	GI	GIP	GPI	GIP	GIP	GIP
Marginal Lands	GIP	GIP	I	I	GI	GIP	GIP	GIP	GIP
for Barley	GIP								

Table 4.7: Deteriorating Trends in Social Change on Rangelands in WANA Countries

Social Change	Impacts
WEAKER CONTROL OF GRAZING LANDS BY PASTORAL COMMUNITIES	Shift in control and decision-making on rangelands to government agencies, and sometimes to large scale livestock owners and traders
MASS MIGRATION TO URBAN AREAS	Weakening in the capacity of pastoral communities to control grazing resources
RISING MEAT DEMAND IN URBAN AREAS	Grazing by large scale livestock owners, and subsequent degradation of rangelands
ABANDONMENT OF TRADITIONAL *Hemma* SYSTEMS OF GRAZING RESERVES AND DEFERRED GRAZING	Loss of some annual species of forage and fodder species
IMPLEMENTING WATER DEVELOPMENT PROJECTS	Overgrazing in the vicinity of water points
CULTIVATION OF MARGINAL RAINFALL LANDS UNDER PERMANENT PASTURE-GRAIN PRODUCTION	Desertification, and loss of valuable grazing

SOURCE: Adapted from Qureshi, A. 1991, *In* Nordblom, T. 1992. Land tenure, social systems, and institutions for dryland farming. Aleppo Seminar Paper.

Land Tenure

29. Land tenure laws and property rights generally are creations and conventions of society, and are only as strong as the society itself makes them. All land developed over the last 250 years in the large dryland farming and pastoral regions of Australia and North America is either privately or publicly owned under English Common Law[30]. In WANA countries, large areas of publicly-owned lands have been given under long-term leases to private individuals for dryland farming.

[30] Nordblom, T. 1992. Land tenure, social systems and institutions for dryland farming. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992

Sustainable development policies for dryland farming in these countries should carefully consider several issues, including environmental conservation, land use planning, natural resources management, land reforms, property rights laws and land management practices.

a. **Land Ownership and Taxes:** Land ownership has an old history in WANA countries, with successive civilizations and governments imposing their own different controls on land use. The spread of Islam in the region, beginning in the 7th century, brought further changes under religious laws of the state. The Islamic State was centered initially in Medina and later in Damascus, Baghdad, Cairo, and finally Istanbul. It systemized taxes on land into a pattern under Islamic (*shariah*) Law, which has been followed for more than a thousand years in Islamic countries. Muslims paid *zakat* (alms); all property owners paid a tax on their lands or buildings; and Christians and Jews paid a *jizyah* (head tax). The Muslim Abbasid Dynasty (762-1258 AD) began the practice of making *iqta'* (land grant) to their bureaucrats instead of paying salaries; this was intended as to provide a short-term delegation of user rights to a piece of state-owned land or property. The Ottoman Empire was founded in 1516 AD and stretched from Hungary in the northwest to the Persian Gulf in the east, including all the Arab countries. It established the Ottoman Land Code of 1858 as the legal basis of land tenure until the 1930s, when land laws were changed. The 1858 Code replaced a confused mass of legislation with an orderly system of five categories of land: *Mulk*, *Miri*, *Waqf*, *Matruka*, and *Mawat* (Table 4.4). Types of land tenure and social systems vary from one country to another in the WANA region. For example, communal (*mubaha*) ownership of village farmland with occasional reallocation of farm strips among families is typical in Syria and Jordan. Coordination of crop rotation at the village level has also been practiced. From the early 19th to the early 20th century, communal or tribal forms of land tenure were replaced by forms of private ownership; and subsistence farming was replaced by market-oriented farming.
b. **Modern Land Reforms:** In the 1950s and 1960s, most newly-independent WANA countries implemented land reform programs to redress gross inequalities in the distribution of land holding and rural incomes inherited from the Ottoman and subsequent colonial or mandate periods. Over the past four decades, the pastoral system of land and livestock management in these countries has deteriorated, and has manifested itself in many ways. Solutions to most of this deterioration will have to be local and adapted to the conditions of each country. Nevertheless, some advantage may be taken from similar experiences around the world.
c. **Land Reform Laws:** There appears to be no coordination between various government agencies responsible for land reform and land use management

within and between adjacent WANA countries. National agencies should examine carefully all issues related to land reform laws, including:

- Size of landholdings;
- Relationship between landowners and land managers;
- Fragmentation of land-tenure systems resulting from the Islamic Laws on inheritance, and large landholdings resulting from the English Common Law;
- Legal grounds for collectively managing small landholdings by a social group or users' organization; and
- Means of improving the coordination between the public sector and the concerned communities in communal projects.

Property and land claims based on "divine" or "traditional" rights may be respected within a society, but not necessarily by other societies. Based on their religious beliefs, some cultures consider land as "sacred as a wife" and discourage its sale. However, such beliefs may die out within a few generations, and be replaced by the development of land markets and the emergence of a society which considers money more important than land.

d. **Land Ethics:** Property ownership should not be confused with land management in WANA countries. Land should be managed by the community for the collective good, and those who do not use their land in a sustainable manner should lose their right to its management.

e. **Land Ownership:** Well-defined land boundaries provide communities with an incentive to invest in maintaining their pastoral drylands in WANA countries. Secure land ownership motivates individuals and communities to invest in improving and sustaining their land resources. In the case of transhumant herdsmen who leave their land to graze their herds elsewhere, there must be an assurance that no one else will use their land in their absence. Land stewardship can be changed through better technology, international investments, and societal shifts. Government policies which establish permanent pastures with good grazing management need not be in conflict with regulations that require farmers to plow and sow barley or lose access to state land (*miri*). Although the two systems cannot be intellectually reconciled, they both strive to achieve the same goal — namely, regulating natural resource use in order to achieve higher productivity and sustainability. Regulations should help farmers secure their livelihood by permanent pastures and maintenance of natural resources management in the area.

Demographic Changes and Urbanization

30. Planners in WANA countries are generally unaware of, or unconcerned about, the long-term needs of their societies. The projected tripling or quadrupling of the population in these countries over the next century is not being adequately addressed in relation to either agricultural or urban development policies. Most of the rural-urban migration in WANA countries, especially from pastoral zones, is dominated by farmer pastoralists who end up husbanding domesticated animals in their settlements. Despite the potential of urban livestock contributing to overall agricultural productivity, local governments tend to discourage such practices for sanitary and aesthetic reasons. Furthermore, urban expansion is pushing farming onto marginal lands throughout the dry areas of WANA countries. Unplanned urban growth usually results in a variety of unhealthy situations — including scattered human settlements, loss of arable lands, and the establishment of residential communities without the minimum of urban services, such as water, sewerage and electricity.

Knowledge Transfer

31. In the dry areas of WANA countries, successful dryland farming strategies are highly site-specific. There is no single formula or strategy for reviving communal forms of pastoral land management and attaining sustainability in all countries. While a good generic framework could be formulated, it would have to be adapted to fit the specific social, economic, and religious situations of a country. Land use management policies and practices from countries such as Australia and the United States may not be altogether valid for WANA countries, due to differences in cultural and value systems; but may nevertheless provide a useful exchange of experiences for local consideration. Ultimately, WANA countries should evolve their own dryland management responses to unique environmental, political, socio-economic and cultural circumstances. Successful external experience should be assessed carefully based on its applicability, transferability, adaptability and effectiveness in formulating national or provincial strategic plans.

Land Conservation

32. Short-term economic concerns in land use have often outweighed longer-term needs of society in WANA countries. Since sustainable production of food

and feed is a primary objective in the dry lands of these countries, all appropriate measures should be taken to prevent or minimize:

- Cultivation of highly erodible soils;
- Overgrazing rangelands;
- Gathering shrubs in excess of their regrowth potentials;
- Tapping of aquifers at rates exceeding their recharge; and
- Harvesting timber from old-growth forests at rates exceeding their regeneration.

Government Financial Policies

33. Natural resources management, especially of land and water, is crucial for WANA countries since economic development cannot be sustained generally without adopting sound environmental policies, and since most national economies depend on their environmental base. Achieving sustainable development by these countries encompasses economic growth, poverty reduction, natural resources conservation and environmental protection. It is an essential goal since government financial policies (mainly fiscal and pricing policies) always affect the overall management of the natural resources and, thereby, the environment. Most governments in WANA countries have intervened in the market process through formal national plans, public ownership of economic enterprises, and the manipulation of input and output prices (Table 4.8). Such interventions have led in many cases to price distortions thereby adversely affecting natural resources allocation and economic performance (Figure 7). Governments' interventions, especially in agricultural product markets, have kept domestic food prices low — thereby reducing agricultural incomes, discouraging producers from investing in land development and conservation, exacerbating rural-urban migration, and adversely affecting the poorest segment of the rural population. In many instances, government financial policies have caused pressure on natural resources and the environment, and thus reduced economic growth and welfare. For example, excessive use of water, pesticides, fertilizers, and other resources have been a direct or indirect consequence of government subsidies (Table 4.9-4.11)[31]. These policies have proved expensive to maintain and detrimental to agricultural productivity, and have drained national budgets with costs that exceed benefits (Table 4.12). Various aspects of financial policy reform need deeper consideration:

---

[31] Abbadi, K. 1992. Financial policy distortions for land and water resources management. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992

a. **Financial Policy Reforms:** Financial policy reforms are needed to address land and water resources management problems in WANA countries. Before recommending changes to existing policies, it is necessary first to examine the issues related to financial policies in each country, and then to assess the impacts of these policies on management of land and water resources. To achieve sustainable development, WANA countries should undertake major changes in:

- Setting economic policies,
- Assigning roles to institutions,
- Formulating an incentives structure,
- Developing public participation in the development process, and
- Mitigating price distortions in the markets for inputs and products.

Policies must address problems in the market, especially those related to secured property rights of land and externalities with their dual spatial and temporal forms.

b. **Measurement of Financial Policy Reforms:** In view of the scarcity of land and water, and land degradation in most WANA countries, preventive and corrective measures of an economic, institutional and technical nature are needed to ensure the appropriate and efficient use of these limited natural resources:

(1) Reduced role of government, particularly central planning agencies, in the development process, and delegation of more responsibility to farmers;
(2) Limiting the role of the public sector in allocating resources in the agricultural sector to developing the needed infrastructure such as dams, roads, irrigation systems, and other public works;
(3) Controlling rapid and unchecked human population growth in WANA countries, since it represents an increasingly serious impediment to development — and pressure on the land beyond its carrying capacity;
(4) Revising existing immigration policies to reflect the instability of foreign labor markets;
(5) Improving land tenure conditions, subsequently requiring all farmers to pay for land and water resources, so that they will have an incentive to manage and conserve such scarce resources properly;
(6) Being aware that well-meaning government actions do not always result in efficient land and water management. Examples include the adverse effects of price fluctuations, due to government interventions in agricultural input and output markets together with market failure, on land and water use in WANA countries; and the profound misuse of

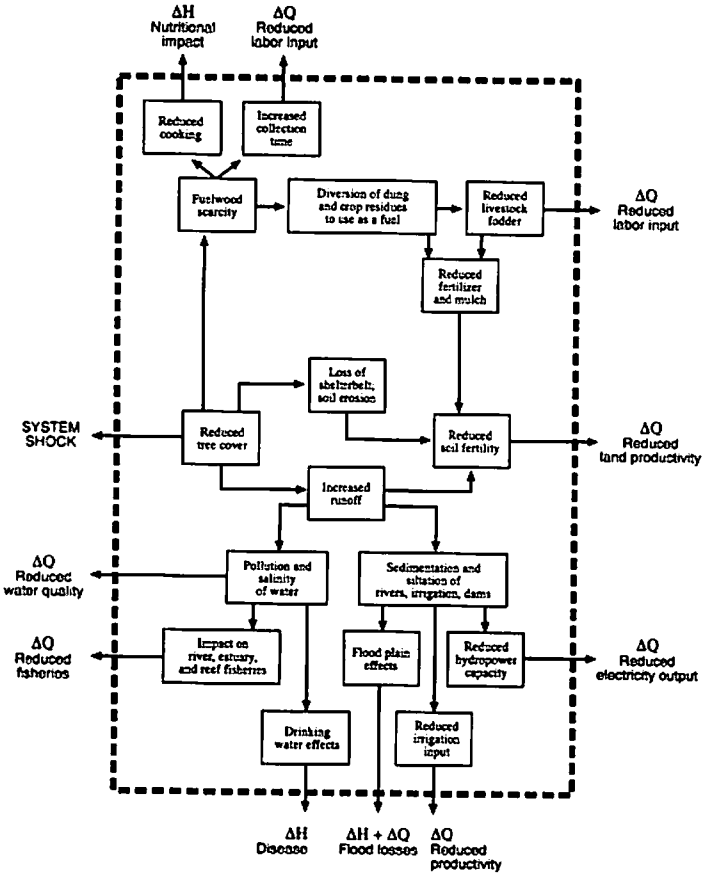
agricultural inputs in Egypt and Saudi Arabia (fertilizers in the former and water in the latter), due to government intervention;

(7) Improving access to external inputs, and to social and economic infrastructure for agricultural production;

(8) Regulating the use of such inputs as water, fertilizers, pesticides, etc., on the basis of economic viability, preventing their misuse and reducing their adverse impacts on land and water resources;

(9) Minimizing soil salinization and waterlogging by installing or upgrading drainage facilities where irrigated agriculture is practiced; and

(10) Developing appropriate and less harmful alternatives to chemical, pesticide and fertilizer inputs.



Note: ΔQ Refers to effects that show up in measured or measureable indicators of development. ΔH refers to effects on health.

SOURCE: Schramm and Warford

Figure 7: Linkages Between a Developing Economy and its Ecosystem

Table 4.8: Comparison of Agricultural Subsidies in WANA Countries

Non-Oil Exporting Countries	Oil Exporting Countries
• Food subsidies for consumers	
• Low producer prices	• Output subsidies to achieve self-sufficiency
• Input subsidies for production	• Input subsidies to stimulate production

SOURCE: Adapted from Karrar, A. 1992. Impact of financial policies on management of land and water resources. Aleppo Seminar Paper.

Table 4.9: Impact of Irrigation Water Subsidies in WANA Countries

Positive Effects	Negative Effects
• Contribution to agricultural growth by enabling farmers to intensify production through:	• Deficiencies in operation and maintenance of irrigation systems
(a) Shifts in cropping patterns, and	• Increasing fiscal drain on the central government budget
(b) Adoption of high-yielding varieties that respond well to fertilization	• Adverse environmental impacts including:
	(a) Promotion of waterlogging, salinization, and soil erosion;
	(b) Providing habitats for disease vectors or carriers
	• Creating a beneficiary class of "rent seekers" who receive an undervalued resource and raise questions about equity in income distribution
	• Adverse impacts on future investment opportunities

SOURCE: Adapted from Abbadi, K. 1992. Impact of financial policies on management of land and water resources. Aleppo Seminar Paper.

Table 4.10: Impact of Pesticide Subsidies in WANA Countries

Positive Effects	Negative Effects
• Subsidies contribute: (a) to increases in crop yields, and (b) to improvement in overall agricultural and economic performance	• Serious health hazards especially to farmers and workers exposed to the dangers of highly toxic substances, since in most WANA countries farmers do not have adequate knowledge or means to take all needed precautions • Extensive injury through the consumption of contaminated food and the use of contaminated containers and implements • Ecological risks including the destruction of non-target species, the emergence of new pests as their predators are eliminated, and the development of pesticide resistance in target population, leading to crop losses and high costs of crop protection • Fiscal drainage of the central budget • Distortion of most farm economic decisions • Diminished rural employment opportunities • Emergence of equity issues since subsidy allocation usually conforms to distribution in the size of land holdings, usually highly skewed. This further favors large-scale farmers

SOURCE: Adapted from Abbadi, K. 1992. Impact of financial policies on management of land and water resources. Aleppo Seminar Paper.

Table 4.11: Impact of Fertilizer Subsidies in WANA Countries

Positive effects	Negative effects
• Help farmers overcome uncertainties and risks associated with the adoption of new technologies	• Contribute to distortion of options and decisionmaking by farmers, especially in relation to cropping patterns and input mix
• Contribute to achievement of higher yields	• Reduce farmer's incentives to practice soil conservation
	• Contribute towards inequitable distribution of income when large-scale farmers, already better capture more gains
	• Necessitate the creation of public agencies for regulating supplies and distribution
	• Cause environmental degradation, including adverse effects on soil structure, land productivity, and off-farm pollution

SOURCE: Adapted from Abbadi, K. 1992. Impact of financial policies on management of land and water resources. Aleppo Seminar Paper.

Table 4.12: Horticultural Inputs in Selected WANA Countries, 1975-87

Countries	Cropland		Average Annual Fertilizer Use (kg. per ha. cropland)		Average Annual Pesticide Use (m. tons active ingredient)		Tractors		Harvesters	
	Total (x1000 ha) 1987	Ha/per Capita 1989	1975-77	1985-87	1975-77	1982-84	Annual Average Number 1985-87	Percent change Since 1975-77	Annual Average Number 1985-87	Percent Change Since 1975-77
Algeria	7,540	0.31	19	37	16,457	21,400	81,373	95	8,073	107
Egypt	2,560	0.05	188	347	26,970	19,567	44,000	100	2,250	12
Libya	2,145	0.49	21	24	2,610	2,017	29,567	98	0	x
Mauritania	199	0.10	7	7	11	x	315	43	0	x
Morocco	8,462	0.35	23	36	2,225	3,350	32,000	45	3,187	14
Somalia	933	0.13	4	3	x	x	2,043	50	0	x
Sudan	12,478	0.51	6	4	x	x	19,000	110	1,190	25
Tunisia	4,680	0.59	10	21	x	1,330	26,100	7	2,587	9
Iraq	5,450	0.30	8	36	x	x	40,305	101	2,977	37
Jordan	414	0.10	16	34	x	x	4,840	24	340	70
Kuwait	4	0.00	100	139	x	x	91	361	0	x
Lebanon	301	0.10	74	81	x	x	3,000	0	90	0
Oman	48	0.03	12	96	x	x	127	67	27	158
Saudi Arabia	1,180	0.09	7	337	x	x	1,750	108	563	88
Syria	5,630	0.47	15	42	x	4,892	47,977	164	2,890	37
United Arab Emirates	19	0.01	85	153	x	x	x	x	x	x
Yemen AR	1,360	0.18	3	10	325	1,614	2,180	66	0	x
Yemen RDA	119	0.05	7	13	x	x	3,021	56	15	25
AFRICA	185,424	0.30	14	19	x	x	535,798	29	535,798	42
ASIA	450,920	0.15	42	93	x	x	4790,874	128	1248,829	113
WORLD	1473,699	0.28	67	91	x	x	25252,192	31	3953,208	28

SOURCE: WRI, 1991. World Resources Report, 1990-91. Washington, DC: World Resources Institute

Environmental Awareness

34. There is a need for greater awareness of the linkages between environmental degradation and human poverty in relation to natural resources management in WANA countries, especially in the dry areas. While long-term environmental protection provides lower farm incomes in the short-run, human poverty can dictate a perilously short-term approach to the exploitation of natural resources for the sake of survival. There is an urgent need to:

- increase public and government awareness to the scarcity of land and water resources, and the need to manage and conserve them; and
- provide farmers with options for managing their agricultural resources, and educate them about the significance of environmentally sound management practices.

Risks and Uncertainty in Agricultural Production

35. Several factors contribute to risks and uncertainty in agricultural production. They are economic, physical and social. Economic factors encompass prices and markets; physical factors involve the complex interaction of natural resources and the environment; and social factors include cultural beliefs, social behavior, group dynamics, information, and communication processes[32]. The unpredictability of annual crops depending heavily on the combination of these three factors is the basic source of uncertainty in dryland agricultural production. Eventually, the phenomenon of uncertainty is translated into a subjective assessment of risk, which people react differently depending on availability of information, education, wealth, experience and their own psychology. Several aspects of agricultural risk and uncertainty are particularly important in dryland farming in WANA countries:

a. **Risk Assessment Agents:** The risks involved in unpredictable agricultural production have to be seen through the eyes of two groups: policymakers and agricultural producers; and secondly marketing agents and agroindustrial processors. Judicious management of risks by these two groups decreases output uncertainty and variability, and contributes to provision of adequate

---

[32] Somel, K. 1992. Risk management in rainfed agriculture in the Middle East and North Africa (MENA) countries. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992

goods for human and animal consumption and agro-industries. Farmers apply various common-sense strategies to manage the risks involved in agricultural production, including diversification of crop production, incorporating production in their farm operations, and finding off-farm employment. However, some government policies generate counterproductive effects in risk management by providing disincentives for crop diversification, and by encouraging increases in food self-sufficiency while neglecting to exploit a country's comparative advantage. Conflicts and contradictions between policymakers and farmers can be expected, since each looks at risk management from a different perspective. Although there are no easy solutions for such a dilemma, a wise approach may be:

- to emphasize the private sector and markets as the primary media for resource allocation through market prices;
- to complement this, through judicious policies, with regulated markets, strategic stocks, and targeted supports;
- to promote education, provide adequate facilities for the communication of market information, and to focus on farmer-oriented adaptive research and extension programs; and
- to implement a well-maintained agricultural and marketing infrastructure.

b. **Types of Agriculture Risks:** Governments, policymakers and farmers face considerable risks in rainfed or dryland agricultural production[33]. Those risks taken by governments and policymakers are:

- Fluctuations in agricultural production due to unpredictable weather conditions; and
- Unresponsive, rigid government policies that do not change as fast as production conditions; for example, environmental degradation, which is usually dealt with when it is too late to take practical and economically viable counter-measures; or when policies actually result in favoring one group of farmers over another.

Those risks taken by farmers include:

---

[33] Somel, K. 1992. Tradeoffs between yield levels and yield variability: an example of fertilizer use on rainfed barley. Paper presented at EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February 1992

- Unpredictable weather conditions;
- Input and output price fluctuations;
- Insecure land tenureship; and
- Lack of land markets.

All these risks reduce investment incentives. Furthermore, in many cases and as a result of government policies, farmers who are better off get the larger subsidies, while those most in need receive very little government support.

c. **Role of Governments:** Both governments and farmers employ risk management strategies to counterbalance the effects of risk on agricultural production. Governments usually work through the agencies of the public sector to implement their strategies, including:

- Making credit available to farmers, and trying to control all strategic agricultural inputs and outputs, as a means to minimize risk. For example, the Turkish government provides financial assistance to farmers when hail storms strike and reduce yields heavily; the Lebanese government endeavors to reduce farmers' risks through soil and water conservation measures; and similarly the Tunisian government has a very high profile soil and water conservation and management program.
- Pursuing the goal of food self-sufficiency — which, though attractive, is largely unattainable — as another means to manage risk. Governments see food self-sufficiency as a risk avoidance measure, necessary because of perceived vulnerability to the whims of foreign powers, thus making it justifiable on political, and not economic, grounds. Such a policy may be inevitable until WANA countries achieve a state of mutual trust and a perception of mutual strategic interests.
- The Tunisian government is currently building small farm ponds to catch runoff and regenerate local aquifers. The World Bank is not convinced of its long-term economic feasibility and has refrained from providing funding. In this case, the Tunisian government policy blurs the distinction between rainfed and irrigated agriculture, and underscores the close relationship and interdependency between the two.
- In the Sudan, farmers with large holdings (> 1,000 feddans) face risks of inadequate availability of foreign exchange, farm machinery spare parts, pesticides, export facilities, and markets; whereas the small farmers face the problem of survival. The Sudanese government is addressing these risks by supporting water and soil conservation measures, providing more financial support to agricultural credit institutions, and funding public works.

d. **Role of Farmers:** The risk management measures taken by farmers include off-farm employment, livestock rearing, etc.[34] For example, Lebanese farmers engage in the cultivation of illegal but highly profitable crops or in apiculture to reduce their risks; Tunisian farmers resort to off-farm employment as a common means to complement farm income, especially in times of risk; and the Maghreb and Turkish farmers purchase crop and livestock insurance. Risk management strategies or their deficiency directly affect agricultural production, farmers' incomes, the natural resource base and environmental quality. The absence of secure land tenureship and adequate produce prices is not conducive to preservation of the natural resource base. Poorer farmers are unable to concentrate on long-term sustainability when their immediate concern is short-term survival. These same unfavored farmers are also the victims of high interest rates on funds provided by local credit institutions.

e. **Role of Community Organizations:** Traditional groupings such as cooperatives and community organizations could provide effective input and guidance in policy formulation at the local level, but this alternative has not been fully exploited by farmers in WANA countries because governments have tended to impose associations and organizations onto farmers "from above", and then exploit them for political purposes largely unrelated to agriculture. As a consequence, farmers have developed an "immune response" to cooperatives. Such unfortunate experiences, however, should not serve to devalue the cooperatives' potential as an insurance mechanism against disaster.

f. **Role of Local Universities:** Agricultural research, extension, and education in local universities should be actively engaged in the search for appropriate risk management strategies. Research needs to focus on agroecological characterization, risk assessment, government pricing policies, market analysis and marketing structures. It should adopt an integrated approach to sustainability, taking into account traditional means of risk management. A similar approach should be taken in education and in the development of production technologies, with due regard to the experience of and feedback from farmers engaged in traditional risk management.

g. **Role of Government Policies:** Government policies in relation to risk management should evolve to reflect changes in people's food requirements and preferences. Human populations have grown rapidly in the WANA region, and meat and dairy products, fresh fruit and vegetables are in ever-increasing demand. Governments should consider meat not as a basic commodity, but a

---

[34] Somel, K. 1992. Agricultural diversification in the Middle East and North Africa. Paper presented at EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992

luxury, on the basis of its production costs and the impact of its production on natural resources and the environment. In the past, when human populations were smaller, it was easier to manage natural resources and conserve the environment, and such government policies and measures as prices or production subsidies were less costly. Today, the costs of natural resources and environmental conservation are much higher, and world economic trends are making subsidies on basic commodities increasingly unaffordable. In the short-term, abandoning the old policies may involve certain risks and cause some disorientation; but maintaining them in the long-term may very well prove to be far more dangerous. Excessive government intervention in the economy leads to heavy, non-productive burdens on the national budget; inflation; and overall economic imbalance. The responsibility for correcting these distortions lies with the policy-makers. Ideally, governments should perform a regulatory role rather than an active interventionist one.

Cost Benefit Approach

36. The cost-benefit analysis (CBA) approach is designed to ensure that proposed projects would eventually yield net benefits exceeding the costs of borrowing, and that policies would yield overall benefits in excess of overall costs. The approach relies on discounting future costs and benefits, and reducing them to simple parameters. Traditional project appraisals use "ideal" or economic prices, not just market prices — which are often adulterated by taxes and subsidies, or are affected by structural distortions. As well as calculating financial rates of return on projects, economists use "shadow prices" to calculate economic rates of return. Social rates of return are occasionally calculated to reflect the distribution of net benefits among project beneficiaries. Environmental impacts are occasionally integrated into project analysis. The cost-benefit approach has not been used comprehensively for drylands development in WANA countries. Some of the reasons for this include:

a. **Environment as a Capital:** The market in WANA countries usually sets values on environmental products and services that are much lower than their true worth. Projects that pollute or degrade the environment cause extra costs to society at large. Furthermore, agricultural raw materials such as wood or agriculture products tend to have prices that do not fully reflect their true environmental costs. By using "shadow" environment prices in project appraisal, economists are able to reflect the true value of these products; and care is needed to ascertain whether the costs of environmental inputs have been fully considered in the following situations:

- Reduction in land productivity;
- Atmospheric degradation;
- Quantitative or qualitative depletion in water resources;
- Loss of biological diversity.

b. **Environmental Degradation and National Accounting:** It is necessary to keep environmental capital intact for proper national income measurement, while distinguishing between renewable and nonrenewable resources[35]. Provisions made for environmental depreciation should, therefore, keep environmental capital intact, even though depreciation is inappropriate for renewable resources. And WANA countries should act urgently to incorporate ascertainable environmental degradation into national accounting.

c. **Environmental Satellite Accounts:** If the environmental cost of an economic activity is not fully deducted from what is conventionally considered as national income, then this income is overestimated. But it is not always easy to assess environmental damage in physical terms or to put a precise value on environmental impacts, and hence approximations have been attempted in several areas. The United Nations is in the process of revising the existing guidelines for calculating national income so as to add a set of Environmental Satellite Accounts that reflect the impact of environmental degradation on national income. WANA countries should establish such accounts to protect their drylands from further degradation.

d. **Rates of Return:** Project analysis uses several parameters, a key one being the rate of return; and the World Bank does not usually finance proposed projects that yield rates of return less than 15%. This is higher than in many projects currently under implementation, and thus appears unreasonable for their time horizons. Since determining the rates of return on some types of projects, such as in the education and health sectors, is imprecise, the World Bank has dropped traditional accounting and cost forecasting methods, and has instituted a formula capable of taking into account the long-term benefits of these types of projects. WANA countries need to review the rates of return on dryland agricultural projects, and assess whether they are realistic — and what their environmental consequences will be.

---

[35] El Serafy, S. 1991. The environment as capital. *In* R. Costanza (ed.), 1991. Ecological Economics: The Science and Management of Sustainability, pp 168-175. New York: Columbia University Press

Australia's Landcare Program

37. In 1990, ministers from all levels of government in Australia met and agreed on *The Decade of Landcare Plan* to promote sustainable land use and the ideals of Landcare[36]. The Landcare action plan coordinates research, education, community awareness and government policymaking; provides a basis for making funding decisions on resource allocation; and provides mechanisms for community participation in contributing to land use planning and management. The key elements of this program are elaborated below:

a. **Landcare Concept:** Landcare is an innovative management concept for achieving sustainable land use in all environments, by all sectors of the community and government. It is an ethos, an activity, a program, and a change of thinking about the responsibility for, and the use of natural resources in Australia. It involves an integrated framework for natural resources management at the local level, in terms of decision-making and action. As a national program, Landcare has developed out of discussions between the National Farmers' Federation and the Australian Conservation Foundation. As an activity, it promotes cooperation, provides technical and financial support to different parties, involves all stakeholders in the process of decision-making, broadens the focus of different groups involved, and works at the local level to achieve sustainable land use and to rehabilitate degraded areas. As an ethos, Landcare is about education and action to achieve the vision of sustainable land use. Its primary concern is the efficient and effective use of community, individual, and government resources in land management. The concept of Landcare is not new, since it is essentially a synthesis of various ideas and experiences which have made concepts like sustainable development and integrated resource management understandable to as large an audience as possible. It grew out of the need to create a forum for the exchange of views on land use management, and to narrow the gap between the competing interests of farmers and conservationists.
b. **Landcare Implementation:** Landcare is a problem-solving approach to land use management. It requires the cooperation of a wide range of government agencies and private groups. Its success in Australia has been largely through considerable and continuous effort in mobilizing support, technical and

---

[36] Marston, D. 1992. Landcare: An Australian program for community and government involvement in natural resource management. Paper presented at EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, at Aleppo, Syria, 16-27 February, 1992

otherwise, and the involvement of all concerned parties. The "Landcare" approach could only succeed where the political system and the bureaucratic infrastructure are committed to, and capable of, implementing its action plan. It would be difficult to implement the Landcare model where landowners lease their lands to tenant farmers, as in many WANA countries. Landlords who are not interested in long-term initiatives, such as Landcare, can put considerable pressure on tenants not to cooperate in these types of schemes. Financial incentives are critical for any scheme intended to achieve an ethos of sustainable land use. For a program such as Landcare to succeed in Australia, all necessary funds have had to be readily available when needed.

c. **Landcare Application in WANA Countries:** A land use system based on the Australian Landcare concept needs significant modification before its successful application in WANA countries. Attainment of sustainable land use in WANA countries will depend considerably on incorporating the following concerns in a system of Landcare: (a) changing the attitudes and activities of land managers and the general public, (b) providing government support to the country's social and economic framework, and (c) implementing remedial and preventive actions, both for short- and long-term goals (Table 4.13). Land degradation began in WANA countries when central governments imposed local organizations and cooperatives in order to control dislocated local communities, when the traditional rights of land users were exploited for political purposes, when new technologies for land management were abruptly or inappropriately introduced, when misguided government policies for land management were applied, and when interventions in the form of projects and programs were abruptly introduced by donor agencies in concert with central governments.

d. **Landcare Multiple Goals:** The successful application of the Landcare concept in WANA countries will depend on its sensitivity to local socioeconomic, cultural, and physical conditions, while pursuing the following goals:

- Raising public awareness about the importance and relevance of environmentally sustainable development and land use management;
- Educating the public and government officials about the existing misuse of environmental and natural resources, and the urgent need to take corrective and preventive measures to rectify such abuses;
- Implementing an extension service model that encompasses information sharing, group or collective advice, and exchange of experiences;
- Maximizing the use of local technical expertise, knowledge and understanding;
- Emphasizing the role of peer groups in land use management;
- Achieving the maximum level of power sharing in land use planning and

management between the government and the local community, and between urban and rural populations;

- Developing a procedure of conflict management among the various groups concerned, to be implemented ideally through an open public forum; and
- Discouraging and controlling unilateral actions and policies that could have an adverse impact on other land users.

e. **Conservation Traditions and Institutions:** The Arab countries in the WANA region abound with traditional examples of environmental and natural resources conservation laws, techniques and institutions which have incorporated many of the concepts of the Australian Landcare, such as the *hemma* system, the *Hisbah*, the *Waqf* and the *Ihya*[37]. In the past, farmers in WANA countries practiced sound land and water conservation techniques. These sensitive practices allowed communities such as those of the Yemen highlands and the steppe areas to live in harmony with their environment. Today, the success of applying any one of these traditional systems of management in WANA countries is highly dependent upon local situations, and the level of awareness of those involved.

Table 4.13: Actions for Reversing Land Degradation Trends in WANA Countries

Agencies	Actions
PUBLIC EDUCATION	Introduce a land conservation ethos into the educational system from the primary level
MASS MEDIA	Provide information to raise public awareness on issues of water and land conservation and environmental protection
RESEARCH & DEVELOPMENT	Include within the national research agenda a focus on surveying, analyzing, and modifying traditional systems of land management for adaptation to the modern contexts
AGRICULTURAL PRODUCTION & ENVIRONMENTAL PROTECTION	Target technological research and development, and agricultural extension services, towards the application of appropriate technologies for sound land management
	Improve the capacity for environmental assessment and accounting in various governmental agencies
LEGISLATION	Introduce stronger regulatory measures to tax the over-users or misuse of environmental and natural resources

[37] Hamed, S. 1992. Application of Shariah to natural resources planning and management. Journal of Agricultural and Environmental Ethics, 6 (2), pp. 145-164

National Agricultural Research

38. The WANA region is diverse biophysically, ethnically, and socio-economically; it contains 19-26 countries, depending on the basis of definition. Populations range from 105 million to less than half a million. In recent years, the problems faced by National Agricultural Research Systems (NARS) in WANA countries in building capacity to manage and implement sound research programs have been studied in detail[38]. Although extension services in the WANA region have not been studied comprehensively, the extension capability in each WANA country has been reviewed by the World Bank. The following are some issues confronting research and extension:

a. **National Agricultural Information Systems:** Agricultural Information Systems (AIS) in WANA countries are diverse, with a wide range of institutional forms and capacity. There is abundant information identifying the major problems currently affecting AIS efficiency in the region. There is also information defining adequate AIS structure, staffing and equipment to meet dryland agriculture development and challenges, and reviewing the effectiveness of current international support. The main focus of AIS lies in identifying the challenges likely to face WANA countries with the evolution of their agriculture over the next two decades, and the implications of this. There are strong pressures on WANA countries to increase resource allocation for agricultural production because of rapid population growth, rapid urbanization, and increasing and relatively high income levels. Agriculture production faces severe physical constraints due to predominantly low and highly variable rainfall, critical scarcity of new high-quality cultivable land, increasing shortage of water for irrigation, and rising costs of water and labor. There is thus a widening gap between domestic supply and demand for food. These pressures, together with growth in mechanization and a failure to find technological solutions for sustainable management of low rainfall ecological zones, are leading to serious environmental degradation. Governmental fiscal policies in the pursuit of food self-sufficiency for political reasons often exacerbate these environmental problems.
b. **Agricultural Research and Extension (R&E):** Agricultural research is often ambiguous in most WANA countries partly because it is formulated jointly by

---

[38] Oram, P. and Hayward, J. 1992. Research and extension services for land and water resource management in the WANA region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992

policymakers, extension service officers, and researchers. Some problems confronting agricultural research and extension in these countries include:

- Inadequate diversification of agricultural R&E to meet the needs of different dryland farming systems;
- Priorities of national dryland agricultural R&E programs being defined byinternational donor ideology, rather than local and national needs;
- Lack of donor coordination on dryland agricultural R&E priorities;
- Inadequate donor consideration of national views when financing dryland agricultural R&E projects, thereby serving donor rather than recipient country interests;
- Imposition of central government agricultural R&D priorities on regional institutes, without adequate consideration of local dryland needs and priorities, and the acceptance by most institutions of these assignments to gain other benefits, such as financial support and technical equipment;
- Incompatibility between the incentives for individual research accomplishment and the need for dryland production;
- Staff performance, work habits and training unsuitable for present or future job requirements for dryland agricultural R&E;
- Non-involvement of social scientists in dryland agricultural R&E;
- Inadequate dissemination of dryland agricultural R&D results to local farmers; and
- Inadequate sharing of dryland agricultural R&D&E results among the countries of the WANA region.

These factors hinder moves by agricultural R&E systems to address land and water resources issues in WANA countries and design steps for resource improvement. Prevailing agricultural R&E systems allow for very little feedback from farmers, and result in a vicious cycle of inappropriate technology, failure of technology adoption, loss of confidence of government in the value of an agricultural information system, and a subsequent decline in state support for AIS. A key issue is the attainment of close cooperation between the various parties of an AIS, at the planning and operational levels, and the participation of farmers and other clients in these processes. It will entail a greater role for the social, information and environmental sciences in accessing traditional knowledge; and in understanding the economics of marketing and other issues affecting farmers' attitudes to risk. These disciplines must also be active in improving managerial competence, in encouraging inter-disciplinary and inter-institutional cooperation, and in involving international organizations, NGOs, women's groups and disadvantaged communities, and the private sector in decisionmaking.

c. **Agricultural R&E Collaboration:** Successful coordination and management of dryland agricultural R&E programs, both to meet the common goals and to address local and diversified problems, require a more symbiotic relationship between all concerned parties. These include policy-makers, researchers, scientists, extension officers, social workers and farmers. Such a dryland agricultural R&E collaboration should allow for inputs and feedbacks in all directions and levels, and should emphasize several factors, including:

- A complementary relationship between agricultural research and extension services, accomplished by involving both on and off-farm projects and programs, and by encouraging the cooperation of researchers and extension agents and the mutual recognition of professional accomplishments and contributions;
- Intensification of collaborative agricultural R&E with the assistance of international and regional institutions and their technical know-how and financial resources;
- Utilization of a proposed Agricultural Information System by the governments of WANA countries, depending on local conditions and considerations, and the assistance of international research institutions, in identifying information needs and opportunities, in promoting information dissemination, in assisting countries in project preparation for funding, and in coordinating available resources, especially in transboundary projects;
- Sharing research goals and results among countries with similar research needs, so as to minimize any unnecessary duplication of effort.

d. **Improving Agricultural R&E:** Dryland agricultural R&E budgets are spread too thinly in WANA countries for adequate coverage of all problems. Countries in this region should, therefore, exploit their comparative ecological and socio-economic advantages to identify priority areas for R&E on commodities, land use and technology mix; and to provide feedback to policymakers on the economic and social implications of resource concentration on R&E areas. Dryland agricultural research should not only focus on "upstream" production problems, but also on "downstream" ones such as post-harvest storage and processing, marketing, and product diversification for consumer preferences. Mistakes made elsewhere should be avoided. In South East Asia, for example, it has been difficult to establish extension education due to cross-cultural factors, lack of incentives, and a top-down approach to funding that has created stratification and resulted in those needing the funds most not receiving them. This situation has made extension workers unwilling to cooperate fully with research program managers. Dryland agricultural extension systems should be flexible so as to ensure appropriate response to particular needs; for example,

in low-rainfall areas, a successful extension service requires the active involvement of social scientists and the local community.

e. **Improving Agricultural Information Dissemination:** Regional agricultural extension centers should facilitate information dissemination, identify research problems, and maintain effective linkages between extension workers and farmers, especially through voluntary land-user advisory groups supported by extension liaison units. Modern communications systems, such as radio and television, are underexploited for the timely dissemination of dryland agricultural information, and could help answer the need for focused agricultural extension. A regional technical bulletin publishing R&E results, and circulated among concerned scientists in the region, would give recognition to local agricultural scientists and extension workers, and would contribute to information sharing among different countries in the region.

Global Environmental Facility

39. Global environmental problems linked to human development on an international scale were accepted politically by the United Nations Conference on the Human Environment [UNCHE] in 1972, and led to the establishment of the United Nations Environment Programme (UNEP) and UNESCO's Man and Biosphere (MAB) Programme. They have emerged as priority issues in the Brundtland Report of the World Commission on Environment and Development (WCED), entitled *Our Common Future*, to the United Nations. There are several real, and other potential, global environmental problems, including: the loss of vegetation; desertification; pollution; high population growth, density and poverty; the loss of biodiversity; global warming and sea-level rise; human-induced or natural changes; island adjustments; and energy imbalances (Table 4.14)[39]. A study by the United Nations Education, Scientific, and Cultural Organization (UNESCO) suggested prospective solutions to these global change problems — including, among others: contingency management centers and networks, environmentally-sound technology, strengthened institutional capacity, assessment of signatures or indicators of changes, and careful assessment of effects; and establishment of regional and global cooperative networks (Table 4.15). The same study listed several resource and organizational constraints to global environmental problem-solving, and proposed a variety of approaches to them (Table 4.16 and Table

[39] Furtado, J. 1992. The Global Environment Facility: an innovative instrument for structural adjustment. Paper presented at EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in Dry Areas, Aleppo, Syria, 16-27 February, 1992

4.17). These constraints are particularly critical in the developing countries and in the tropics, where much of the biological diversity and ecological complexity of this planet resides.

40. Some of these environmental problems have regional and global effects. The Global Environment Facility (GEF) is an instrument to address some of them in the developing countries. It was established by a group of 14 industrialized and eight developing countries in Paris in 1990, for providing low-interest loans and grants. It is a cooperative venture of member nations with a tri-partite management group comprising the World Bank (WB), the United Nations Development Programme (UNDP), and the United Nations Environment Programme (UNEP). The GEF does not provide funds to countries with per capita incomes in excess of US$4,000, since these would have their own funds to manage their emission of gases. Its principle mission is to provide funds to those countries which can not afford to protect their biodiversity or arrest their environmental degradation; and, especially, to manage critical emerging global problems in four areas:

- Reducuction of emissions of **greenhouse gases** which cause global warming;
- Preservation of the Earth's **biological diversity** and maintenance of natural habitats;
- Stopping pollution of **international waters**; and
- Protection of the **ozone layer from further depletion.**

41. Some important aspects of the GEF are detailed below:

a. **Evaluation Criteria:** While most GEF funds are for investments, some will also support technical assistance, pre-investment and feasibility studies, scientific information and training. Eligible projects are appraised using the following criteria:

   - Costs, benefits and risks inherent in their design;
   - Effectiveness of their global environment component in its biophysical (i.e. non-monetary) aspects;
   - Innovative solutions to conservation problems;
   - Technical feasibility in terms of institutional capacity-building, appropriate technology and local community participation;
   - Their sustainability; and
   - Their harmony with other global environmental conventions, and national environment and development plans.

In addition, generic criteria have been developed for all four environmental issues (Table 4.18). Detailed criteria for project eligibility and selection have been developed for each issue.

b. **Allocation:** About 75% of GEF funds is available in the form of low-interest loans, with 25% available as technical assistance. Nevertheless, very few GEF projects have been developed for the WANA countries (Table 4.19). This may be due to the availability of UNDP funds for environmental protection under an active Mediterranean Action Programme (METAP). The WANA region has unique and rich biological diversity, not only in the Mediterranean region but also in the Red, Black, Caspian and Aral Seas, the Trans-Caucasus mountains, the area of the fertile crescent around the Tigris and Euphrates Rivers, and the Gulf of Oman. The opportunities for developing GEF projects need to be carefully ascertained in relation to the Bank's investment and UNDP's technical assistance programs. There appears to be considerable scope for mobilizing further GEF resources for other environmental issues in WANA countries, but this needs to be built on existing work and experience, and exploring innovations unique to environmental problems and cultural setting in each case.
c. **GEF Budget:** The United States of America is the largest single contributor to the GEF, and the G7 countries have been the most active supporters of this initiative. Approximately US$1.5 billion were available to the GEF for the years 1991-94; and additional funds have been committed to it since the Rio Conference. The sheer magnitude of the environmental challenge requires a far greater effort in monetary terms than is currently on offer; and former World Bank President Robert McNamara stated recently that the annual cost of conserving the global environment would be around US $45 billion. There is considerable doubt whether the international community is currently prepared to make such a large financial commitment.
d. **Time Horizon:** In the pilot phase (1991-94), GEF worked within a three-year time frame to demonstrate a definite positive impact, and to support pilot projects that could be sustained later by the recipient countries.
e. **Community Participation:** Most, but not all, GEF projects will be proposed by governments, although non-governmental organizations are expected to play an important role in their implementation. In light of the gravity of the global environment's deterioration, local communities should be actively involved in measures to protect it. Although community participation is not a precondition for GEF funding, it would be better if a GEF project both meets the appraisal criteria and contains a community participation component.
f. **GEF Activities:** There appears to have been very little interest in reversing desertification in WANA countries, partly for financial reasons, and partly because the problem of desertification lies in other sectors such as energy and agriculture. In any case, these countries need technical assistance to reverse

desertification, including an early warning system for predicting climatic changes, incorporating traditional and modern knowledge and prediction techniques. There is already considerable research on desertification, and there is an urgent need to preserve the region's biological diversity by protecting threatened species and their natural habitats in the steppe and desert zones.

Table 4.14: Nature of Global Change Problems for Human Carrying Capacity

Perceived Areas	Problem Specification
1.1 CURRENTLY IDENTIFIED GLOBAL ENVIRONMENTAL CHANGES	
REDUCED FOREST & VEGETATION COVER DESERTIFICATION	* Soil exposure & erosion * Breakdown water retention in root zone * High surface run-off & flooding
INDUSTRIAL POLLUTION	* Toxic materials * Thermal discharge
HIGH POPULATION GROWTH & DENSITIES POOR LIVING CONDITIONS	* Disease epidemics * Water scarcity * Water transfers * Food scarcity
BIODIVERSITY LOSS	* Species extinction * Habitat & ecosystems loss * Ecological processes disrupted
1.2 CURRENTLY UNCERTAIN GLOBAL ENVIRONMENTAL CHANGES	
GLOBAL WARMING & SEA-LEVEL RISE	* Reduced coastal areas * Inundation of several metropolitan areas
2.1 PREDICTED GLOBAL ENVIRONMENTAL CHANGES	
PALEONTOLOGICAL	* Glaciations * Warming periods
CURRENT	* "El Nino" effects * Sahelian droughts
2.2 PREDICTED GLOBAL ISLAND ADJUSTMENTS	
ATOLL GROWTH & RISE IN THE TROPICS	* Atoll nations [e.g. Maldives]
2.3 PREDICTED GLOBAL ENERGY IMBALANCES	
HEAT DISPLACEMENTS & WEATHER	* Land clearances * Urbanization
HABITAT & ECOSYSTEM CHANGES & WEATHER	* Reduced size of forests
CONURBATIONS FOR GROWING POPULATIONS	* Megapolises

SOURCE: Adapted from UNESCO. 1990. The Analysis of Global Change: A Structural Approach." UNESCO Regional Office, Jakarta

Table 4.15: Prospective Solutions to Manage Global Environmental Changes

Areas	Specifications
CURRENT GLOBAL ENVIRONMENT PROBLEMS	
CONTINGENCY MANAGEMENT CENTERS & NETWORKS	* Specify & implement evacuation & mitigation measures at national and regional levels * Maintain sustainable production * Ameliorate adverse environmental effects
ENVIRONMENTALLY-SOUND HIGH TECHNOLOGY	* Mobilize & transfer technology * Develop & diversify marketable products
STRENGTHEN INSTITUTIONAL CAPACITY	* Generate high technology * Manage contingencies
PREDICTED OR UNCERTAIN GLOBAL ENVIRONMENT PROBLEMS	
ASSESS CHANGE SIGNATURES OR INDICATORS	* Use historical environmental changes
CAREFULLY ASSESS EFFECTS	* On small states: e.g. sea-level rise * On disadvantaged communities
ESTABLISH COOPERATIVE NETWORKS	* As appropriate on a regional or global basis * To gather critical information

SOURCE: Adapted from UNESCO. 1990. The Analysis of Global Change: A Structural Approach." UNESCO Regional Office, Jakarta

Table 4.16: Social Constraints to Solving Global Environmental Problems

Constraints	Specifications
	RESOURCE CONSTRAINTS
MONITORING NETWORKS	* New field stations to verify satellite observations * Upgrading of existing facilities
DATABASE FACILITIES	* Different forms & structures for data storage on computers * Human resources shortage for data handling
USING EXISTING RESOURCES	* Technological adjustments/upgrading * New sources [e.g. species] of development capital * Demand-driven exploitation
	ORGANIZATIONAL CONSTRAINTS
CONCEPTUAL	* Multi-disciplinary/cultural information * Inter-disciplinary participation * Cooperative problem-solving
COOPERATION	* Between regional institutions * Between global institutions
SUSTAINABILITY	* Environmental management for sustainable development * Environmental valuation techniques

SOURCE: Adapted from UNESCO. 1990. The Analysis of Global Change: A Structural Approach. 50 pp. UNESCO Regional Office, Jakarta

Table 4.17: Prospective Solutions to Surmounting Social Constraints

Features	Specifications
FOR RESOURCES CONSTRAINTS	
FIELD ASSESSMENT TECHNIQUES	* Coordinate globally * Involve tertiary & community organizations
DATA MANAGEMENT TECHNIQUES	* Train especially in relational databases
TECHNOLOGY NETWORKS	* Especially at regional & global levels * Promote technology innovation & transfer * For high & environmentally-sound technologies
ORGANIZATIONAL CONSTRAINTS	
INTEGRATED CURRICULA & TRAINING	* At all levels * For urgent transfer of technology * For technological innovation
REGIONAL & GLOBAL COOPERATION	* For identifying & predicting environmental effects * For developing mitigative strategies, policy options, and contingency plans
REALISTIC POLICIES	* Related to resource availability, and environmental effects * Through regional cooperation & consultations
ECONOMIC INSTRUMENTS	* Develop valuation techniques, incentives and disincentives for environmental management * Relate to "absorptive" capacities of ecological and social systems for technological interventions

SOURCE: Adapted from UNESCO. 1990. The Analysis of Global Change: A Structural Approach." 50 pp. UNESCO Regional Office, Jakarta

Table 4.18: Generic Criteria for all GEF Projects

GLOBAL BENEFITS: Lead to potential benefits for the global environment in terms of reducing "greenhouse" gas emissions, protection of biodiversity, protection of international waters, or reduction in ozone depletion

INNOVATION: Have some innovative characteristics

MATURITY: Be sufficiently mature to have a good chance of succeeding

REPLICABILITY: Be replicable, within both the national and international contexts

CAPACITY-BUILDING: Develop human and institutional capability, through education, training and research

WELFARE & SUSTAINABILITY: Contribute to human welfare and sustainable development

COMPREHENSIVENESS: Be placed in the context of comprehensive existing or evolving national environmental programs

BASIS: Have an adequate scientific and technical basis

EVALUATION & DISSEMINATION: Include plans for evaluation and dissemination of results and knowledge

FOLLOW-UP: Include plans (as appropriate) for post-GEF project continuation of the activity within the national context

INVENTORIES: Develop, as appropriate, inventories of, for example,"greenhouse" gas emissions, biodiversity, sources of water pollution, or halocarbon emissions

PARTICIPATORY: Be participatory in nature, involving close collaboration with local communities wherever possible

EXTRA-NATIONAL: Be unlikely to be included in the country's development portfolio without GEF funding, even though it has significant global and national benefits

TIME-SCALE: Be of sufficient maturity that it can be developed within the three-year GEF time horizon for project approval

ENVIRONMENTAL ASSESSMENT: Be subject to a comprehensive environmental impact assessment that examines potential adverse consequences relevant to other issues of concern to the GEF

Table 4.19: GEF Projects in WANA Countries

Country	Project	Costs (USD Million)		
		Total	Gef	Cofinance
ALGERIA	El Kala National Park	11.50	9.20	2.36
EGYPT	Red Sea Coastal and Marine Resource Management	5.73	4.75	0.98
JORDAN	Conservation of Dana and Azraq Protected Areas	6.30	6.30	0
IRAN	Teheran Transportation Emission Reduction	4.00	2.00	2.00
MOROCCO	Repowering Existing Power Plants	38.00	6.00	?
SUDAN	Community-based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity	1.50	1.50	0
TUNISIA	Solar Water Heating	4.00	4.00	0
REGIONAL	Regional Strategy for Reduction of Greenhouse Gas Emissions in Arab States	5.00	2.50	2.50
EGYPT	Lake Manzala Engineered Wetlands	11.30	4.50	6.63
YEMEN	Protection of Marine Ecosystems of the Red Sea Coast	2.80	2.80	0
REGIONAL	Oil Pollution Management System for the Southwest Mediterranean Sea	20.00	18.30	1.70

SOURCE: GEF, 1994. Global Environment Facility. Quarterly Operational Report, August 1994. Washington, DC: Global Environment Facility

Japan and Drylands Agriculture

42. The Ministry of Agriculture, Forestry and Fisheries of Japan and the International Development Center of Japan (IDCJ) conducted a four year (1990-1993) study on agricultural resources and environmental management; and found that the major cause of environmental degradation in the agricultural sector is over-exploitation of natural resources in the form of slash-and-burn cultivation, overgrazing and fuelwood harvesting[40]. The findings of this study include:

a. A conceptual framework of socio-economic development and global environment based on international consultations, in which population and economic growth are central to the proposition of development and the main cause of environmental destruction; and in which the major development sectors were rural development, industrial development and urban and infrastructure development;
b. An identification of the causes of environmental destruction in the agricultural sector as being slash-and-burn, overgrazing, and fuel-wood harvesting, all of which originate from over-exploitation in farming, grazing, livestock production and agroforestry;
c. Three minimal requirements for achieving a positive co-existence between environment and economic development: political support, technical innovation and people's participation;
d. Even if the world's average population increase is successfully controlled at a constant increase of 1% per annum for the next 50 years, there is a need for economic growth of about 3.8% per year, to narrow down the disparity in GNP between the developed and the developing countries from 50:1 at present to 10:1 in 2040, in a long-term global macro-economic plan;
e. A markedly different experience in the economic development and the agricultural and environmental management of Japan and the WANA countries, particularly since the 1950s, with Japan's economic success due partly to its negligible defence spending since World War II — whereas more than 60% of the national income in some WANA countries is allocated to military expenditure;
f. Japan's realization in the 1970s of the importance of environmental protection domestically and overseas, because of the negative impact created by its dependence on imported raw materials for its industrial development, its

[40] Takase, K. 1992. A case study on agricultural resources and environmental management. Paper presented at the EDI/WB/ICARDA and AOAD Seminar on Natural Resources and Environmental Management in Dry Areas, Aleppo, Syria, 16-27 February, 1992

resource-poor status, and its exploitation of natural resources from developing countries; and its resolve to promote reforestation projects, etc. to redress past mistakes.

Those findings pertinent to economic development in WANA countries include:

- **Role of Education:** Investments in education, and concern for political stability and social discipline, contributed significantly to Japan's impressive economic development and also to South Korea's. However, the latter spends a significant portion of its national income on defense like WANA countries, but has been much more successful than them in achieving economic growth.
- **Role of Public Education:** If one compares the development experiences of Japan and a WANA country such as Iran, there is a significant contrast. Japan's modernization occurred with the Meiji restoration about 120 years ago, which resulted in the establishment of internal secondary and university education systems for the public masses along German standards of academic excellence. Iran's modernization occurred at about the same time, but followed a completely different approach in encouraging the education of the elites in secondary schools and universities of high standing abroad. Thus, while many Iranian elites went abroad for advanced studies and then stayed there for the better opportunities on offer, the Japanese made these opportunities available to scientists and engineers who returned to Japan to put their education to practical use.

V. Conclusions

43. The major challenges for achieving sustainable development of natural resources in the dry areas of WANA lie in six key but related areas:

a. **Policy, Institutional and Technical Interlinkages:** Although most WANA countries have in place Ministries of Agriculture and/or Environment, or similar institutions at the national level, they may be unable to discharge their mandates effectively due to weak linkages between policies, institutions and technical considerations on environmental issues. These elements include:

(1) **Environmental Collaboration:** Environmental conservation in WANA countries is not merely a national challenge but, rather more importantly, a regional one. Confronting a challenge of such magnitude requires a closer degree of collaboration, coordination and integration on specific common environmental issues between various levels of government within each WANA country, between national agencies and local organizations, and between national, regional and international institutions with respect to education, training, research and extension. Critical areas for such collaboration include:

- Pilot projects on land and water conservation in degraded areas;
- Active involvement of local leaders in the planning and management of natural resources;
- Assessment of environmental and natural resources; and
- Understanding the economic value of environmental and natural resources as national capital in the development and problems of the agriculture sector.

(2) **Information Dissemination:** An integrated Agricultural Information System (AIS), which includes environmental and natural resources information, is of critical importance in WANA countries. It is needed not only for decision making and research but, perhaps more importantly, for education in schools and universities; and for public awareness about conservation. Lack of knowledge continues to impede effective agricultural and environmental research, even though a wealth of information and data on problems is generated in the region. Regional organizations, such as ICARDA and AOAD, could play an important role in collecting and disseminating such information to all who need it in the WANA region. Information dissemination could help overcome language barriers through

Arabic/English translations. More information is needed on the following issues:

- Land and water resources conservation;
- Fallow replacement;
- Agroforestry;
- Biodiversity;
- Population control.

(3) **Extension Services:** Agriculture extension services are generally weak in WANA countries, partly because most government agencies are inward-looking and follow a narrow discipline-oriented approach, and partly because these services are poorly linked to university and public-sector research, and local communities. Research priorities, educational curricula and the nature of agricultural advice thus needs to be revised especially on the basis of interactions between economics and ecology. Furthermore, there is an urgent need to improve the impact of agricultural and environmental research and advice; improvement is needed in terms of relevance, development orientation, economics and ecology, information availability and accessibility, and clarity of presentation. Comprehensive extension services using appropriate technologies and with adequate international support could help address some of the challenges in agricultural development and environmental management in WANA countries. For example, they could help in confronting challenges such as erosion or desertification, changing marginal lands to productive uses, and in enabling farmers to maintain their pastures and herds.

b. **Strengthening Traditional Socio-Cultural Institutions:** Very few WANA countries have an effective institutional capacity for environmental and natural resources policymaking, priority setting, coordination, and regulation. Exchange of experiences on natural resources development, through the case study approach, is useful in clarifying social science issues and socio-cultural constraints in economic and institutional development. Social scientists are well-equipped to analyze the human aspects of agricultural development in the dry lands, especially the involvement of end users and local communities in the planning process from the inception stage. Community involvement could be cost effective in forest conservation. Traditional institutions such as the *Hemma*, *Waqf*, *Iqta'* and *Hesbah* should be critically evaluated in terms of their integration into modern techniques of land management. Governments need to avoid massive and rapid introduction of new technologies and social institutions and, instead, focus on improving and modernizing local and traditional resource management techniques and organizations.

c. **Treating the Environment as a Capital:** Environmental and resources within the WANA region are generally scarce and always finite. It is essential, in such conditions, to distinguish clearly between true income generation on the one hand, and, on the other, the draw down of capital assets by environmental or resource depletion or degradation. Where resources have been overexploited, efforts should be made for their regeneration, lest they contribute to further environmental degradation such as waterlogging, salinization and degradation of fertile soils. Moreover, the impact of converting previously productive agricultural lands for urban development should be carefully assessed.

d. **Integrated Approach to Environmental and Natural Resources Management:** Government policies relating to natural resources development and environmental management need careful review and linkage in WANA countries, so that policy- and decision-makers succeed in formulating appropriate policies, programs and projects. The sectoral or piecemeal approach to development decision making causes considerable adverse effects on the environment; it must be replaced with a comprehensive, interdisciplinary approach to project and policy planning, design, and management, such as the Australian Landcare or the Tunisian Soil Conservation program. Although many countries conduct environmentally-oriented projects such as reforestation, water harvesting, sand dune control and irrigation improvement, there is a need for a more integrated approach in preparing large complex projects or programs. Institutions responsible for agroclimatic zones or regions, such as the Agency for Barami (Dryland) Area Development (ABAD) in Pakistan, use an integrated approach in collaborating with bodies concerned with natural resources and the environment (livestock, agriculture, wildlife, fisheries) and on infrastructure (transportation, water supply and sanitation, and health services). A central committee provides the coordination for various kinds of specialized funds, technical inputs and support in such institutions; and such institutions usually enjoy proximity to sources of power in government.

e. **Regional Cooperation on Common Environmental Threats:** Nowhere is the battle between people and the desert so ancient and complex as in the WANA region, where approximately 94% of pastoral lands, 70% of rainfed agricultural lands and 17% of irrigated lands face the threat of desertification[41]. The countries of Northwest Africa (*Maghreb*), Libya, Tunisia, Algeria and Morocco, have responded to the desertification threat by developing a joint action plan to minimize it. Such joint regional plans need to address a range of complex environmental and natural resource problems, difficult though it is

[41] Ghabour, Samir. Developing the African deserts. Development and Environment, 6 (4).

to check the forces of nature. Regional and international cooperation is useful in such ventures, especially in promoting technology transfer. Regional environmental projects of this nature could contribute to promoting economic prosperity and reducing ethnic tensions.

f. **Changing Global and Regional Priorities, Plans and Policies:** Regional and international organizations, such as ICARDA, AOAD and the World Bank, appear best equipped to assist WANA countries technically so that they may prioritize their agricultural and environment policies and programs in response to changing global and regional conditions. Such changes could be in research and development approaches for policy change, which is usually a slow process influenced by the governmental agencies involved in policymaking; in regional cooperation on information exchange; and in interdisciplinary collaboration, especially in carefully targeted areas such as on the same crops or in the same agro-ecological zones; such organizations can also help establish closer coordination within national programs, especially in training; and information and training can be mobilized for changing regional priorities, such as the shift in emphasis of CGIAR institutions from increasing crop production to farming systems for agricultural sustainability and environmental conservation.

References

Barghouti, S. and Hayward, J. 1992. Land and water resources in the Middle East and North Africa: issues and challenges. Paper presented at EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Cernea, M. (Ed). 1985. Putting people first: sociological variables in rural development. New York: Oxford University Press.

Cernea, M. 1992. Users' organizations for resource use and environmental management. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

de Haan, C. 1992. Sustainability of changing rangeland management and livestock production systems. Paper presented at EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

de Haan, C. 1990. Low input sustainable field systems: implications for the world's rangelands. *In* Proceedings of the 1990 International Rangeland Development Symposium, 1 February, 1990, Reno, Nevada, USA.

Durutan, N. 1992. Sustainability of fallow reduction. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

El Serafy, S. 1991. *In* R. Costanza (Ed), Ecological Economics: The Science and Management of Sustainability. New York: Columbia University Press.

Fadda, N. 1992. Key research issues in developing land and water resources. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Farvar, M. 1992. Watershed management for rainfed agriculture. Lecture notes of a presentation at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Furtado, J. 1992. The global environment facility: an innovative instrument for structural adjustment. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Ghabour, S. 1975. Developing the African deserts. Development and Environment, 6(4).

GEF 1994. Global Environment Facility, Quarterly Operational Report, August 1994. Washington, DC: Global Environment Facility.

Hamed, S. 1993. Application of *shariah* to natural resource planning and management. Journal of Agricultural and Environmental Ethics, 6(2), pp.145-164.

Hizem, H. 1992. Land resource management policy in Tunisia. Paper presented the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Kassam, A. 1992. An overview of land and water resources in the WANA region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Khouri, J., Rasoul Agha, W. and Droubi, A. 1986. Water resources of the Arab homeland and their prospects. (Arabic) *In* Proceedings of the Seminar on Water Resources and their Use, Kuwait

Marston, D. 1992. Landcare: an Australian program for community and government involvement in natural resource management. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Nordblom, T. 1992. Land tenure, social systems and institutions for the dryland farming. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Oram, P. 1992. Identification of the main farming systems and their sustainability. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Oram, P. and Hayward, J. 1992. Research and extension services for land and water resource management in the WANA region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Pala, M. 1992. Sustainability of fallow replacement. Lecture notes of a presentation at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Pearce, D. and Markandya, A. 1989. Marginal opportunity cost as a planning concept in natural resource management. *In* Gunter Schramm and Jeremy J. Warford (eds.) Environmental Management and Economic Development, pp. 39-56. Baltimore: The John Hopkins University Press.

Sankary, M. 1992. Local participation and the organization for natural resources conservation and development in the WANA region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Sayegh, A. 1992. Land resources survey and land use and development. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Somel, K. 1992. Tradeoffs between yield levels and yield variability: an example of fertilizer use on rainfed barley. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Somel, K. 1992. Agriculture diversification in the Middle East and North Africa. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Takase, K. 1992. A case study on agricultural resources and environmental management. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

UNESCO 1990. The analysis of global change: A structural approach. 50 pp. Jakarta: UNESCO Regional Office.

Walker, G. 1992. Understanding physical resources for agricultural planning: importance of data, information, and technology. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

WRI. 1990. World resources 1990-91. Washington, DC: World Resources Institute. Oxford: Oxford University Press.

Annex 1

Seminar on Natural Resources and Environmental Management in the Dry Areas

Aleppo, Syria, 16-27 February 1992

Seminar Participants and Resource Persons

Participants

ALGERIA
Mrs. D. Nedjaroui,
Special Adviser,
Research Unit on Biological and Terrestrial Resources,
Ministry for Universities,
Algiers.

Mr. Z. Zemmouri,
Chief of Studies,
Directorate of Planning for Environment and
Forest Hydrological Areas,
National Planning Council,
Algiers.

EGYPT
Dr. Adel M. Aboul Naga,
Under-Secretary,
Department of Animal Production,
Ministry of Agriculture,
Cairo.

LEBANON
Prof. Mousa Nimah,
Chairman,
Department of Soil and Irrigation,
American University of Beirut,
Beirut.

MOROCCO
Mr. Mriouah Driss,
Principal Engineer,
Directorate for Water Resources,
Ministry of Public Works,
Raba.

Dr. Rejdali Moh,
Head,
Department of Plant Ecology,
Hassan II Institute,
Rabat.

PAKISTAN
Mr. Bashir Ahmed,
Joint Secretary,
Ministry of Water and Power,
Islamabad.

Mr. Mohammad Aslam,
Member (Evaluation),
Planning and Development Department,
Government of Punjab,
Lahore, Punjab.

Mr. Syed Shahid Hussein,
Senior Member,
Board of Revenue,
Government of Baluchistan,
Quetta, Baluchistan.

SYRIA
Mr. Adib Haj Hasan,
Engineer,
Ministry of Agriculture and Agrarian Reforms,
Damascus.

Mr. Mishel Ni'ma,
Engineer,
Ministry of Agriculture and Agrarian Reforms,
Damascus.

Mr. Mohamad Walid Sheet,
Engineer,
Ministry of Local Administration,
Damascus.

TUNISIA
Mr. Rached Akrout,
Chief Engineer,
Sub-Directorate of Agricultural Statistics ,
Ministry of Agriculture,
30 Rue Alain Savary,
Tunis 1002.

Mr. Mohamed Hermes,
Principal Engineer,
Ministry of Agriculture,
30 Rue Alain Savary,
Tunis 1002.

TURKEY
Mr. Metin Birbudak,
Director-General,
Directorate-General of Rural Affairs,
Ankara.

Mr. Mesut Kamiloglu,
Director,
Foreign Financial Projects,
Foreign Relations and EC Department,
Board of Research Planning & Coordination,
Ministry of Forestry,
Orman Bakarlrgi-Gazi,
Ankara.

ACSAD
Dr. Moustafa Ahmad Al-Shourbaji,
Director,
Plant Research Administration,
Arab Center for Studies in Agriculture in Dry Areas (ACSAD),
Damascus, Syria.

SPEAKERS / RESOURCE PERSONS / RAPPORTEURS

AOAD
Dr. Yahia Bakour,
Representative,
Regional Office,
Arab Organization for Agricultural Development (AOAD),
P.O. Box 3800,
Damascus, Syria.

Dr. Karrar A. Abbadi,
Head,
Project Evaluation,
Economic Department,
Arab Organization for Agricultural

Development (AOAD),
P.O. Box 474,
Khartoum, Sudan.

Dr. Mohamed Nazir Sankary,
Al-Haisha Al-Jadida Project,
Arab Organization for Agricultural Development (AOAD),
P.O. Box 474,
Khartoum, Sudan.

EDI/WB

Dr. Shawki Barghouti,
Head,
Agriculture Production & Services Division
(AGRPS),
Agriculture & Rural Development Department,
The World Bank,
1818 H Street, NW,
Washington, DC 20433, U.S.A.

Dr. Michael M. Cernea,
Social Science Adviser,
Environment Department (ENVDR),
The World Bank,
1818 H Street, NW,
Washington, DC 20433, U.S.A.

Dr. Cornelis de Haan,
Agriculture Production & Services Division (AGRPS),
Agriculture & Rural Development Department,
The World Bank,
1818 H Street, NW,
Washington, DC 20433, U.S.A.

Dr. Nedret Durutan,
World Bank Field Office,
211 Ataturk Bulvari,
Gama-Guris Building, Kat 6,
Kavaklidere,
06683 Ankara, Turkey.

Dr. Salah El Serafy,
Economic Adviser,
Environment Department (ENVDR)
The World Bank,
1818 H Street, NW,
Washington, DC 20433, U.S.A.

Dr. Jose I. dos R. Furtado,
Environment Specialist,
Agriculture & Rural Development Division (EDIAE),
Economic Development Institute (EDI),
The World Bank,
1818 H Street, NW,
Washington DC 20433, U.S.A.

Dr. John Hayward,
Chief,
Water Resources Unit (EMTWU),
Europe, Central Asia, Middle East & North
Africa Technical Department (EMT),
The World Bank,
1818 H Street, NW,
Washington, DC 20433, U.S.A.

Dr. Kutlu Somel,
Agriculture Division (EMTAG),
Europe, Central Asia, Middle East & North
Africa Technical Department (EMT),
The World Bank,
1818 H Street, NW,
Washington, DC 20433, U.S.A.

IDCJ
Dr. Kunio Takase,
Executive Director,
International Development Center of Japan (IDCJ),
Kyofufku Building,
9-11, Tomioka 2-chome,
Koto-Ku,
Tokyo 135, Japan.

IFPRI
Dr. Peter Oram,
Emeritus Research Fellow,
International Food Policy Research Institute (IFPRI),
1776 Massachusetts Avenue, NW,
Washington, DC 20036, U.S.A.

FAO
Dr. Amir Kassam,
Senior Research Officer,
TAC Secretariat,
Research and Technology Development Division,
Food and Agriculture Organization of the U.N.,
Via delle Terme di Caracalla,
00100 Rome,
Italy.

Dr. Antoine Sayegh,
Food and Agriculture Organization of the U.N. (FAO),
62 Mahdi ben Baraka Street,
P.O. Box 10709,
Damascus, Syria.

UNEP
Dr. Michael Gwynne,
Global Environment Monitoring Systems (GEMS),
United Nations Environment Program (UNEP),
UN Complex, Gigiri Road,
P.O. Box 30552,
Nairobi, Kenya.

CENESTA
Prof. M. Taghi Farvar,
Center for Ecodevelopment Studies and Application (CENESTA),
142 Azerbaijan Avenue,
13169 Tehran, Iran.

NSWDCLM
Mr. David Marston,
Director,
NSW Soil Conservation Service,
NSW Department of Conservation & Land Management,
Zenith Center, 3/F,
821 Pacific Highway,
P.O. Box 198,
Chatswood, NSW 2057, Australia.

TSCS
Mr. Mohamed Habib Hizem,
Soil Conservation Service,
Ministry of Agriculture,
30 Rue Alain Savary,
Tunis, Tunisia.

ICARDA
Dr. Nasrat Fadda,
Director-General,
International Center for Agricultural Research in the Dry Areas (ICARDA),
P.O. Box 5466
Aleppo, Syria.

Dr. Aart van Schoonhoven,
Deputy Director-General (Research),
International Center for Agricultural Research in the Dry Areas (ICARDA),
P.O. Box 5466,
Aleppo, Syria.

Mr. John E. Noisette,
Director,
Finance Department,
International Center for Agricultural Research in the Dry Areas (ICARDA),
P.O. Box 5466,
Aleppo, Syria.

Mr. Mohamed A. Hamouieh,
Head,
Visitors Service,
International Center for Agricultural Research in the Dry Areas (ICARDA),
P.O. Box 5466,
Aleppo, Syria.

Dr. Michael Jones,
Leader,
Farm Resources Management Program,
International Center for Agricultural Research in the Dry Areas (ICARDA),
P.O. Box 5466,
Aleppo, Syria.

Dr. Tom Nordblom,
International Center for Agricultural Research in the Dry Areas (ICARDA),
P.O. Box 5466,
Aleppo, Syria.

Dr. Ahmed Osman,
International Center for Agricultural Research in the Dry Areas (ICARDA),
P.O. Box 5466,
Aleppo, Syria.

Dr. Mustapha Pala,
International Center for Agricultural Research in the Dry Areas (ICARDA),
P.O. Box 5466,
Aleppo, Syria.

Ms. Afaf Rashed,
Administrative Assistant,
International Center for Agricultural Research in the Dry Areas (ICARDA),
P.O. Box 5466,
Aleppo, Syria.

Dr. Graham Walker,
International Center for Agricultural Research in the Dry Areas (ICARDA),
P.O. Box 5466,
Aleppo, Syria.

Annex 2: Socio-economic Indicators, and Present and Future Populations.

Country	GNP/caput $ (1988)	HDI	Population			
			1990	2010	2050	Stationary
I. HIGH INCOME COUNTRIES (GNP/caput $6000 & above)						
Bahrain	6340	0.74	515	823	1	1
Kuwait	13400	0.84	2090	3451	4	5
Qatar	9930	0.59	367	632	1	1
Saudi Arabia	6200	0.70	14131	29551	50	54
U.A.Emirates	15770	0.78	1588	2286	3	4
IIa. UPPER MIDDLE INCOME COUNTRIES (GNP/caput $2000-6000)						
Algeria	2360	0.61	25364	10685	70	81
Cyprus	6260	0.93	701	826	1	1
Iran	-	0.66	56585	94691	137	169
Iraq	3020	0.76	18920	35323	63	75
Libya	5420	0.72	4544	5977	15	17
Oman	5000	0.54	1468	2882	4	5
IIb. LOWER MIDDLE INCOME COUNTRIES (GNP/caput $500-2000)						
Egypt	660	0.50	584059	78456	117	132
Jordan	1500	0.75	4270	8941	11	13
Lebanon	-	0.74	2965	4170	5	6
Morocco	830	0.49	25139	36977	51	59
Syria	1680	0.69	12501	23656	34	42
Tunisia	1230	0.66	8169	11273	16	18
Turkey	1280	0.75	55616	76641	102	112
Yemen	553	0.35	10508	20124	36	48
III. LOW INCOME COUNTRIES (GNP/caput below $500)						
Afghanistan	-	0.21	16557	32765	55	76
Djibouti	480	0.07	406	747	2	2
Mauritania	480	0.21	2024	3545	6	9
Pakistan	350	0.42	122666	205472	320	423
Somalia	170	0.20	7555	13247	23	30
Sudan	480	0.26	25195	44007	79	101
TOTAL			473903	777138	1368	1689

HDI = Human Development Index; measure of human development based on three elements of human life: longevity, knowledge and living standard; HDI below 0.50 reflects low human development; HDI between 0.50 and 0.80 reflects medium human development; and HDI above 0.80 reflects high human development.

SOURCE: Kassam, A, 1992. An overview of land and water resources in the WANA region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Annex 3: Total Land Area and Land Use in Countries of the WANA Region.

Country	Land Area (000 ha)	Rainfed Arable Land (000 ha)	Irrigated Arable Land (000 ha)	Total Arable Land (000 ha)	Permanent Cropland (000 ha)	Permanent Pastures (000 ha)	Forest & Woodland (000 ha)	Other Land (000 ha)	Arable Land Per Caput (ha)
I. HIGH INCOME COUNTRIES (GNP/caput $6000 and above)									
Bahrain	62	0	1	1	1	4	-	56	0.002
Kuwait	1782	2	2	4	-	134	2	1642	0.002
Qatar	1110	5	0	5	-	50	-	1045	0.014
Saudi Arabia	214969	700	425	1125	55	85000	1200	127589	0.080
U.A. Emirates	8360	24	5	29	10	200	3	8118	0.018
IIa. UPPER MIDDLE INCOME COUNTRIES (GNP/caput $2000-6000)									
Algeria	238174	6600	360	6960	570	31155	4384	195105	0.274
Cyprus	924	100	32	132	53	5	123	610	0.188
Iran	163600	8400	5740	14140	730	44000	18020	86710	0.250
Iraq	43397	3600	1750	5350	200	4000	1890	31949	0.283
Libya	175954	1600	238	1838	345	13300	660	159811	0.404
Oman	21246	7	41	48	32	4000	-	20166	0.033
IIb. LOWER MIDDLE INCOME COUNTRIES (GNP/caput $500-2000)									
Egypt	99545	3	2580	2583	173	-	31	96458	0.048
Jordan	9718	200	57	257	66	790	70	8535	0.060
Lebanon	1023	100	86	186	93	10	80	654	0.063
Morocco	44630	6900	1255	8155	570	20900	5200	9805	0.324
Syria	18406	4300	654	4954	613	8293	523	4023	0.396
Tunisia	15536	3020	280	3300	1525	3035	560	7446	0.404
Turkey	77076	22400	2190	24590	2980	8800	21099	20507	0.442
Yemen	52797	1200	308	1508	103	16065	3140	31981	0.143
III. LOW INCOME COUNTRIES (GNP/caput below $500)									
Afghanistan	54750	5200	2660	7860	144	30000	1900	24846	0.475
Djibouti	2198	0	0	0	0	200	601	1992	-
Mauritania	103040	200	12	212	3	39250	15000	48575	0.105
Pakistan	77088	4190	16310	20500	427	5000	3150	48011	0.167
Somalia	62734	900	112	1012	17	28850	8850	24005	0.134
Sudan	237600	10500	1870	12370	58	56000	47080	122092	0.491
TOTAL	1735708	80159	36543	117119	8768	396042	132071	1081708	
% of total		4.6	2.1	6.7	0.5	22.8	7.6	62.4	

SOURCE: Kassam, A. 1992. An overview of land and water resources in the WANA region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February , 1992.

Annex 4: Present and Future Food Demand in Relation to Production, Yields of Food Crops and Potential Yields.

Country	Demand		Production (000t GE) 1990	Surplus (+) Deficit (-) (000t GE)	Food Crop Yields (t GE/ha)		Fertilizer Use on Arable Land (kg/ha)
	1990	2010			Present*	Potential**	
Afghanistan	3963	8708	3447	-516	0.44	4.53	10
Algeria	7869	15561	2912	-4957	0.42	6.10	32
Bahrain	165	295	2	-165	1.65	-	-
Cyprus	254	316	257	+62	1.95	2.96	135
Djibouti	284	719	57	-227	-	-	-
Egypt	19283	30008	10798	-8485	4.18	7.84	351
Iran	18180	33910	12181	-5999	0.86	5.94	66
Iraq	6261	12650	1816	-4445	0.34	3.68	40
Jordan	1415	3420	241	-1174	0.94	2.46	36
Kuwait	679	1210	7	-672	1.70	5.00	81
Lebanon	1025	1595	236	-789	1.27	4.79	67
Libya	1686	2286	472	-1214	0.26	3.12	42
Mauritania	490	855	176	-314	0.83	2.54	6
Morocco	7613	14143	5100	-2513	0.63	3.52	38
Oman	390	983	78	-312	1.62	4.97	41
Pakistan	31837	60986	30245	-1592	1.48	4.80	83
Qatar	118	226	12	-106	2.36	3.80	173
Saudi Arabia	4593	10363	3100	-1493	2.75	5.43	368
Somalia	1932	4656	1063	-869	1.05	4.42	4
Sudan	5463	9585	5627	+164	0.46	3.82	4
Syria	4310	9044	3060	-1250	0.62	3.67	40
Tunisia	2733	4312	1694	-1039	0.51	5.55	22
Turkey	20178	29314	20380	+202	0.83	5071	64
U.A. Emirates	422	779	42	-381	1.45	2.62	163
Yemen	2671	5851	1096	-1575	0.73	4.41	7
TOTAL	143814	261775	104099	.			

SOURCE: Kassam, A. 1992. An overview of land and water resources in the WANA region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

NOTES:* Average present yields of food crops in grains equivalent per hectare from the present rainfed and irrigated arable land.

** Average potential yields of food crops in grain equivalent per hectare from the present rainfed and irrigated arable land.

GE = Wheat grain equivalent

Annex 5: Water Resources (cubic km per year) in the WANA Region*.

Country	Water Availability			Total Withdrawn	% Needed in Agriculture
	Internal	Flow from Outside	Total		
I. HIGH-INCOME COUNTRIES (GNP/caput $6000 and above)					
Bahrain	0@	0	0	0	4
Kuwait	0	0	0	0.01#	4
Qatar	0.02	0	0.02	0.04#	38
Saudi Arabia	2.2	0	2.2	2.33#	47
U.A.Emirates	0.3	0	0.3	0.42#	80
IIa. UPPER MIDDLE-INCOME COUNTRIES (GNP/caput 2000-6000)					
Algeria	18.9	0.20	19.2	3.00	74
Cyprus	0.9	0	0.9	0.54	91
Iran	117.5	-	117.5	45.40	87
Iraq	34.0	66.0	100.0	42.80	92
Libya	0.7	0	0.7	2.62#	73
Oman	2.0	0	2.0	0.43	94
IIb. LOWER MIDDLE-INCOME COUNTRIES (GNP/caput $500-2000)					
Egypt	1.8	56.5	58.3	56.40	88
Jordan	0.7	0.4	1.1	0.45	65
Lebanon	4.8	0	4.8	0.75	85
Morocco	30.0	.0	30.0	11.00	91
Syria	7.6	22.9	35.5	3.34	83
Tunisia	3.8	0.6	4.4	2.30	90
Turkey	196.0	7.0	203.0	15.60	58
Yemen	2.5	0	2.5	3.40#	94
III. LOW-INCOME COUNTRIES (GNP/caput below $500)					
Afghanistan	50.0	-	50.0	26.11	99
Djibouti	0.3	0	0.3	0.01	51
Mauritania	0.4	7.0	7.4	0.73	84
Pakistan	298.0	170.0	468.0	153.40	98
Somalia	11.5	0	11.5	0.81	97
Sudan	30.0	100.0	130.0	18.60	99
TOTAL	813.92	430.6	1249.62	390.49	

SOURCE: Kassam, A. 1992. An overview of land and water resources in the WANA region. Paper presented at the EDI/WB/ICARDA/AOAD Seminar on Natural Resources and Environmental Management in the Dry Areas, Aleppo, Syria, 16-27 February, 1992.

Footnotes:

- * Figures do not include fossil or desalinized water
- @ 0 = Zero or less than 0.01 cubic km per year
- # Deficit balance by fossil groundwater, desalination and/or recycling

ICARDA-054/250/Nov1995