

EPTD WORKSHOP SUMMARY PAPER NO. 6

**INTERNATIONAL CONFERENCE ON AGRICULTURAL GROWTH,
SUSTAINABLE RESOURCE MANAGEMENT AND
POVERTY ALLEVIATION IN THE LOW RAINFALL AREAS OF
WEST ASIA AND NORTH AFRICA**

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EPTD Workshop Summary Papers provide an overview of the discussions and findings of workshops and conferences that the Division has helped organize or sponsor. It is generally expected that a proceedings volume of papers will be published at a later date.

SUMMARY

An international conference was held in Amman, Jordan in September 1997 to examine mounting problems of poverty and environmental degradation in the low rainfall areas (LRAs) of the eight Mashreq and Maghreb countries of West Asia and North Africa (Iraq, Jordan, Lebanon and Syria from the Mashreq region, and Algeria, Libya, Morocco and Tunisia from the Maghreb), and to seek solutions which reconcile economic growth with equity and environmental conservation -- the "3 E's" of sustainable development.

The conference, held under the distinguished patronage of His Royal Highness, Crown Prince Hassan of Jordan, was co-sponsored by the German Foundation for International Development (DSE), the Jordanian National Center for Agricultural Research and Technology Transfer (NCARTT), the International Center for Agricultural Research in the Dry Areas (ICARDA), and the International Food Policy Research Institute (IFPRI). It was attended by policymakers, scientists, and farmers from countries of the region, international development agencies, and international researchers.

The conference was also presented with the findings of a three-year collaborative research project dealing with these issues and including scientists from the eight Mashreq and Maghreb (M&M) countries and two international agricultural research centers. This project was co-financed by the Arab Fund for Social and Economic Development (AFSED) and the International Fund for Agricultural Development (IFAD).

I. Key problems identified by commissioned papers and working groups.

- A. Seven commissioned papers were prepared for the meeting as a basis for problem analysis and subsequent discussion by working groups and plenary sessions. These papers and the debate that followed show that the countries of the M&M regions face extremely challenging and interlinked environmental, economic, and social problems if they are to achieve the goals of the conference. Those problems include:
 - *Climatic aridity and frequent droughts.* The eight countries have an extraordinarily high proportion of their total agricultural area in ecozones with less than 400 mm rainfall, and their irrigation potential is nearing exhaustion. This restricts farmers' choice of enterprises and places a ceiling on crop yields. Drought compounds aridity, inhibits adoption of new crops and farming techniques, causes extreme inter-annual variability of production and loss of animals, and in severe cases can seriously damage the national economy.
 - *Rapid population and income growth are putting severe pressures on*

the fragile environment of the LRAs. Concern over environmental degradation in these regions is not new: the 1959 report of the FAO Mediterranean Development Project sounded a strong warning on those issues. Since then, however, human population has more than doubled to 112 million, numbers of small ruminant animals have risen by 65 percent (an addition of 25 million head), tractor numbers have increased five-fold to about 345,000 and encroachment on the fragile rangeland system have increased also.

- *Attempts by governments to achieve food self-sufficiency have created perverse incentives to agricultural mismanagement, resulting in resource depletion.* Producer and consumer subsidies on red meat and cereals and on fuel and agricultural machinery, have encouraged mechanized cereal cultivation of marginal lands, while subsidized animal feed has raised animal numbers in the same areas, generating conflicts, degrading the environment and increasing vulnerability to drought. These measures also create dependencies, with social repercussions if they are withdrawn—as has happened under structural adjustment. As they are generally untargeted, they favor larger farmers.
- *Insecure property rights have prevented farmers and communities investing in productive land improvements and adopting sustainable cropping and grazing practices.* Archaic legislation, state appropriation of traditional common pasture in Mashreq, and incapacity of local institutions to address adequately the new resource demands of a growing populations are major contributory factors. This has opened the way to land grabbing, degradation of common property resources, and exacerbated conflicts over rangeland resources.
- *Government and private investment has been concentrated primarily on high rainfall and irrigated areas.* Research, extension, market development, and social infrastructure of the LRAs has been neglected. Consequently there is a dearth of improved agricultural technology to generate productive growth of crops and livestock and increase farm incomes, as well as of alternative employment opportunities. Hence, these are the most impoverished regions of their countries, with increasing spontaneous out-migration. Contrary to conventional wisdom, however, participants did not consider that the poor were the main agents of environmental degradation, with the possible exception of damage due to fuelwood gathering.

- B. In-depth discussion by working groups of the issues raised in the commissioned papers focused on four assigned topics: Public and Private Investment; Technology Adoption; Crop-livestock Integration; and Range Rehabilitation.

Their analysis both confirms the main conclusions of the commissioned papers and highlights the difficulties of attempting to treat the major problems of the LRAs in isolation, whether from each other or from decisions made at the national level, because of their linkages and interactions.

Four main categories of problems are evident from their discussions, cutting across their assigned topics. These are: policy and economic constraints, resource endowment and management problems, technology related issues, and institutional, social, and property rights problems. Nested within each of these categories there are numerous sub-problems, like a Chinese box. For example, nine such problems were identified under policy and economic constraints.

This approach proved useful in locating the main obstacles to progress in achieving sustainable development of the LRAs, identifying the actions needed to find solutions, and indicating where the main responsibilities for initiating action should lie. It is noteworthy that while all working groups allocated high priority to solving policy and economic problems, each of them weighted priorities for solutions to the other three problem categories somewhat differently in relation to the nature of their assigned topic.

II. *Problem-solving: Instruments for achieving the 3 E's.*

In the second main phase of the conference, four different working groups were convened to examine the *instruments* which might be applied to solution of the problems discussed above. Those four instruments were: Market Liberalization; Property Rights Reform; Drought Management; and Appropriate Technologies. Each working group was assigned an instrument and asked: i) to identify its impact on the 3 E's, and ii) how it could be better designed to achieve positive and minimize negative effects in solving problems of the LRAs.

Their findings were then reviewed in plenary discussion to reduce overlapping, and applied to the four key topics identified under problem analysis so as to develop recommendations for presentation to an invited audience of policymakers, donors, and farmers on the final day of the conference. Field visits by the working groups to four diverse communities in Jordan, and discussions with farmers, extension staff, and local people provided further insights to problems and possible solutions. Their particular

concerns relate to the future of the rangelands in the absence of more secure property rights and a suitable technological package; to the lack of opportunities for income diversification in or outside agriculture; and to difficulties of obtaining credit without better collateral. The ever-present threat of drought is highlighted by the unfortunate conjunction of the elimination of feed subsidies in Jordan with one of the worst drought years on record, resulting in the premature slaughter of 30 percent of the national flock and emphasizing the need for development of a comprehensive national drought management strategy.

A lesson which emerges from these exchanges on the ground, is the inter-relation of the 3 E's; and the risks inherent in policy changes which unduly favor one component of the "critical triangle," without careful assessment of their potential impact on the other two sides of the triangle. A more effective mechanism for providing policy makers with reliable information from the grassroots on local conditions and the impact of their decisions, is considered indispensable.

In a final summation by participants, five key issues were discussed. These were:

- *Which of the 3 E's should have priority?* Participants stressed the need to study and capitalize on the positive interactions among the 3 E's in attempting to achieve this delicate balance. However if "equity" implies more even access to resources, it was felt that this should be a first choice. Currently too much emphasis is placed on "efficiency" and not enough on social security. Moreover, efficiency and growth are not necessarily synonymous, if the growth pattern is environmentally or socially destructive or distorts the economy.
- *How to reform markets and eliminate policy distortions without increasing poverty.* Abrupt withdrawal of long standing price and subsidy supports under structural adjustment could increase poverty in the LRAs, which have generally been neglected by other government investments and services, and which have limited scope for economic diversification. They should be phased out cautiously, with safety-net measures to protect the poor, over a transitional period, and their social impact should be carefully monitored.
- *What can be done to deal more effectively with drought to replace the current crisis-driven approach?* Participants emphasized the need for better information and sharper definition of the most vulnerable areas, and for the establishment of holistic national drought management strategies supported by a permanent institutional and technical infrastructure nation-wide. Eleven potential components of such a strategy were identified, with emphasis on early-warning and monitoring systems, water development, diversification of

land use, closer crop-livestock integration and related market measures for destocking and restocking in drought emergencies, judicious allocation of emergency feed, examination of crop insurance options, support to community self-help measures, and action to upgrade the earning capacity of low income people both on and off farms. Assisted migration was not excluded.

- *What are the requirements for technology adoption?* Concern was felt at the redundancy of imported on-farm technology for the LRAs, and the limited understanding of their resource potential and problems resulting from past concentration of research in the higher rainfall and irrigated areas. The participants felt that the type of growth at the expense of the environment being promoted by perverse incentives to cultivate and overstock rangelands was ultimately unsustainable, confirming a warning in the commissioned papers that the existing LRA system may be in danger of collapse.

Nevertheless, since extricating themselves from these policies could create a social dilemma for policymakers: precipitous change should be avoided, and savings from withdrawal of subsidies should be channeled into applied research to find more efficient and sustainable technologies; as well as to the education of local people, improvement of rural infrastructure, and other measures to help the poor. These measures should be integrated into comprehensive regional development plans, formulated with the participation of farmers and rural communities.

- *How can property rights reform contribute to the 3 E's?* While secure property rights alone will not necessarily solve all of the problems of sustainable development in the LRAs, appropriate tenure security was seen as virtually indispensable to the success of policies and technologies to improve resource management, promote equity, and raise living standards there. Better knowledge and understanding of the existing situation is needed to clarify current uncertainties and provide the basis for establishment of legal rights to grazing lands and water resources in participation with local communities, and credit to support investment in their sustainable management.

III. *Final Conference Recommendations to the invited audience; including His Excellency, the Minister of Agriculture of Jordan, policymakers, donors and representatives of the farming community.*

These recommendations emphasize the need for stronger government support to the social as well as the economic development of the LRAs, the complementarity of public and private investment, the importance of closer collaboration of government and local communities in their implementation, and the establishment of a safety-net to protect the poor against structural adjustment measures. The conclusions are summarized below.

- A. *Public and Private Investment.* Priority areas for public investment in the LRAs are: agricultural research on natural resource management; water resource development, water harvesting, and watershed management; rural infrastructure, including access roads, electricity, and rural service centers; and investment in people, especially education and training of poor people and women. All public investment should be developed in close collaboration with the local communities, who should co-finance and help maintain investment structures.

Private investment is considered essential for sustainable development of the LRAs and for diversifying the local economy to create new employment in agriculture, agroindustry, and non-farm activities. However private and public investment are highly complementary, and governments may need to create new incentives, through credit, tax policy, and infrastructural investment, to encourage private enterprise.

- B. *Technology Adoption.* Linkages between research and extension in the LRAs must be strengthened, in close association with farmers, to enhance the efficiency of research, with a focus on crop diversification, including tree crops, water harvesting linked to range improvement and soil conservation, and agroprocessing and marketing of produce.

It is essential that social and environmental benefits be given equal weight with economic considerations when assessing the feasibility and evaluating the impact of technology in the LRAs.

- C. *Improved crop-Livestock Integration* is seen as a crucial instrument for sustainable development of the LRAs, but its success requires an integrated approach involving several complementary components, including:
- Establishment of secure property rights to individuals or communities, and discouragement of land fragmentation; improvement of marketing

systems for livestock, inputs, and outputs, including support to producer cooperatives; promotion of fodder crop production and storage of feed at farm level.

- Reinforcement of research to develop improved drought management packages that reduce dependence on government assistance in drought years.
- Governments should devise protective measures compatible with the GATT agreement to safeguard barley and livestock production, and should create the necessary scientific and technological infrastructure to help farmers manage drought more effectively.

D. *Range Rehabilitation.* Measures recommended to achieve this goal are closely linked to those proposed under crop-livestock integration and drought management. They include: establishment of a range database supported by a monitoring, evaluation, and information system using modern technology (resource inventory, a Geographical Information System, and early warning capability); and improved property rights, with institutional capacity for devolving the control and management of rangeland to local communities and for implementation of such arrangements. The development of effective resource stewardship, whether through communal or private management is seen as of crucial importance.

The creation of a national authority in each country to protect the resource base and to ensure efficient and sustainable use of the natural endowment is strongly recommended.

CONTENTS

	Page
1. Background to the Conference	1
The Opening Ceremony	4
Opening Remarks by Dr. Nasrat Fadda, Chairman of the Conference	6
2. Key Problems and Challenges Facing Sustainable Development of the Low Rainfall Areas	9
The Background Papers	9
Environmental Threats and Their Causes	10
Climatic Aridity and Drought Constraints on Farmers' Options	12
Environmental and Social Problems Generated by Pressures of Demand for Food and Water	15
Widespread Poverty in the Low Rainfall Areas	17
Impediments to Adoption of Improved Technologies	19
Property Rights Uncertainties and How They Inhibit Progress	22
Market Reforms and Their Implications for the Low Rainfall Areas	24
Conflicts Between Agricultural Growth, Poverty Alleviation and the Environment	28
3. Problem Analysis: Working Group Discussion of the Key Problems and Their Causes	31
Policy and Economic Constraints	33
Resource Endowment (Natural Resource Base) and Resource Management (Anthropogenic) Problems	34
Technology Related Issues	36
4. Problem Analysis: Plenary Discussions of Problems Identified by Authors of the Background Papers, and by the Working Groups	40
Which of the 3 E's Should Have Priority?	40
How to Reform Markets and Eliminate Policy Distortions Without Increasing Poverty	41
What Can Be Done to Deal More Effectively with Drought?	42
What Are the Requirements for Technology Adoption?	42
5. Instruments for Achieving Efficiency, Equity, and Environmental Sustainability	43
Market Liberalization	44
What Have Been the Impacts of Market Liberalization on the Low Rainfall Areas in Terms of Efficiency, Equity, and Environmental Sustainability?	44
How Can Market Liberalization Be Designed/implemented to Achieve Positive Impacts and to Minimize Negative Impacts on the Low Rainfall Areas?	46
Property Rights as an Instrument	47
What Have Been the Impacts of Property Rights (Positive or Negative) on the 3 E's and How Have They Changed over Time?	47
What Are the Options for Strengthening or Reforming Property Rights to Enhance Efficiency, Equity, and Environmental Sustainability?	50

Drought Management as an Instrument	51
Why Do Farmers Need Special Drought Assistance Today, When it Was less Necessary in the Past?	51
Reasons Why They Need Help Which Are Beyond the Direct Power of Farmers to Influence	52
Problems Which Farmers Could Address More Directly Themselves, with Help	53
What Have Been the Impacts of Drought Management Policies on the 3 E's?	53
How Can Drought Management Policies Be Designed in Order to Enhance Their Positive Impact on the 3 E's in the Low Rainfall Areas?	55
Appropriate Technologies as an Instrument	56
What Have Been the Impacts (Positive or Negative) of the Various Forms of Technology on Efficiency, Equity, and Environmental Sustainability in the Low Rainfall Areas?	56
Why Have Apparently Beneficial Technical Solutions Not Been Adopted in the Low Rainfall Areas?	59
How Can Appropriate Technology Be Designed in Order to Enhance its Positive Impact on the 3 E's in the Low Rainfall Areas?	60
6. Farmers Views on the Crucial Issues Affecting the 3 E's: Results of Visits by Working Groups to Four Communities in Jordan	63
7. Round-up: Summation by the Working Groups of Their Preceding Discussions, and Final Recommendations of Participants	65
The Roles of the Four Instruments in Achieving the 3 E's	66
Under Market Liberalization	66
Under Appropriate Technologies	67
Under Drought Management	68
Under Property Rights	69
Final Conference Recommendations	70
Public and Private Investment	70
Technology Adoption	71
Crop-livestock Integration	71
Range Rehabilitation	72
Annex 1. Workshop Participants	75
Annex 2. Conference Agenda	80

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by Peter Oram

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1. BACKGROUND TO THE CONFERENCE

A major challenge facing governments and society worldwide on the threshold of the twenty-first century is to achieve sustainable economic growth by means which alleviate poverty without jeopardizing the quality of the environment. While this is a task of global significance it presents particular problems to the agricultural sector because of the direct links between production and the natural resource base, especially in the developing countries where dependence on agriculture for income and employment is generally high.

In order to address this key issue of agricultural development, a series of conferences has been held in recent years to bring together policymakers, national and international agricultural researchers, representatives of local institutions, and non-government organizations. Following an international conference in Germany in 1991, regional conferences were held for East and Southeast Asia in 1994, and Latin America in 1995, with the aim of identifying ways of reconciling the sometimes conflicting goals of agricultural growth, poverty alleviation, and environmental sustainability—often described as the "critical triangle."

This report concerns the third regional conference convened to address this critical issue, held in Amman, Jordan, in September 1997, with a geographical focus on the low rainfall areas (LRAs) of the eight countries of the Mashreq and Maghreb (M&M) regions

* The Amman conference was planned and managed by a steering committee comprising Drs. Peter Hazell (IFPRI), Tom Nordblom (ICARDA), Jürgen Richter (DSE), and Nabil Chaherli and Tidiane Ngaido (ICARDA/IFPRI). Dr. Nasri Haddad (ICARDA), Dr. Awni Taimeh (NCARTT), and Dr. Nasrat Fadda (Conference Chair) were also instrumental in organizing the conference.

of West Asia and North Africa.¹ A fourth conference, for Sub-Saharan Africa is to be held in Uganda in May 1998. Each of these conferences has a different geoclimatic and agro-ecological focus.

All of the conferences have been co-sponsored by the German Foundation for International Development (Deutsche Stiftung für Internationale Entwicklung) and the International Food Policy Research Institute (IFPRI), together with other national and international co-sponsors as appropriate.

In the case of the Amman Conference the additional co-sponsors were the International Center for Agricultural Research in the Dry Areas (ICARDA), the Jordanian National Center for Agricultural Research and Technology Transfer (NCARTT), the International Fund for Agricultural Development (IFAD), and the Arab Fund for Social and Economic Development (AFSED). The conference was held under the distinguished patronage of His Royal Highness, Crown Prince Hassan of Jordan.

Within the broad goal of contributing to balanced agricultural growth and food security in the M&M regions, the conference had six objectives. These were

- i. to present to an informed audience the principal results of the ongoing M&M project for the development of sustainable integrated crop/livestock production systems in the LRAs of West Asia and North Africa, involving ICARDA, IFPRI and inter-disciplinary teams from the eight M&M countries;²
- ii. to initiate a discussion of those results by four subject matter working groups, and of how current government policies in those countries affect the LRAs, as described in the seven background papers prepared for the conference;
- iii. to identify the appropriate medium- and long-term roles of the LRAs in

¹ The Mashreq countries of West Asia are Iraq, Jordan, Lebanon, and Syria; the Maghreb countries of North Africa are Algeria, Libya, Morocco, and Tunisia.

² This project became operational in January 1995 and is due to terminate in its current mode in December 1997. It is funded by the Arab Fund for Social and Economic Development (AFSED) and the International Fund for Agricultural Development (IFAD).

- contributing to poverty alleviation and food security in the M&M regions;
- iv. to develop a close participatory dialogue amongst policymakers from the region and donor agencies on the key issues identified by the ICARDA-IFPRI project and the working groups, the possible solutions, and their implications for future economic, social, and environmental policies;
 - v. to evaluate possible consequences of alternative policies and strategies for different LRAs so that they can be appropriately developed to meet the livelihood needs of local people, while sustainably managing the natural resource base and halting desertification; and
 - vi. to examine the need for follow-up action to the current M&M project, and to develop recommendations for future participatory research on the identified issues.

The conference spanned five days of intensive discussions among the 60 participants, with a format of plenary discussions interspersed with working groups. The first two days focused on problem analysis derived from the discussion of the seven commissioned background papers, the results of the M&M project, and the four working groups; followed by working group consideration of the role of four key instruments in helping to solve those problems. One day was devoted mainly to field trips to four contrasting sites designed to highlight the nature of local communities and the problems they face in managing their resources sustainably. Discussion of the field trips provided further insights to the participants; leading to the synthesis of the working groups results on the penultimate day, and the presentation of their conclusions and recommendations to an invited audience of policymakers and members of the agricultural community in Jordan on the final day.

THE OPENING CEREMONY

The conference was formally opened by His Excellency Mijhem Al-Kharaisha, the Minister of Agriculture for Jordan, on behalf of His Royal Highness, Crown Prince Hassan of Jordan, Patron of the Conference.

He highlighted the need for modern technology to increase agricultural output in order to overcome the problems facing the inhabitants of the arid regions. In Jordan, those regions occupy 91 percent of the total area of the kingdom, and are home to 70 percent of the country's livestock on which some 400,000 people depend for a livelihood. The government is concerned to promote rural development there while maintaining the natural balance, since the environment is vulnerable to rapid deterioration due to natural and human pressures. Prompt attention is needed to achieve sustainable development and boost agricultural production.

He therefore welcomed the conference, whose broad goal was to contribute to balanced agricultural growth and food security in the eight countries through the participatory formulation of strategies for sustainable resource management and poverty alleviation.

Following the Minister's statement, conference delegates, policymakers, and researchers from the M&M regions, and other participants were welcomed in the opening session by representatives of the co-sponsoring institutions:

Dr. Hans Bühler, Director General of the German Foundation for International Development (DSE), also speaking on behalf of the German Federal Ministry of Economic Cooperation and Development, informed participants that since its inception in 1959, with the special task of contributing to human resource development, training, and dialogue with policymakers in developing countries, DSE had focused its activities on areas crucial for development. Thus the so-called critical triangle was naturally one of its priorities.

In 1991, an initial international conference on this issue was held in Germany, followed by a series of regional policy conferences, each with a special focus, organized jointly with IFPRI—to inform policymakers of current policies in this area and to help develop a conceptual framework for analysis of the potential effects of new policies. The Amman conference is the most recent and is specifically focused on the LRAs, but all deal basically with the key issue of finding relevant strategies for managing the interrelationship between economic growth, equity, and environmental sustainability—the "3 E's"—on which our future depends.

He was pleased that this conference was solidly based on the collaborative research input from the countries and the two international research centers, IFPRI and ICARDA, involved in the M&M project, and with their excellent cooperation during the preparations for the meeting. He expressed thanks to Dr. Fadda, Chairman, for his contribution as the guiding spirit of the conference, and to IFAD and the Arab Fund for their central role in supporting the M&M project. He also emphasized the importance of interaction with the farming community, as an insight to designing and implementing sound policies, and thanked Dr. Taimeh, Director General of NCARTT and his staff for arranging field visits under the conference program.

He was profoundly grateful to His Royal Highness, Crown Prince Hassan, both for his kindness in agreeing to host the conference in Jordan, and for taking it under his patronage. DSE was proud and privileged to have developed an excellent cooperation with Jordan over the years. He wished all present a successful conference with tangible results for their work and for their countries.

Welcoming participants on behalf of the International Fund for Agricultural Development—Dr. Slama, Director of IFAD's Technical Advisory Division—informed participants that as IFAD is a financial and development institution with a mandate for the reduction of rural poverty, it gives strong emphasis to mainstreaming the concerns and aspirations of the poor in the programs of its member countries. In this context, IFAD's Technical Assistance Program supports the application of research results which impact on the livelihood of its target groups. However, IFAD's resources were limited, therefore, it is their goal to use them as effectively as possible.

According to IFAD's experience one of the major problems facing the attempt to transfer technical results is the absence of a suitable policy and an appropriate institutional framework. This issue was the driving force for IFAD's support to the M&M project. The project is not only unique as a multidisciplinary, collaborative, and participatory research effort, but because it looks for means and approaches to solving the technical problems in conjunction with solving the socio-economic and policy constraints.

The conference was specifically designed to present the results of hard work in

research by the implementing institutions, ICARDA and IFPRI, and to explore the policy and property rights issues which are the driving forces behind sustainable use and management of the livestock-crop systems in the LRAs of the participating countries. This work has been significant because it is under the direct responsibilities of the national coordinators and the national research institutions of the participating countries. Moreover, it is important to emphasize that the livestock producers and the barley farmers were also major contributors to this work. This was achieved through inter- and intra-regional workshops, on-farm research, and visits.

Dr. Bühler was pleased to be part of this important event and wished all present a fruitful outcome.

Brief welcoming statements were also made by the Directors-General of the three co-sponsoring research institutions: Dr. Adel El-Beltagy of the International Center for Agricultural Research in the Dry Areas (ICARDA); Dr. Per Pinstrup-Andersen of the International Food Policy Research Institute (IFPRI); and Dr. Awni Taimeh of the Jordanian National Center for Agricultural Research and Technology Transfer (NCARTT). Each of them also made an important contribution to the meeting through their plenary papers, which are reported on in more detail under that heading in Part Two of this report.

OPENING REMARKS BY DR. NASRAT FADDA, CHAIRMAN OF THE CONFERENCE

Dr. Fadda warmly thanked His Royal Highness, Crown Prince Hassan for his gracious and impressive opening message; ably delivered by His Excellency, Mijhem Al-Kharaisha, Minister of Agriculture. His task as chairman was to facilitate the conference and assist others to deliver their ideas, experiences and accumulated knowledge.

Broadly, the conference was designed within the three basic parameters of poverty alleviation, growth (as an element of poverty alleviation and food security), and sustainability, reflecting the strong relationship between man and his environment. While interrelated and interdependent, these goals are difficult to attain simultaneously, hence,

trade-offs among them are the norm. It is the participants' task to identify complementarities and antagonisms, assess their magnitude and significance, and seek ways to soften negative impacts. The eight countries involved have a large measure of ecological similarity to justify grouping them, yet enough variability to widen the scope of discussion, and render the results of interest to other countries with comparable ecologies and problems.

The focus of the meeting on rainfed agriculture towards the lower limits of the dry farming zone was not fortuitous. The better endowed rainfed and irrigated zones had been the first to harvest the fruits of the "Green Revolution." They were rightly seen as offering the promise of greater returns and lower risks, and generally had met those expectations. However, it could legitimately be speculated that diminishing returns would limit future advances in these zones.

By contrast, the potential of the lower rainfall zones, which comprise over 70 percent of usable agricultural land in West Asia and North Africa (WANA) has yet to be tapped. Hence, these areas merit greater attention than hitherto accorded them.

While this meeting represents only one link in a chain of global discussions affecting our planet, in certain respects the WANA region faces a more acute situation than most, due to its extremely high population increase, resource depletion and stalled economic growth. As a result, this region is poorer than it was a decade ago. Attempts to meet these pressures through the expansion of mechanized crop production into lower rainfall regions while also increasing numbers of animals there, are accelerating environmental degradation, endangering in a few decades a system that has endured for countless generations.

These were some of the issues to which participants would be seeking better understanding and workable solutions; starting in the next session with an in-depth analysis of the agricultural situation and prospects of the LRAs of WANA.

This would be followed by consideration of selected instruments of change towards healthier agricultural production and food security, drawing extensively on experiences of national scientists working in the region and living its problems. Many of them were

active players in the ongoing M&M project together with colleagues from ICARDA and IFPRI. Thus the conference would be able to have an early view of the findings of this project.

There would also be an important opportunity for free interaction with farmers and local communities, through field visits to four sites in Jordan.

The meeting was structured as a hybrid between a seminar and a workshop, delegating much of its business to working groups. They would have the task of critically reviewing issues and analyzing papers and proceedings of plenary sessions, returning to plenary sessions with their own contributions for further debate and adoption of agreed conclusions and recommendations.

At the end of the meeting Dr. Fadda expected that the conference would have achieved

- a deeper understanding of the agro-ecologies of the LRAs and the socio-economic, institutional and policy factors that have impelled both the productive and destructive developments of recent decades;
- a more realistic assessment of the potential contribution of these vast areas to poverty alleviation and enhancement of food security;
- clearer grasp of the elusive concept of sustainability and the means to give it an operational focus;
- greater sensitivity to the potential conflicts between growth and sustainability, with the exploration of options for reconciling the rising needs of current generations with inter-generational equity.

2. KEY PROBLEMS AND CHALLENGES FACING SUSTAINABLE DEVELOPMENT OF THE LOW RAINFALL AREAS

THE BACKGROUND PAPERS

Seven plenary papers were commissioned for the conference: their titles and authors are listed below in their order of presentation.

1. The Current Situation and Outlook for Agriculture in West Asia and North

- Africa and for the Low Rainfall Areas. Dr. Adel El-Beltagy; International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria.
2. Environmental Threats to the Low Rainfall Areas and Their Causes. Professor Awni Taimeh; National Center for Agricultural Research and Technology (NCARTT), Amman, Jordan.
 3. Inter-Relationships Among Agricultural Sustainability, Growth, and Poverty Alleviation. Drs. Per Pinstrup-Andersen, Peter Hazell, and Peter Oram; International Food Policy Research Institute (IFPRI), Washington, D.C. USA.
 4. The Impact of Market Reforms on the Low Rainfall Areas in West Asia and North Africa. Dr. Nabil Chaherli; IFPRI/ICARDA, with contributions from colleagues in the M&M project national teams in Jordan, Morocco, Syria, and Tunisia.
 5. Land Improvements and Sources of Income in the Low Rainfall Areas of the M&M Regions. Do Property Rights Matter? Dr. Tidiane Ngaido; IFPRI/ICARDA, with contributions from colleagues at IFPRI, ICARDA, and the M&M project national teams.
 6. The Experience with Drought Management Policies in WANA. Drs. Mohammed El-Mourid and Mohamed Moussaoui; Centre Aridoculture, INRA, Settat; and Ecole Nationale d'Agriculture, Meknes, Morocco.
 7. Facilitating Wider Adoption of Existing and Promising New Technologies in the Low Rainfall Areas. Dr. Nasri Haddad, Regional Coordinator, West Asia Regional Program, ICARDA, Amman, Jordan.

The authors' principal findings are synthesized in the discussion which follows, in order to highlight the key issues and constraints facing sustainable management of the LRAs.

Environmental Threats and Their Causes

The world's natural resources have been subjected over time to various processes

causing their deterioration, partly as a consequence of natural factors such as drought and climatic variability, and partly due to the demands of an increasing human population. The latter include urbanization, pollution, and poor resource management. Desertification is a multiple process which poses maximum threats to the arid and semi-arid ecosystems, and has links to global warming, the displacement of people, and the degradation of biodiversity.

Soil salinity is another major cause of worldwide degradation with serious implications for water management in the Arab countries, where arid land represents 89 percent of their total area, with 69 percent receiving less than 100 mm mean annual precipitation (m.a.p.), and only about 11 percent exceeding 400 mm m.a.p.

Although both natural and anthropogenic factors contribute to resource degradation and the latter have a long history in the WANA region, human influence has increased immeasurably since the 1950s. Rapid population growth and related pressures for food, fuelwood, and water have led to overgrazing through increasing numbers of animals on the range, deforestation, mechanized cultivation of low rainfall lands below 200 mm rainfall, intensive traffic movement, pollution with plastic waste, improper agricultural practices and intensive use of chemicals, over-exploitation of groundwater, and loss of land to urban development.

Climatic aridity, which was the primary source of desertification until 3000-5000 B.C. has been overtaken since then by the influence of man. Nevertheless, climate remains of crucial importance and the interaction of climate with soil is a principal determinant of vegetation cover. Although farmers in some of the M&M countries claim that the weather has become drier and droughts more frequent, it is not evident that climate has changed significantly in the last 2000 years, although there is recent evidence of cyclical drier and less dry periods of varying length, reported for example, in Jordan, Libya, and Morocco. In addition, rainfall records show very high inter-annual and inter-seasonal variability of precipitation.

However, it is difficult to draw concrete conclusions from a climatic record of only 60 years; or (except in specific cases such as soil salinity due to irrigation

mismanagement), to differentiate between natural and human influences as sources of large-scale soil and vegetative degradation. Nevertheless, many scientists believe that human activities are the main factor causing desertification. It has been said that it is man who creates the desert: the climate only provides the right conditions!

The author cites numerous striking examples of destruction of vegetation cover from fire, cutting, and grazing, especially of forest, as a continuing cause of agro-ecological changes in the M&M countries, including Algeria, Morocco, Tunisia, and Syria. These problems have been compounded by other adverse processes, including mechanical cultivation of marginal lands, poor land management, intensive traffic movement on fragile soils, and improper housing strategies, leading to desertification.

Although quantitative data regarding the rate and hazards of each of these factors is scattered, the author estimates that the current area subject to desertification represents about 36 percent of the total land in the Mashreq region and 81 percent in the Maghreb. In addition, almost another 50 percent of the total is threatened by desertification in the Mashreq and 17 percent in the Maghreb. These are alarming statistics!

Factors which contribute to resource degradation include: *water erosion*, especially active on steppe and rangeland in West Asia; *wind erosion*, especially in arid areas, leading to sandy soils and dune formation; estimated to affect about 28 percent of Arab countries in West Asia, and 17.5 percent in the Maghreb region. *Chemical degradation* is also of major importance, due both to an increase in soil salinity, and to accumulation of toxic materials. Salinization is particularly damaging, as it is prevalent in irrigated land, whether the result of indigenous soil salinity, poor surface or ground water quality, or the absence of drainage. Not only are crop yields reduced, but land may go out of production altogether.

Over-pumping of groundwater is a further contributory factor, increasing the salinity of irrigation water, with accumulation of salt in the soil. About 7.4 million ha in the Mashreq, and 7.7 million ha in the Maghreb are reported to be saline.

Environmental hazards related to water utilization include over-pumping for irrigation, rising demand for water overall, and competition between agricultural and non-

agricultural uses of water. Thus irrigation will have to rely more on water of marginal quality, and farmers will have to increase water use efficiency.

An additional environmental hazard arising from the population explosion stems from the increasing accumulation of sewage water around urban centers. This is a useful but hazardous source of water, on which irrigated agriculture may have to rely to an increasing extent, with risks of introducing toxic materials into other water resources and creating hazards for wild life. This may pose an imminent threat to countries dominated by dry conditions, as in the M&M regions.

Impact on vegetation and wildlife. Numerous natural factors related to climate, rainfall, erosion, and physical weathering influence vegetation cover and quality, and the interaction between vegetation and wildlife plays an important role in the environmental balance. There is evidence of significant loss of biodiversity, deterioration of the quality of the natural vegetation, and the decline or disappearance of indigenous wildlife, especially mammals.

Climatic Aridity and Drought Constraints on Farmers' Options

Low rainfall in itself is not necessarily an insuperable problem. As long as precipitation is well distributed and not highly variable within and between seasons, farmers can adjust their cropping or grazing systems and management techniques to deal with it.

However, where precipitation is both limited and erratically distributed, as is the case in most of WANA with frequent unpredictable and sometimes prolonged periods of drought, it is extremely difficult to cope with. Farmers are reluctant to innovate, either with respect to diversifying their cropping systems or adopting new cultivars or farming techniques; avoiding risk of crop failure is often more important than maximizing their yields in good years.

Examples of drought incidence in the M&M countries cited in the background paper show that in North Africa it has occurred in about 30 percent of the years during the last half-century, in some cases persisting for five consecutive years. Average rainfall

deficits (departures from "normal" rainfall) have varied from 20-51 percent in Morocco and Tunisia, with extremes of 85 percent in Morocco in 1982-84. The situation in West Asia is very similar.

The impact on crop and livestock production can be dramatic. In the severe 1994-95 drought, cereal production in Morocco was the lowest ever recorded; 1.7 million metric tons (m.t.) compared to 9.6 million m.t. in the bumper harvest year of 1993-94. Similar high inter-annual variability of cereal yields is reported from Tunisia. In 1983, both crops and range vegetation failed almost completely in Iraq. Losses of small ruminants can be enormous. In the two-year drought of 1982-84 in Syria, the sheep population fell by 2.5 million, a quarter of the national flock. In Morocco, 25 percent of the cattle and 30 percent of the sheep perished or were sold prematurely in the 1981-82 drought. In 1997, the coincidence of severe drought in Jordan and the withdrawal of feed subsidies under structural adjustment led to the premature slaughter of an estimated 30 percent of the sheep flock there.

The impact of such events can transcend the farming community and affect the entire economy, as was the case in Morocco in 1995. National growth was depressed, the balance of payments was disturbed, credit default increased, unemployment rose, and emergency relief measures costing \$565 million had to be instituted.

While this is the most recent and dramatic example, virtually all WANA countries have been forced to implement a range of measures and policies to limit the social and economic damage from drought. These include emergency purchase and distribution of concentrate feed to livestock owners; veterinary prophylaxis measures; water development and well-sinking for people and livestock; and special access to credit and debt relief. Longer-term actions include construction of dams and other water storage systems, and shrub and tree planting programs.

Although there is some recent evidence that these measures have helped to mitigate losses of animals from drought, they have been financially costly, and where they have involved untargeted distribution of subsidized supplementary feed to livestock, they have benefitted the larger flock owners most.

Moreover, they have created dependencies on feed supplements and have encouraged the maintenance of larger numbers of animals on the rangelands for longer periods each year, thus accelerating resource degradation. Consequently, the contribution of the natural grazings to total feed supply has fallen dramatically in nearly all M&M countries, while concentrate feed use has escalated.

Governments have expended large sums of money on these transient crisis management measures, which could have been invested more productively in national development. There is an urgent need to establish national plans to manage drought in a more timely, consistent, and equitable way. Those plans should, *inter alia*:

- provide timely and reliable information on drought conditions and related impacts to farmers and governments;
- develop and implement improved impact assessment techniques;
- plan assistance programs well in advance of drought to avoid delays.

Any strategic plan to manage drought should have three components: supply augmentation, demand management, and institutional development, and it should look at all technology options concerning water, rangeland and livestock management.

Drought should be treated both as an integral component of the production function, and as a structural feature of the climate in the LRAs. Government actions should be developed around five main themes:

1. Establish permanent institutional base to manage drought, establish priorities, coordinate actions, and improve early warning and monitoring systems;
2. Improve public investment in the LRAs; including public works, water harvesting, land reclamation, and education and health services;
3. Encourage private sector investment in rural development of LRAs to increase local employment and incomes;
4. Implement policies that protect the environment in the LRAs; discourage cultivation of marginal land; increase shrub and tree plantations, develop loans and insurance systems to help farmers incorporate risk management, and encourage cost-sharing measures;

5. Establish a strong multi-disciplinary research network to address key issues of alleviating poverty in the LRAs, while protecting the environment, and develop baseline information systems on physical, biological, sociological, and economic issues. The study of farmers' own means of coping with drought should be evaluated and incorporated in the drought planning strategy.

Environmental and Social Problems Generated by Pressures of Demand for Food and Water

Pressures of demand for food and water are interacting with aridity and drought to degrade the environment. Human population of the M&M regions has increased by almost 60 million over the 30 years from 1965 to 1994 and is projected to rise to about 234 million by 2020, with a particularly rapid expansion in the Mashreq countries. This will be concentrated primarily in the urban areas, with the urban population forming over 80 percent of the total in 2025 compared to around 65 percent in 1990; and the share of rural population declining from 35 percent in both countries in that year, to only 14 percent in the Mashreq and 18 percent in the Maghreb by 2025.

These trends, together with income growth, have both stimulated demand for staple cereals, and diversified the diet, far exceeding domestic production capacity in most M&M countries. Assuming that per capita consumption of grains remains the same, the gap between demand and supply for the WANA region as a whole will rise from 51 million m.t. at present to 109 million m.t. by 2025 unless the growth of production accelerates. Demand for red meat is also far in excess of domestic production capacity, despite incentive measures by governments to encourage farmers to increase numbers of small ruminants and to shield them from the worst hazards of drought.

The better watered agricultural lands are already under heavy pressure, leading to abandonment of the traditional restorative fallow on rainfed farms, and creating incentives to extend the frontier of mechanized cereal cultivation to lower rainfall areas, and to the rangelands, even down 150 mm MAP.

A parallel trend is to raise stocking rates of small ruminant livestock on the shrinking area of natural grazings, and to keep them there longer through trucking water

and feed to the flocks. Numbers of small ruminants have risen by two-thirds (29 million head) since 1960, but it has been estimated that the contribution of the rangeland to animal feed resources has declined from around 70 percent in the 1950s to 30 percent today as a result of mismanagement. Productivity per head of livestock or per ha of arable land has not increased; competition for land has.

A further adverse impact of human pressure on the natural resource base has been the destruction of the natural vegetation and of wildlife. Valuable trees, shrubs, and other beneficial native species have been virtually eliminated from the M&M regions due to cutting, conversion of land to cultivation, overgrazing and urbanization. Many species listed in historical records are now extinct or seriously threatened. Drought and reduction of spring flows due to pumping are further contributory factors, leading both to the loss of wild plant species and to the disappearance of animals which co-existed with them.

Thus both the flora and the fauna of the region are victims of man's lack of stewardship of his natural heritage. It is the task of this conference to find means of halting this downward spiral of destruction before it becomes irreversible. Unabated continuation of this resource exhaustive pattern of growth threatens the collapse of the system.

Widespread Poverty in The Low Rainfall Areas

Largely because of the region's oil resources there is a popular concept that WANA is a land flowing with milk and honey, with very little poverty. However, oil exporters represent only 5 percent of the regional population: 76 percent have a per capita GNP below US \$2 a day. A recent World Bank report shows that in fact the percentage of the population in poverty in WANA is greater than in Latin America or East Asia. Consumption of grain per capita has declined in the poorest WANA countries. That report does not disaggregate poverty by ecological region, however, it is generally believed that it is most prevalent in the rural areas, especially in the LRAs with less than 300 mm of mean annual precipitation.

The principal causes of poverty in the LRAs include the following:

- Insufficient access to land, with the majority of arable farms being under 10 ha in size, while the bulk of the cultivated area is in the hands of a few large landowners. A similar asymmetric relationship exists with respect to flock size and ownership. Recent surveys show that a significant number of farm families are virtually landless, with an increasing dependence for their survival on casual labor on larger holdings or in urban areas.
- Lack of secure tenure, particularly in the rangelands which have historically been a principal source of sustenance for the small ruminant livestock that are the mainstay of agricultural income in the LRAs, especially below 200 mm of annual precipitation. A related obstacle facing land-scarce people is lack of collateral for loans to acquire land, or for other means of adding to their income such as planting olive trees or establishing cottage industries.
- Low agricultural productivity due to low and unstable rainfall, lack of appropriate technology, uncertain property rights, and reluctance of small farmers to put their families at risk by investing in unfamiliar crops or production inputs. The impact of drought is especially severe on small livestock owners whose animals are often their only source of savings as well as of income. Larger flock masters, especially those with arable land may be able to store forage from good years to tide them over, or to buy supplementary feed if necessary. They are also better equipped with trucks, water tankers and farm machinery, and can move stock around to avoid drought and search out better grazings, or to market animals before they lose condition or die. Small farmers may lose everything and become destitute.
- Difficulties of supporting large nuclear families on small farms. Population in the region is growing at over 2 percent per year, and life expectancy is increasing.
- Governments have largely neglected investment in the LRAs, compared to the higher rainfall and irrigated regions, with respect to both infrastructure and to research/extension. Given the remoteness of many rural communities in these

areas and the lack of social amenities there, the improvement of basic local services and access to markets may be one of the most important steps that governments could take to improve the lot of the poor, especially that of women.

- Inequality of opportunity within farm households. Women play a particularly important role in care of livestock, but do not necessarily reap an equal share of the returns: they generally have lower levels of literacy and poorer healthcare than men, and in many outlying villages are forced to spend much of their time collecting fuelwood and water. When male heads of households leave for work elsewhere, the burden on their wives may increase but with more limited access to credit and extension services.

Increasing pressures of population on land and water resources in the LRAs, rising food prices, or loss of incomes as a result of changes in government support to agriculture (for example, under structural adjustment), may drive poverty-stricken farmers to degrade the environment. Devising policies which mitigate poverty without creating dependencies on subsidies or other handouts is a major challenge facing governments in the M&M countries.

Impediments to Adoption of Improved Technologies

The wider adoption of improved agricultural technologies in the LRAs is impeded by numerous constraints. Declining productivity is evident in the low rainfall arable areas through depletion of soil fertility as a result of cultivating marginal land and replacing restorative fallow by continuous barley production. In the rangelands, the same decline occurs as a result of increasing numbers of animals and lack of secure tenure. Halting this slide towards resource degradation will depend heavily on the identification and adoption of promising agricultural technologies for barley-livestock based arable farms and for grazing systems, supported by appropriate policies and property rights reforms.

Past and ongoing research has identified existing or potential technologies and management strategies for developing better crop-livestock production systems, by

integrating local (on-farm) feed production with the more efficient use of alternative feed sources (feed blocks, treated straw, shrubs and spineless cactus); and by improving livestock management, health, nutrition and reproductive fertility. However, adoption rates of these technologies have generally been low, for a range of technical, institutional, social, and policy reasons.

These reasons vary according to the nature of the technology, the farming system, and the environment—whether related to barley-based farming and crop-livestock integration, with forage legume introduction in low rainfall arable areas; range rehabilitation techniques and shrub plantations; animal health and nutrition; or water harvesting.

Generally speaking, farmers' flexibility, choice of options, and willingness to take risks declines progressively with decreasing precipitation from the 350 mm isohyet. Nevertheless, this does not necessarily foreclose all possibilities of improving productivity per ha or per animal through innovative technology and this represents a major challenge to researchers.

This challenge is made more difficult, however, by a number of non-environmental constraints, whose alleviation appears to be of overriding importance to achieving progress in the adoption of improved technology in the LRAs:

- Government investment in research and extension services has been concentrated on the high rainfall and irrigated lands; the LRAs have been neglected both with respect to those services and in the development of rural infrastructure. Concerns over high risks and low economic returns to such investments have been an important deterrent to governments, but the outlook changes when environmental and social benefits are taken into account along with the potential increases in productivity from the sustainable development of this very large resource. The establishment of ICARDA, and the ongoing collaboration between ICARDA, IFPRI, and the national teams in the eight M&M countries has provided new impetus to research in support of national efforts. Governments must step up investment in research,

especially in technology transfer if the fruits of these efforts are to be achieved.

- An important step in this direction would be to relieve some of the bottlenecks which currently deter farmers from trying out promising new methods. These bottlenecks include:
 - Inadequate provision for producing seed of improved, higher-yielding barley varieties, and grain and forage legumes, and high costs of the seed;
 - High costs and poor distribution systems for fertilizer, which is showing higher returns to its use on barley in LRAs as soil fertility is declining;
 - Subsidies on barley grain for animal feed result in its availability to livestock producers at below cost of production, removing incentives to barley growers to spend money on improving yields—when subsidies are removed there are indications that flock owners restrict numbers of stock and show more interest in forage production;
 - Restrictions in some countries on small ruminants remaining in cropped areas during the growing season of cereals, which defeats the goal of closer crop-livestock integration in farming systems;
 - Availability of subsidized feed, which both provides a low-cost incentive to keep more animals on rangelands, and acts as a deterrent to private investment in range improvements—re-seeding, phosphate application, shrub plantations, and water harvesting;
 - Cheap fuel and easy credit for purchase of farm machinery, water tankers and trucks—further incentive to keep more animals on rangelands, mainly benefitting larger flock owners;
 - Erratic changes in government policies towards livestock and their movements, and low investment in infrastructure and marketing systems in the LRAs, creating uncertainty among stock owners.

The following actions by governments would encourage the development of further innovative technology and stimulate wider adoption of existing knowledge:

- Increase long-term investments in research and extension for the LRAs and in training professional staff for those services. It is important to recognize that the horizons for progress in these areas are likely to be longer than for higher rainfall (>350 mm) or irrigated agriculture.
- Discontinue unrestricted feed subsidies and replace with selective, targeted support measures, designed to sustain the productivity of small ruminants during drought years without degrading the environment.
- Encourage the development of integrated production systems that link crops and livestock, and exploit the complementarities of low rainfall, higher rainfall, and irrigated agricultural areas.
- Encourage diversification of cropping systems for the LRAs, including the establishment of tree plantations, supported by water harvesting and supplemental irrigation techniques. This could reduce risk and increase income stability. However, diversification is hampered by lack of market alternatives for crops from the LRAs, and this needs to be addressed with government assistance.
- Strengthen farmers' and land users' participation in the development and transfer of technology for the LRAs.

Property Rights Uncertainties and How They Inhibit Progress

Uncertainties over property rights are a critical obstacle to sustainable development of the LRAs. Governments have taken action to redress policies that impede sustainable growth of production and poverty alleviation in the LRAs and to support enhanced research to increase productivity and shed more light on technical problems impeding adoption. However, it is vital that they also address the critical obstacles to progress in land and water development created by uncertainties over tenure and property rights.

Like the 3 E's, these policy, technology, and property rights problems interact with

each other, and solutions to sub-problems within one may be impeded by failure to resolve roadblocks created by the others. For example, adoption of technical solutions to range rehabilitation is limited by the absence of clear and secure rights to the land, even though security of tenure cannot, in itself, generate that technology. Property rights indicate to communities and individuals (1) what they can and cannot do, and (2) the scope and longevity of the expectations arising from the rights granted to them with respect to a given resource. Where uncertainty exists, long-term investment in resource and technological change will be inhibited.

Government awareness of this dilemma is evident from the extensive institutional and legal reforms carried out in the past in the different M&M countries. However, while the mechanisms were often similar they differed considerably with respect to the rights granted to local communities and individuals, sometimes with an adverse impact on their ability to manage their resource base efficiently.

Changing demographic, social, economic, political, and environmental conditions over the last 30 years, including market liberalization, and declining per capita land availability, are highlighting the limitations of present property rights institutions in the LRAs, impelling governments to seek new alternatives, and solutions. The five main land policies being pursued are

1. state appropriation of tribal lands,
2. strengthening customary tribal claims,
3. strengthening traditional private rights,
4. individualization of tribal common resources, and
5. land reforms.

These different policy formulations and interventions focus on property rights of both pasture and crop lands. In the former, the concerns are to create property rights institutions that foster sustainable management of common resources and improve stewardship of rural communities. With respect to crop land, the goal is to create the property environment that enhances producers' options for greater efficiency in the use of their productive resources and income generation.

Investigating farmers' behavior in the use of their land and the links between property rights, investment, adoption of technology, and productivity under different tenure regimes is an important element of the policy and property rights research under the M&M project. The results indicate that property rights is an important parameter in farmers' decisions to invest in more productive land improvements. Complete ownership (mulk), or inherited and divided mulk rights increase the likelihood that farmers will invest productively in their land. However, their propensity to invest and to use those rights efficiently depends significantly on a policy environment which provides them with flexibility of choice and appropriate options. This may not be the case where heavy State intervention limits their decisionmaking power.

The results from incomplete rights are also interesting because they raise the issue of endogeneity, meaning that expectation of future complete ownership guides farmers' behavior. This case is well illustrated in Morocco, where farmers of LRAs are granted perpetual use rights on their tribal lands. They are presently acting as private owners of these lands and are developing them. This is a real indication that at the individual level, farmers have already made their choices.

Thus, with respect to crop land, a preliminary conclusion from the research is that while property rights are a major determinant of farmers' behavior, the constraints to investment in long-term improvements are derived not so much from the rights themselves, as from the policy environment and the availability of technology packages which are accessible to farmers and have potential for enhancing their livelihood strategies.

Nevertheless, care must be taken to avoid inequity in the privatization of tribal-based rights because many members of the communities were at one time transhumant or nomadic herders, and agriculture is unfamiliar or secondary to them. Their position may be precarious as a result of these processes.

In the rangeland in general, the main property rights problems occur at the community level and on their pastures, because in most of the countries, pasture lands are under the stewardship of the state. Continued reliance on the existing land tenure system is creating numerous institutional inefficiencies, resulting in increasing numbers of disputes

as well as encroachment on the pastures. The primary challenge for range development is not how to reduce flock numbers, because rural communities will always find new strategies and loopholes to avoid reducing their herds, but to create legal and institutional incentives that enable local communities and individuals to adopt efficient and sustainable production strategies.

Such incentives are directly linked to the recognition of communities' customary rights and their involvement in the rangeland development process. This will then provide the adequate policy environment to facilitate the adoption and implementation of technology packages for protecting the environment and sustaining productive activities in the rangelands.

Market Reforms and their Implications for the Low Rainfall Areas

Until recently, the eight WANA countries have variously pursued mineral- or industry-led growth strategies, service and light manufacturing-based economic development, emphasis on import substitution, or a combination of these strategies. Government participation and involvement in production and distribution activities is a feature in all WANA countries. Though this dominance of the State ranges from the most radical intervention to a less substantial role, the impact has been widely felt in all sectors of economic activity and, in particular, by agriculture because of its strategic nature. Government involvement has been expressed in diverse forms: ownership of enterprises, price controls, import and export controls, market regulation, and the planning of production, distribution and consumption of goods.

Rising populations, expanding gaps between food consumption and production (filled by greater dependence on imports), and perceived acceleration of resource degradation, particularly in the LRAs, have alerted governments to the need for fundamental changes in agricultural policy, including market reforms and changes in income support measures. The advent of the GATT, and its implications for agricultural trade when coupled with structural adjustment, enhances this need.

The transition from a planned agricultural sector to a dynamic agro-food system

closely integrated within a global and open market economy involves a complex process of institutional, structural, and behavioral change, not only for the private sector but also for the government.

The standard agricultural sector adjustment package (ASAP) includes policy reform provisions related to domestic pricing, trade, marketing, land tenure, investment and natural resource conservation. The eight M&M countries have moved along this transition at different paces and to different degrees. Algeria, Jordan, Morocco, and Tunisia, have initiated and/or implemented market liberalization. The other four countries have started reforming their agricultural sectors, but within less ambitious structural adjustment packages.

Since these policy reforms are likely to set standards for the future, monitoring their progress and evaluating their economic, social, and environmental impact and its lessons is of crucial importance. Hence, collaborative research on ASAP in the four market reform countries has been initiated under the aegis of the M&M project.

This effort involves comparative analysis of the objectives, implementation, and results of market liberalization in the context of ASAP, using multi-market modeling tools. Modeling of the community and on-farm effects in a LRA of Western Morocco looks at the introduction of new barley technologies in the context of trade liberalization with respect to grain and livestock price reforms and reduced tariffs on wheat, barley, sheep, and beef at border level. This is seen as a case study for future comparison, using policy, property rights, and technology adoption scenarios.

Sector-level comparisons primarily involve Morocco and Tunisia. Jordan and Algeria are at an earlier stage of market liberalization. The analysis indicates that while significant progress has been achieved in both countries with respect to the removal of subsidies on agricultural inputs—with private sector involvement in input supply and services and with the elimination of state restrictions on land use—the pace has been slower in the case of producer and consumer price liberalization. Although price fixing has been lifted on a number of commodities, including barley, meat, and milk, protection through tariffs or price supports remains on "strategic products" such as bread, sugar, and

oils.

The deregulation of state monopolies, particularly concerning grains, is also a contentious issue. This is especially the case in Tunisia, where sales by state-controlled agencies seem to be subsidized over private operators even where markets are theoretically liberalized.

In Morocco, farmers are eligible for government financial assistance directed specifically towards agricultural equipment, land and water development, genetic improvements, storage, and conservation, rather than to general small farm investment financing. Changes in water pricing in both Morocco and Tunisia should lead to more efficient water use while reducing costs to government.

While it is premature to evaluate progress in Jordan and Algeria because of their relatively new experience with structural adjustment; the combined impact of drought, the abrupt downsizing of subsidies on animal feed under pressure to meet ASAP requirements, and restrictions on cross-border sales of sheep, has had serious economic and social effects on the LRAs in Jordan, where ruminant livestock are almost the only source of livelihood of many people.

This indicates the need for careful analysis of the potential implications of structural adjustment and other policy measures on these areas where the range of options open to farmers is very limited, poverty is rife, and the margin of error is low. Hence, a requirement under the ASAP is for governments to establish an agricultural policy unit in the Ministry of Agriculture.

Preliminary results of the M&M project's comparative study of the sectoral effects of market liberalization in Jordan and Tunisia and at the community level in Morocco confirm the value of such analysis. They reveal important country specific effects of structural adjustment, as well as interesting differences between countries. For example, the reduction in price support and feed subsidy removal has a substantial negative impact on farm income of the LRAs in Jordan. However, the effect is smaller in Tunisia, possibly because of alternative agricultural opportunities such as olive production. The impact on imports, especially of livestock, is particularly important.

Simulations on the impact of trade reforms in Morocco show that market

liberalization in the crop and livestock sectors generates important trade-offs between income growth and income distribution. When substantial income increases are obtained at the community level, price policy changes tend to also generate a less equitable revenue distribution between farm types. It is particularly important in this context to establish some direct income transfers to farmers with limited potential to benefit from the new liberalized environment.

There remain important questions concerning the impact of structural adjustment on equity and environmental sustainability in the LRAs. Research at the community level in Morocco shows that even with less distortion in the pricing system, trade liberalization in the form of reduced tariffs combined with new barley techniques, generates higher income increases for the rich segment of the Moroccan community studied. This hypothesis, however, finds mixed support when the impact is analyzed at the regional level. In Tunisia, for example, the loss in profits from market liberalization is higher in the high rainfall areas than in the LRAs, while in Jordan the situation is the opposite.

It is probably premature to form conclusions as to the environmental impacts on the LRAs, which ongoing research indicates may vary among the countries. While the removal of feed and price subsidies on small ruminants may reduce numbers of animals on the rangelands, those remaining may depend more heavily on the natural grazings. Closer crop-livestock integration could help to alleviate those problems. These issues merit in-depth discussion at this conference.

Conflicts Between Agricultural Growth, Poverty Alleviation and the Environment

Normally, one expects to find a high degree of complementarity in less-favored lands between the goals of agricultural growth, poverty alleviation and the sustainable management of natural resources. However, the agricultural growth achieved in recent decades in the LRAs of North Africa and West Asia has worsened both poverty and environmental degradation. Moreover, while the poor have been negatively impacted by environmental degradation, they have not been the major cause of that degradation. These perverse outcomes reflect a set of policy, property rights, and agricultural research interventions that have favored large farmers and herders and capital intensive farming.

Some of the unfortunate results have been excessive displacement of labor by tractors, overstocking and degradation of the range, encroachment of barley cultivation into fragile areas, diminished access to the range by small herders (including transhumant and nomadic peoples), and an increasingly less equitable distribution of land.

To elaborate on these linkages more fully, two key hypotheses were submitted for discussion at the Conference.

HYPOTHESIS I.

Agricultural growth in the LRAs has been of greater benefit to large farmers and herders than to small farmers and herders. This results from a set of policy and property rights interventions, and agricultural research priorities that are biased in favor of larger farms and herders and more capital intensive production systems.

HYPOTHESIS II.

Environmental degradation in the LRAs is driven more by inappropriate policies and insecure property rights than by poverty.

If these hypotheses are correct, then continued agricultural growth in the LRAs without any major change in policy and property rights systems seems destined to worsen poverty and environmental degradation, possibly to the point where the entire farming system collapses. What is urgently needed is a major realignment of government policies to achieve a different type of agricultural growth; one that is efficient and not dependent on government subsidies, that is beneficial to the poor, and is environmentally sustainable. There are seven pillars to the needed strategy:

- *First*, to redress policies that distort economic incentives and encourage farmers to over-stock and over-cultivate the range, and to pursue excessively capital-intensive production practices. Ongoing structural adjustment programs and market liberalization policies should help move things in the right direction, although additional attention may be needed to modify

drought relief programs that inadvertently encourage farmers to over-stock the steppe.

- *Second*, to correct property rights problems and empower local herders to promote better management of grazing on the steppe, and to invest in improving and rehabilitating rangeland.
- *Third*, to redirect agricultural research and extension towards the problems of smaller farmers and herders. This will require higher priority to integrating social and biological research so as to improve understanding of the complex linkages and tradeoffs between growth, poverty alleviation, and the environment, and to target research and extension more effectively to productive but less exploitive low-rainfall land use systems linking crops, livestock, and markets across ecozones.
- *Fourth*, to invest more in rural infrastructure, and to improve access to credit, marketing and input services for small farmers.
- *Fifth*, to strengthen livestock markets, particularly for live animal transactions across ecozones. Current practices of slaughtering young sheep on rangelands at very low weights are extremely wasteful.
- *Sixth*, to invest more in the education and health of poor people to increase their opportunities for self advancement, either through better farming, diversification into local non-farm activities, or migration to jobs in other regions.
- *Seventh*, to the extent that the above strategies do not fully resolve problems of continuing degradation of the steppe and soil erosion in cropped areas, to introduce regulations and taxes on the inappropriate use of natural resources and targeted subsidies in order to encourage investment in sustainable resource management by farmers and communities.

If the above strategies were followed, some significant changes in the farming systems of the LRAs should occur. Use of feedgrains to supplement grazing would become less profitable, and there would be a shift towards more extensive livestock

production systems with increased dependence on the range as a source of forage, but at lower stocking rates, with weaned lambs being sold to farmers in higher rainfall areas for finishing. With improved grazing, the value of range production would increase relative to plowing for barley while the cost of the latter would become more expensive, thereby encouraging increased investment in rangeland improvements. Better endowed areas of cropland in the landscape (e.g., wadis) would also become more valuable for feed and forage production, and farmers might find it economically worthwhile to invest in improving those resources (e.g., investments in water harvesting, re-seeding, phosphate application, fencing and small scale irrigation).

Economically, there would probably be a decline in the total value of agricultural production from the LRAs. However, with the shift to more extensive farming practices, costs would also decline and the net impact on farm income (ignoring the value of subsidies lost) might still be positive. Since hefty subsidies would no longer be required to sustain unprofitable activities in the LRAs, there would be substantial financial savings to government. These savings could be used for other purposes, such as direct assistance to the poor through the kind of investments in LRAs mentioned above. Small farmers and herders would benefit more under the new system, and the environment would be improved rather than further degraded.

Given their difficult agroclimatic conditions and scarce water resources, the potential for continuously raising agricultural productivity in the LRAs is limited. This means that in the longer term, the number of people dependent on agriculture in these regions must diminish, otherwise per capita incomes will stagnate and fall further behind the rest of the economy. There may be possibilities for diversifying the regional economy in the LRAs to increase non-farm sources of income. But reduced population growth and out-migration will also need to play important roles. Both will require increased investments in the health and education of rural people in order to enhance their opportunities for self advancement. Both also require time. For these reasons, governments must play a more active role in managing the transition problems of the LRAs.

3. PROBLEM ANALYSIS: WORKING GROUP DISCUSSION OF THE KEY PROBLEMS AND THEIR CAUSES

Following the presentation and discussion in plenary of the background papers describing the current situation and main issues facing sustainable agricultural development and poverty alleviation in the LRAs of the M&M countries, and the results of the M&M project, four working groups were convened to enable conference participants to examine these key problems and their causes in more detail. Each of those groups was allocated a different topic on which to focus its discussion. Those topics were:

- A. Range Rehabilitation
- B. Crop-Livestock Integration
- C. Technology Adoption
- D. Public and Private Investment

The groups' listing of the main issues under each of these four topics shows fairly clearly where their main priorities lie.

- Group A, dealing with range rehabilitation, placed considerable weight on resource management and institutional/property rights issues, but relatively little on technology adoption, probably reflecting a paucity of adoptable technology for rangelands under current systems of management and property insecurity.
- Groups B & C, dealing respectively with crop-livestock integration and technology adoption, emphasized technology related issues, but placed less weight on resource management problems, presumably because they were focusing more on the cultivated areas, whereas the main problems and causes of resource degradation are occurring on the rangelands. However, groups C and D also placed heavy weight on institutional, social, and property rights issues.
- All groups allocated high priority to finding solutions to policy and economic problems, although only group A attempted to differentiate economic

constraints from policy problems. Faulty policies and insufficient allocation of public funds to research and development of the LRAs are clearly identified as major stumbling blocks to achieving sustainable growth and poverty alleviation in the LRAs, as well as to preventing further resource degradation.

Analysis across working groups of the sub-problems and constraints which they list under each of the four major categories is also helpful in determining which are the important issues—for example, where at least three groups identify a problem in more or less the same terms, compared to "outliers" of apparently minor significance identified by only one group. This analysis suggests that policy makers and agricultural research institutions should pay particular attention to the following issues in pursuit of the goals of the conference:

1. POLICY AND ECONOMIC CONSTRAINTS

- *Distortions due to inappropriate and untargeted price, subsidy or self-sufficiency policies* favor urban consumers and larger farmers and encourage overstocking and ploughing up rangelands (economic growth at the expense of social welfare and environmental sustainability)
- *Inadequate investment in the LRAs* is evident because of existing policies and technologies that favor the high rainfall and irrigated lands and fail to address the potential of LRAs. Research is underfunded and focused on the wrong problems.
- *Poor social and physical infrastructure and access to markets* hamper development of the LRAs. The political environment is inimical to long-term investment in these areas, which lack a powerful lobby; while unstable governments avoid making such commitments.
- *Banking and credit policies* disfavor small farmers and the poor in the LRAs, because of the risky environment, lack of collateral, and difficulties of access to credit institutions.
- *Policies and development programs are poorly integrated*, due to conflicts

between sectors and interest groups, and wrong trade-offs between efficiency, equity, and environmental sustainability.

- *A top-down approach to policy making* means an absence of consultation or involvement of local farmers/people, or access to their expertise and indigenous knowledge. This leads to ignorance of their real needs and inappropriate policies.
- *The risky climate and frequent droughts* limit crop diversity, technology adoption, higher yields and propensity to invest in the LRAs. Adapted crops tend to be of low value, and policies fail to promote alternatives of higher value.
- *Limited off-farm employment and non-farm income opportunities* and market constraints inhibit income diversification.
- *Land tenure and ownership problems* impede progress and lead to conflicts. The legal framework to deal with these problems is inadequate. Lack of rights leads to credit problems. Unequal distribution of land, predominance of small farms, and land fragmentation compound these difficulties.

2. RESOURCE ENDOWMENT (NATURAL RESOURCE BASE) AND RESOURCE MANAGEMENT (ANTHROPOGENIC) PROBLEMS

- Resource endowments have their origin in the climate, topography, soils, and water resources and their influence on the natural vegetation of a region; but while their nature and quality may be modified slowly over time by changes in the climate, volcanic action, and weathering; *human activity* is now the primary determinant of resource improvement or degradation. At the same time the inherent nature of the resource endowments has an important influence on human activity and propensity to extract economic goods from the use of the resource, as well as to manage it sustainably. The working groups identified three principal problems arising from the resource endowments of the WANA region and especially of the LRAs. These were:
 - low and variable rainfall and a high incidence of drought

- water resource limitations and water scarcity
- soil degradation, desertification, and low soil fertility, all of which could be the result of poor natural endowments and processes over time; or, especially the first two, principally a consequence of human mismanagement of the resource; thus it is not surprising to find that drought, low soil fertility and resource depletion are also listed as management problems by all groups.
- While *resource depletion* is cited as the major problem of resource management, its causes are manifold. They include:
 - Excessive pressures on the resource base resulting from government subsidy, price, and drought emergency feed policies, creating perverse incentives to mechanized ploughing of fragile low rainfall soils, and to keeping more animals on rangelands for longer periods, leading to overgrazing and deterioration in the quality and volume of the natural vegetation.³
 - Poor crop-livestock integration. Lack of an integrated approach to management of crops and livestock within the low rainfall systems, and between farms in the higher rainfall and irrigated areas and the LRAs, was a problem identified by three working groups. The concept of stratification—moving immature sheep from rearing areas on

³ It should be noted, however, that most of those policies were designed to stimulate food production in the higher rainfall and irrigated areas and/or to protect consumers; reflecting pressures of demand arising from population and income growth and their spillover ecologically to the less-favored areas as the capacity of the better endowed areas to meet national needs has become saturated. The feed subsidies are the main exception, since they were originally intended to help minimize losses of small ruminants in time of drought, and those animals are mainly located in the LRAs. Thus government action to reverse resource depletion will also require revision of sector-wide policies. This is in fact a goal of structural adjustment programs in some M&M countries. It is also noteworthy that, with the one exception of cutting trees and shrubs for firewood the working groups did not blame resource depletion mainly on the poor, thus supporting the hypotheses in the background paper on the critical triangle.

rangelands for sale to fattening areas on farms or feedlots in higher rainfall areas, both to reduce grazing pressures on rangelands at critical points in the growth cycle of the natural vegetation and to fatten them to higher and economically more efficient weights—has long been seen as a desirable goal of flock management. However, it does not appear to be widely practiced; some animals do move to rented grazings off the rangelands during the dry season, but they tend to remain under the same ownership and often return to the range the following season.

- A critical lack of resource stewardship for the rangelands. Government land nationalization and deregulation policies, insecure property rights, and legislative problems, are leading to exclusion of some communities from their traditional grazing areas, and creating open access conditions for incursion of mechanized cereal cultivation in the rangelands and overstocking. High demographic pressures and misappropriation of land for urban development are contributory factors.
- Inappropriate or inadequate technology and related services for LRAs. These problems are exacerbated by a lack of appropriate well-adjusted technology and farming systems for sustainable management of the LRAs, and particularly for the rangelands. Important contributory factors are serious information gaps on feed resources, feeding practices, and weather trends over time; and inadequacies in the number, quality, location, and level of commitment of services to the farming communities in the LRAs.

3. TECHNOLOGY RELATED ISSUES

- *Lack of appropriate and adoptable technology* is identified by all working groups as an overriding constraint to sustainable development of the LRAs. Contributory factors include:

- Inadequate research effort and insufficient expenditure on research for the LRAs. Research in the M&M countries is mainly directed to the needs of the high rainfall and irrigated areas. Researchers prefer to work in those areas, both career-wise and because they are less isolated.
- Lack of involvement of local people in setting research priorities and consequent lack of information on their needs. This leads to inappropriate decisions on research policy for LRAs.
- *Inadequate extension effort* is seen by all groups as a second major constraint, both on research policy decisions and on technology transfer and adoption. Rates, levels, and efficiency in the use of adopted technology may all be affected. Contributory factors include:
 - Insufficient expenditure on extension services.
 - Extension staff lack motivation.
 - Lack of user involvement in providing feedback to research and extension personnel, and a lack of information to farmers on appropriate technology.
 - Inadequate access of farmers to credit and factors of production.
 - Crops which are well-adapted to the low rainfall environment are generally of relatively low value, and farmers are reluctant to risk investing in yield-increasing inputs or alternative crops; strategies to promote diversification and production systems with higher cash value should have higher priority.
- *A chicken-egg dilemma appears to exist with respect to the adoption of "improved" technologies, higher yielding crops and livestock, and more diverse and productive farming systems in the LRAs.* Most working groups identify low productivity and low cash value of existing systems and the crops adapted to the low rainfall environments as a major constraint to raising output and income for small farmers there. They castigate research and

extension staffs for their failure to develop improved technologies, to increase productivity and sustainability of the existing barley-based systems, to introduce alternative production systems, or crops with higher cash value, and promote better crop-livestock integration.

However, while there are undoubtedly inadequacies in the research and extension efforts devoted to the LRAs, both financially and operationally, they are up against powerful forces wishing to maintain the status quo, especially in ecozones with less than 300 mm annual precipitation.

A principal factor inhibiting change is the riskiness of the climate and the aversion of the smaller farmers to hazarding their limited incomes on purchased inputs, or new crops and cultivators. This conservatism is reinforced by current price support, subsidy, and feed supplementation policies which tend to favor existing crop and livestock production systems in the LRAs, and also by credit constraints. The latter are a particular disincentive to tree crop plantations, which require considerable investment in their establishment and several years before yielding income.

Further obstacles to the successful adoption of improved technologies, tree crops, new barley-based systems which could contribute to better crop-livestock integration, or improved rangeland productivity, stem from property rights problems and traditional customs. Farmers are reluctant to make long-term investments in tree crops, range re-seeding, phosphate application, fencing or shrub plantations, if they are uncertain of capturing the benefits. Even the introduction of re-seeding pasture legumes, such as annual *Medicago* species, into cereal-based systems has been inhibited by risks of invasion by wandering flocks, although these legumes are indigenous to the WANA region, and have proven extremely beneficial in comparable ecozones of Australia.

Thus simply rectifying deficiencies in funding, priority-setting, and motivation of research and extension staff will not be sufficient to promote

the changes in farming systems, range management, and adoption of improved technologies, needed to promote sustainable growth and alleviate poverty in the LRAs. A broader-based more comprehensive approach to their problems appears necessary, with much stronger involvement of local communities and the farming population.

4. INSTITUTIONAL, SOCIAL AND PROPERTY RIGHTS PROBLEMS

The working groups recognized that in attempting to foster sustainable and equitable systems of resource management and to promote growth through technological change, governments of the region face difficult and complex social, institutional, and legal problems related to property rights, tenure, and competition for land and water resources among various end users. The following issues were highlighted as of high priority.

- Where governments have nationalized ownership of communal rangelands without substituting effective and equitable systems of management to replace traditional tribal or customary rules for resource conservation they have compounded problems of sustainable growth. Exclusion of communities has facilitated open access to rangelands and competition for land, leading to resource degradation.
- Problems and conflicts arising from insecure property rights, ownership and/or tenure of land and water resources are seen as of major concern in formulating strategies for sustainable management of the LRAs, especially the rangelands and upland watersheds.

However the working groups recognized that successful solutions to those problems will depend heavily on closer community involvement and on the existence or creation of acceptable and effective local institutions. Lack of supporting social infrastructure and legitimate local organizations is therefore rated as a major problem by all groups. It is an obstacle not only to the equitable resolution of property rights conflicts, but also to sustainable

resource management and technology adoption.

- Inadequacies of existing legislation and institutions for dealing with problems of land tenure and property rights are seen by the working groups to be a further important obstacle to conflict resolution, and to the creation of an appropriate modern framework for efficient and sustainable resource management—whether under communal or private ownership. However, stronger enforcement of existing laws or legal reforms will also be needed to resolve problems equitably and without undue delay.
- Small size of farms, unequal distribution and access to land, and land fragmentation, are important social problems identified by all working groups. They compound the problems of achieving equitable solutions to the alleviation of poverty while also impeding the efficiency of land and water use in the LRAs, and pose a major long-term challenge to governments.
- Lack of information on the social problems of the LRAs is seen by the working groups as a further serious obstacle to their future development.

There appear to be several reasons, including:

- Relative lack of government interest in the LRAs compared to the lands of higher agricultural potential, and the urban areas.
- Low political influence of farmers in the LRAs; due to the prevalence of small enterprises, low levels of literacy, remoteness, and absence of strong community based institutions. Hence governments tend to exclude representatives of those areas from their inner councils.
- Poor feedback to governments from research and extension systems, for reasons elaborated above under technology related issues.
- The nature of the low rainfall problems, and the difficult problems of their solution.

4. PROBLEM ANALYSIS: PLENARY DISCUSSIONS OF PROBLEMS IDENTIFIED BY AUTHORS OF THE BACKGROUND PAPERS, AND BY THE WORKING GROUPS

WHICH OF THE 3 E's SHOULD HAVE PRIORITY?

Participants in the open discussions sounded a warning on the difficulties of simultaneously achieving growth and alleviating poverty, without degrading the environment; and stressed the need to look carefully at the interactions among the 3 E's and how to capitalize on them to realize those goals.

It was argued that farmers should not be blamed for overlooking sustainability when they were struggling for survival; the focus of research should be on finding viable alternative growth paths to improve their incomes without degrading the environment. Which of the 3 E's should receive priority? It was suggested that if "equity" implied more even access to resources that should be a first choice: currently there is too much emphasis on "efficiency" and not enough on social security.

HOW TO REFORM MARKETS AND ELIMINATE POLICY DISTORTIONS WITHOUT INCREASING POVERTY

A cautionary note was also expressed concerning changes in price and subsidy policies. Subsidies and price supports have been in place for a long time in the region, and farmers have come to rely on them, both in the LRAs and in the better-watered zones. However, the latter have been the main focus of public investment and agricultural services, including research, whereas the LRAs have had low priority. Subsidies have also benefitted people in the cities.

Abrupt removal of subsidies could increase poverty in the LRAs; the case of Jordan was cited where the run-down of feed subsidies under structural adjustment led to precipitous 30 percent drop in small ruminant livestock, the main source of agricultural income in the drier areas.⁴ Safety-net measures should be introduced to protect the poor during a transitional period associated with market liberalization and the elimination of subsidies.

⁴ This might reduce environmental degradation through overgrazing, but at the expense of poverty alleviation.

Careful monitoring of the social impact of structural adjustment programs must be undertaken with modeling of their potential short and longer-term impact to assist policymakers in their decisions. Because of input-output relationships among commodities market liberalization has implications for the whole economy, not just the agricultural sector.

WHAT CAN BE DONE TO DEAL MORE EFFECTIVELY WITH DROUGHT?

Participants recognized a crucial need to evaluate longer-term opportunities for developing effective strategies to manage drought as a way to replace the current crisis-oriented approach.

It was pointed out that in the really dry areas with very limited annual precipitation drought and aridity are virtually indistinguishable: there is permanent drought! Drought becomes an economically and socially significant problem in the LRAs as rainfall increases and agricultural production is of greater importance. Therefore, research on the ground is needed to identify marginality of production due to declining precipitation and any other limitations imposed by the natural resource base, as well as the influence of human activities on drought.

The aim of these studies should be to provide better information to policymakers and researchers as a basis for developing improved management systems and agricultural technologies to cope with drought; while avoiding drought emergency measures which create dependencies, increase the vulnerability of the resource base to future droughts, or favor the rich at the expense of the poor. Closer dialogue between researchers and policymakers was seen as essential with respect to drought management. Scientists should be able to communicate more effectively with administrators and the latter should learn to listen to them; to avoid errors consequent on top-down planning, policymakers need firsthand information from the grass roots.

Apart from better information and sharper definition of the areas most vulnerable to drought, participants emphasized the need for development of holistic national strategies to manage drought, supported by a permanent institutional and technical infrastructure

nationwide.

WHAT ARE THE REQUIREMENTS FOR TECHNOLOGY ADOPTION?

Participants were concerned about the relatively limited levels of adoption of "improved" technology and farming systems in the LRAs, particularly where mean annual precipitation is between 200 mm and 350 mm. This was attributed to several causes, including:

- Past concentration of research and investment on the higher potential areas and insufficient understanding of the resource potential and problems of the LRAs.
- Redundancy of imported technology in the LRAs, and insufficient on-farm trials to test new or improved techniques.
- The perverse incentives to cultivate rangelands created by price and subsidy policies. The type of growth which these policies have encouraged is seen as ultimately unsustainable, and is another example of conflict between growth and the environment—although it could hardly be classed as "efficiency" as defined under the 3 E's.

Nevertheless, extricating themselves from these policies creates a social dilemma for policymakers, hence participants saw a necessity to avoid precipitous changes, and suggested that savings achieved by the withdrawal of subsidies should be channeled into support for applied research to find more efficient and sustainable technologies, the education of local people, the improvement of rural infrastructure, and other measures to help living conditions of the poor. These measures should be integrated into comprehensive regional development plans, based on a deeper understanding of potentials and risks, and formulated with the participation of farmers and rural communities.

5. INSTRUMENTS FOR ACHIEVING EFFICIENCY, EQUITY, AND ENVIRONMENTAL SUSTAINABILITY

Following the discussion of problems facing countries of the region in achieving the Conference objectives, four working groups were convened to examine instruments which could contribute to the solution of those problems. Those instruments were:

- Market liberalization
- Property rights reform
- Drought management
- Appropriate technologies

One group was assigned to each of those instruments and each group was asked to focus primarily on two questions:

- What have been the impacts of their assigned instrument on the LRAs in terms of efficiency, equity, and environmental sustainability?
- How can the instrument be designed, strengthened, or implemented to enhance its positive impacts on those goals and minimize any negative effects?

While it was inevitable that these working groups covered some of the same ground as that identified in the preceding discussion of problems, the focus on specific instruments—all of which were seen as important by the discussants, provided opportunities for a more precise and forward-looking approach to problem solving.

MARKET LIBERALIZATION

What have been the impacts of market liberalization on the low rainfall areas in terms of efficiency, equity, and environmental sustainability?

This was defined by the working group as a reduction of government interventions in commodity and factor markets (e.g., subsidies, price fixation, tariffs, exchange rates, and interest rates), and of direct controls (e.g., compulsory cropping patterns) with respect to agricultural production. These measures may affect consumers as well as producers.

However, the working group expressed doubts about the applicability of the question as it was worded, because it was felt that empirical evidence was not sufficient to

allow precise answers. There may be different trends for different products, and observed changes could have been influenced by several factors which make it impossible to define simple cause-effect relationships. Therefore, the working group decided to include plausibility considerations on the impact of market liberalization in its deliberations.

With this understanding, the working group tried to collect facts from countries of the WANA region. In the case of Jordan it was noted that feed subsidies have been lifted, tariffs have been reduced, and control of retail prices discontinued. One visible result is a reduction of the sheep population by about 30 percent which, however, has also been influenced by drought.

In Morocco, internal markets have been liberalized to a large extent, but tariffs are established under the GATT Agreement at such high levels that the 29 percent reduction over 10 years which was agreed upon would still allow a high rate of protection.

For Tunisia, statements on impact are not possible because there were no market interventions for livestock.

Impacts on Equity. In trying to assess the impacts of market liberalization the working group concluded that in the case of Jordan feed subsidies were probably introduced with the aim of improving equity. For poor herders this may have represented a contribution to poverty alleviation, with a negative effect caused by their abolition. Price fixation benefitted producers at the expense of consumers, including low income consumers. Without further information it is impossible to assess how their discontinuation affects equity.

Impacts on Efficiency. The working group made it clear that they did not see efficiency as a synonym for growth. As can be demonstrated by the case of Jordan, past price distortions led to artificial growth which was inefficient. Greater emphasis on food security instead of national self-sufficiency is desirable. Correcting these distortions will probably lead to reduced growth in the near term, but improved efficiency. In the long term moving from a distorted to an un-distorted equilibrium may also enhance growth.

Impacts on Environmental Sustainability. Environmental sustainability may be improved by market liberalization, the obvious result of which in Jordan is a reduction in overstocking. It is somewhat surprising that the working group did not also mention the possibility that the withdrawal of price distortions for cereals might also have a disincentive effect on ploughing of low rainfall rangelands for barley production. However perhaps this is not so clear-cut as the effect on livestock, as much of the barley may be grown for *in situ* forage rather than grain, and ploughing is also undertaken as a means of staking claims to land.

How can market liberalization be designed/implemented to achieve positive impacts and to minimize negative impacts on the low rainfall areas?

From the answers to the first question it is evident that, in general, market liberalization implies some hardship for producers, particularly for resource poor farmers. For example, input prices may rise, raising costs of production. It is essential to minimize this hardship, i.e., to limit it to what is really unavoidable. This requires a coordinated and carefully sequenced approach which affects inputs and outputs in a balanced manner. Implementation of market liberalization should also take account of events such as drought which are beyond the control of policymakers.

Reducing distorted production and artificially high profit margins means that agricultural income will decline, unless this effect is compensated for by increased productivity and possibly by shifts in resource allocation—for example, through specialization in higher value "niche" commodities. Measures to increase productivity (e.g., research directed toward better usage of the limited resources of LRAs) therefore deserve high priority.

Inasmuch as a reduction in total agricultural income cannot be avoided, income alternatives for those who are affected are essential if poverty is not to increase. This requires accompanying measures, including incentives for private investments in the

LRA, better access to credit, and public investments in infrastructure. Since market liberalization normally leads to reduced public expenditures, part of the savings can and should be used for this purpose.

At least in the short run, direct income transfers may become necessary in order to prevent a deterioration in the living conditions of the poorest segment of the population. Such transfers—whose scope has to be limited—have the advantage that their efficiency is much higher than that of price fixations or untargeted subsidies.

Again, part of the savings from the public budget brought about by market liberalization could be used to finance direct income transfers. In order to also contribute to environmental sustainability, they could be made conditional on the application of environmentally sound practices.

PROPERTY RIGHTS AS AN INSTRUMENT

Property rights have evolved over a long period, and understanding how they have changed over time is important for evaluating their current status, related legislation impacts, and susceptibility to change

Looking back, the working group noted that centuries ago, land was generally collective property with open access for the tribes in a region. There were no titles or maps charting ownership of land, but an understanding among users. Following the establishment of central governments in the region during the nineteenth century, the States laid claim to ownership of all land not owned by a single person, in countries other than Morocco and Tunisia. Since then, the situation has tended to vary among the different countries, including individual, collective, state, and common property as instruments. However, several governments have claimed rights over tribal lands (mainly in range areas) and declared these and forest lands to be State property. These decisions must be taken into account in evaluating the current impact of property rights on the 3 E's, as well as in seeking means of strengthening existing measures to enhance their positive impact on those goals.

What have been the impacts of property rights (positive or negative) on the 3 E's and how have they changed over time?

Because of differences among countries, the working group had to generalize its evaluation of the positive and negative impacts of property rights. Moreover, it is sometimes difficult to establish exactly what form of rights they were referring to—whether individual, collective, communal, or State. A simplifying assumption might be that any institutional form is of positive value if it provides tenure security to landusers long enough for them to make economically rewarding productive investments, yet at the same time avoid degrading the environment or reducing equity.

The working group's list of positive and negative impacts arising from property rights, or the lack of them, is summarized in Table 1 and shows an impressive number of positive gains from secure property rights, and an equally long list of negative problems arising from their absence.

Comparing these impacts suggests that a lack of secure rights primarily damages the quality and integrity of the environment, and/or has an adverse social impact. By default, it also acts as a disincentive to invest in raising productivity through improved technology.

Conversely, the positive impact of more secure rights of tenure is chiefly related to raising the efficiency of crop and livestock production through providing greater stability for longer-term investment in resource improvement, better credit collateral, and the adoption of improved technology. This should have beneficial impacts on the integrity and sustainability of the resource base. Thus the positive and negative effects of secure tenure on efficiency and the environment, or its absence, are in many ways two sides of the same coin.

The impact on equity is somewhat less clear. Social benefits arise from the clarification of rights to land and/or water, from conflict resolution, from providing better collateral and access to credit, and from increased incomes where investments are made in technological change and/or resource improvement. On these matters, the working group expressed only one reservation: that privatization may lead to over-exploitation of the land, generating undesirable externalities. Thus in nearly all respects, property rights

reform seems a powerful instrument for doing good—virtually a "perfect rose without a thorn!"

Table 1 The positive and negative impacts of property rights or their absence

Positive Impacts - Secure Rights	Negative Impacts - Insecure Rights
Provides stability and incentives to make productive and sustainable long-term investments in resource management	Weakens government authority, impedes long-term planning and decision making, public and private
Stimulates adoption of improved technology	Limits scope for technical improvement - increases risks
Improves access to credit by increasing collateral	Reduces access to credit, due to lack of collateral
Facilitates individual & community decision making and conflict resolution	Generates conflicts and trespasses over land and water resources
Creates or expands land markets and transactions	Increases land fragmentation
Facilitates legal privatization where desirable	Encourages open access to land, and land-grabbing to establish rights
Limits incursion of mechanized cultivation on to rangelands, and promotes better resource stewardship	Facilitates misuse of resources-incursion of mechanized barley cultivation on to rangelands, and overgrazing of the reduced area of remaining rangelands, leading to soil and biomass degradation, and eventually to desertification
Encourages better breeding and management of sheep flocks, leading to improved productivity and higher returns.	

Nevertheless, it is important to note that clear property rights and security of tenure do not necessarily guarantee equity, nor even in certain cases, efficiency. The experience with State farms and collectives in Algeria and Eastern Europe provides examples of this; and was not only taken from large landed estates, but also from smallholders, whose subsequent status in the State conglomerates was sometimes little better than that of serfs. Nor did many of the State enterprises have an outstanding record of production efficiency.

Land nationalization in WANA countries, although technically securing rights to the State, in the interests of the people, also has a poor record, largely because most

governments have not been able to install effective systems of rangeland management to replace traditional tribal or communal rights.

What are the options for strengthening or reforming property rights to enhance efficiency, equity, and environmental sustainability?

Governments in several M&M countries are wrestling with property right issues and related legislative reforms, including the question of privatization. The latter is not necessarily a panacea. In addition to the risks of mismanagement and over-exploitation of the resource identified by the working group, individual privatization of holdings may increase inequity if the permitted ceiling for a holding is too high, or may condemn a family to poverty if it is too low.

Of course, as was emphasized by the working group, the options for privatization in the M&M regions need to be viewed in a broader perspective than that of individual holdings which prevails in Western countries. Property can be individual, collective, communal or cooperative, and the establishment of clear rights to property under any of those systems is essentially a form of privatization. Moreover, any of these options can be exercised at the village, community, tribal, or administrative district level.

There was some disagreement among the members of the working group concerning the need for property rights reform in the settled farming areas, as opposed to the rangelands. In fact, there are indications that measures are needed to establish clearer and more secure rights to land (and water where relevant) both in farming areas and rangelands, if efficiency is to be increased and the quality of the environment sustained. However the environmental and social urgency appears greater with respect to the grazings.

The key question there is what system of range management seems likely to be both most effective in balancing the needs of the 3 E's. Given the low rainfall of the rangelands and the high risks of losses of animals from drought it seems unlikely that individual private rangeland holdings could be economically viable and yet socially acceptable—they would have to be too large. Size and mobility were the keystones of the tribal nomadic

system, which is now recognized as an efficient and sustainable means of managing extensive low rainfall grazing lands.

To strengthen or reform property rights, the working group identified the following needs:

- Information, education, and appropriate technological packages to ensure sound land use and effective policies;
- Efficient management institutions for collective rights integration and recognition of traditional rights and regulations;
- Creation of mechanisms and principles for the transfer of government lands to communities and/or private ownership;
- The involvement of local leadership and empowerment in decision making;
- Establishment of a communication flow between communities and decisionmakers to provide them with essential information.

DROUGHT MANAGEMENT AS AN INSTRUMENT

Why do farmers need special drought assistance today, when it was less necessary in the past?

This question, which was not addressed to the groups working on the other three instruments, reflects the higher profile of drought in the M&M countries in recent decades, the difficulties governments and farmers are experiencing in coping with it, and the need to understand more about its impact and the reasons, as a basis for developing sustainable drought management strategies.

Participants suggested a range of reasons for this greater current need for assistance to farmers in managing drought, and their causes, embracing about 35 items. However, many of them are closely inter-related, and can be grouped operationally into two main categories. Those categories are: 1) reasons which are essentially out of the direct control of farmers and herders, and 2) those for which they are either directly responsible, or which may be in their power to correct or modify.

1. Reasons Why They Need Help Which Are Beyond the Direct Power of Farmers to Influence.

Increasing frequency of drought and possibly its increasing severity. Although the 1994/95 crop year is classed as probably the worst drought on record in Morocco and the 1996/97 drought in Jordan has also been exceptionally severe, evidence concerning its greater frequency is somewhat controversial.

Nevertheless, the devastating economic, social, and environmental impacts of drought in the M&M countries are not in dispute, and finding more effective and sustainable ways of managing it is an important priority for their governments and a life-threatening pre-occupation for their farmers, especially in the LRAs. A key issue with respect to drought strategy is how best governments can help farmers to help themselves; and when, and with what measures governments need to step in when self-help fails. All aspects of the 3 E's may be affected by those decisions.

Demographic pressures. High population growth and higher population densities exert pressures on the resource base, indirectly through rising demand for food, and directly through competition for land and water. This increases drought risks, and stimulates migration from the LRAs. Drought assistance is needed to help keep people on the land:

- *To mitigate or reduce the impact of market liberalization and structural adjustment programs on the LRAs, especially to offset rising feed costs and the removal of supplementary feed subsidies, and to stabilize prices.⁵*
- *To help offset the rising costs of living, labor, and production, which are reducing farm incomes, while living standards and family needs are rising.*
- *To help farmers in the LRAs use improved technology more successfully.*

⁵ Participants felt that although poverty is increasing in the LRAs, those regions are not receiving a fair share of national income and investments—for example, to create new employment opportunities. In particular, the impact of the removal of feed or other subsidies will fall most heavily on small farmers and herders in those areas.

2. *Problems Which Farmers Could Address More Directly Themselves, with Help.*

Disequilibrium between feed resources and the number of livestock. Due to frequent droughts and overstocking, less feed is available from the rangelands, and its quality has also declined. This is increasing risks of stock losses and rendering farmers more vulnerable to drought. Drought assistance and early warning is needed to help them manage these high risks, develop the resource, and preserve the animal genetic base through appropriate destocking and restocking, and crop-livestock integration.

Transfer of communal domains to state ownership. There has been a collapse of traditional social and management systems especially of community self-help, and a concomitant decline of group solidarity. Strengthening social infrastructure and helping communities rebuild local institutions and cohesion is essential.

What have been the impacts of drought management policies on the 3 E's?

The working group noted that while some generalization is possible for the M&M regions as a whole, the impact of these policies has depended significantly on the way they were implemented at the national level. As shown below they may be positive, negative, or uncertain, depending both on their nature and on which of the 3 E's they had an impact. The results of their analysis are summarized in Table 2.

There are clearly important reservations about the feed subsidy policies, even with respect to efficiency, since the growth pattern encouraged by the subsidies is one of increasing numbers without raising productivity per head of livestock. Untargeted feed distribution to herders on a per-head-of-livestock basis also favors the larger farmers.

The livestock-water-supply policies raise questions both of equity and their environmental impact; a narrow concentration of livestock around wells, especially near villages, is a well-known cause of localized environmental degradation. On the other hand, trucking water to dispersed livestock parked on the range may also have adverse environmental consequences, and gives truck owners an advantage over less well-off herders, especially if the truckers are invaders rather than traditional users. Thus there are

Table 2 The impact of drought management policies on the 3 E's

Nature of Policy	Effect of Policy	Impact on 3 E's		
		Efficiency	Equity	Environment
Feed Subsidies	Dramatically increased flock numbers	+	?	-
	Mainly benefits large farmers	?	-	?
	Broke down natural equilibrium			-
	Systematic destocking in drought	+	?	+
Water for livestock	Where no control of user numbers and/or concentration around wells	-	?	-
	Where it allows dispersion of animals, water trucked to grazings	+	?	?
	Where access favors affluent owners (deep boreholes)	?	-	?
	Where whole community has access and water points are well distributed	+	+	+
Domestic water	Clean water for community	+	+	+
Fodder reserves	When properly managed and utilized, with equitable access for users	+	+	+
Animal Health Programs	National vaccination programs	+	+	+
	Delivery of other services at cost	+	- For poor herders	 Depends on implementation
Feed Imports	May be for drought emergency programs or commercial sale	±	±	±
		Depends on purchase price, domestic sale price, subsidy and supply policy and foreign exchange		

numerous question marks against the water programs for livestock, whereas the provision of clean domestic water to communities is seen as generally positive.

Positive signs are accorded to fodder reserve programs; however, with provisions concerning their management, utilization and the need to ensure equitable access to users. Costs and techniques of establishing shrub and other fodder reserves are still subject to experimentation and analysis, as are the approaches to providing access to users.

In some cases, large areas of public grazings have been sequestered by governments for shrub plantations, with a long lapse of time before the local community has been granted access. Once the shrubs are well established, efficiency and equity would best be served by opening them up to herders as soon as possible under government or community supervision, at modest cost to users to recoup some of the costs of management. In addition to familiarizing users with sustainable plantation management practices, this could provide incentives to private or community establishment of plantations, where property rights make this feasible.

Veterinary programs to control major disease epidemics are considered valuable on all counts, especially to help animals survive drought. However, the group expressed some doubts about the ability of low income herders to pay for the costs of dips and other veterinary treatments.

How can drought management policies be designed in order to enhance their positive impact on the 3 E's in the low rainfall areas?

The working group focused principally on 1) the development of more effective approaches to risk management, and 2) on strengthening community capacity to implement those measures. The following measures were identified as priorities under those two headings:

- The development by governments of more effective and comprehensive risk management strategies;
- Establishment of mechanisms and institutions for effective implementation of the drought management policies;

- Creation of livestock and rangeland monitoring and drought early warning systems;
- Provision of affordable veterinary services delivery and stock treatments;
- Strengthening and support of community development programs;
- Availability of community managed livestock development funds;
- Establishment of fodder shrubs and water points owned and managed by the communities;
- Targeted credit for identified priorities.

APPROPRIATE TECHNOLOGIES AS AN INSTRUMENT

What have been the impacts (positive or negative) of the various forms of technology on efficiency, equity, and environmental sustainability in the low rainfall areas?

The working group focused principally on the barley-livestock systems as the dominant form of land use in the LRAs of the M&M countries. It listed the technologies that might apply to increases within barley-livestock systems under four sub-headings: 1) barley productivity; 2) livestock productivity; 3) rangeland productivity; and 4) system productivity.

Barley productivity can be increased with drought-resistant new varieties, although the value of local landraces and the importance of sustaining their genetic diversity was emphasized. Palatability or, more properly, voluntary intake by animals was cited as a criterion of improvement along with good grain yield. Use of fertilizer, particularly phosphates where soils are deficient in P, was listed as an area of possible improvement along with other cultural practices such as seeding rate and method, residue management, and minimizing cultivation.

While genetic improvement through government breeding programs is a long and expensive process being undertaken by most countries, livestock (sheep) productivity can be improved by farmers themselves through selection and culling based on performance. Interventions in reproductive physiology, as with vitamin injections and use of hormones on sponges to synchronize oestrus and induce super-ovulation for higher proportions of

twins, are also being tried. Opinions are divided, however, on the wisdom of encouraging multiple births in the risky drought prone environment of the LRAs. Health interventions for disease prophylaxis, and for controlling internal and external parasites, are possible with off-the-shelf medicines and vaccination. Finally, nutrition management is regarded as important for sheep productivity.

Rangelands may be improved through better grazing management, fertilization (including micro-elements), direct seeding, water harvesting, and planting and irrigation of shrub seedlings.

Improvements in system performance are thought possible through integration of legumes in rotation with barley, and using these for direct grazing rather than harvesting as hay or for seed and straw. Proper soil moisture conservation, supplemental irrigation, and post harvest management of crop residues and soil tillage can also have important positive effects.

The working group debated at length the effects of the barley and system improvements on efficiency, equity and environmental sustainability. These are summarized in Table 3 indicating + positive, - negative, and o, neutral effects, with parentheses where there was uncertainty or disagreement. Participants were somewhat uncomfortable with the table because so much detail had to be omitted. Nevertheless, it shows that various technologies can present trade-offs among the 3 E's. Where doubts exist, more precise specification of the impacts of particular technologies has to be resolved in the light of a particular location, with specifics of climate, soil, and the farming system.

Table 3. Comparison of effects of technologies on the 3 E's

	Efficiency	Equity	Environment
<i>Barley productivity</i>			
New varieties, local landraces	+	(+)	? risky
Single lines	-		
Fertilizer	+	(-)	0
Cultural practices			
Shallower cultivation	+	(+)	+
Earlier seeding	+	+	0
Lower seeding rate	+	+	0
<i>Livestock (sheep) productivity</i>			
Government breeding programs	(-)	-	?
Reproductive physiology	+	+	?
Health interventions	+	?	0/+
Nutrition management	+	+	+
<i>Rangeland improvements</i>			
Shrub plantations	(+)	+	+
Better grazing management	+	-	+
Water harvesting	+	?	+
Fertilization	+	(-)	-
Direct seeding	-	-	+
<i>Improvements in system performance</i>			
Integration of legumes	+	+	+

Why have apparently beneficial technical solutions not been adopted in the low rainfall areas?

Again, the working group concentrated on the barley-based system of farming, offering reasons for non (or limited) adoption under the four headings listed below:

1. Genetic improvement
 - high cost of improved seed
 - seed not available (not produced or sold locally)
 - poor technology transfer
 - lack of farmer education
 - farmers are resistant to change
 - new varieties may exhibit undesirable characteristics
 - micro-environment not suited to new variety
 - lack of research/extension linkage
2. Fertilizer application
 - high costs for poor farmers
 - credit not available to them
 - inefficient extension
 - non-availability on local market
 - too risky in low moisture systems (uncertainty of better yields)
3. Cultural practices
 - farmers think high seed rates give greater production, although experiments do not support this belief and show that lower seed rates could save costs without reducing yields
 - inadequate technology transfer system
 - drought conditions come frequently (worse at seeding time)
 - unsuitable machines (such as disk plows) may be the only ones available
4. Integration of legumes into the barley-based system
 - legumes not sufficiently resistant to drought

- new varieties suited to LRAs are not available
- awareness: small farmers not familiar with techniques of production and grazing or harvesting
- labor constraints
- weed problems
- more difficult to manage than cereals
- no market demand
- hay harvest machinery not available.

How can appropriate technology be designed in order to enhance its positive impact on the 3 E's in the low rainfall areas?

Unfortunately, the working group did not have time to deal fully with this question. Nevertheless, a lot can be deduced from the results of its discussion of question ii, and from the plenary debate. Salient issues appear to be the following:

- *Low rates of adoption of new barley cultivars due to poor adaptation to some micro-environments and/or undesirable varietal characteristics.* Plant breeders should make special efforts to work with farmers and extension staff to define problems and identify possible options in the light of specific local situations and needs. The probable end-uses (grain, feed, biomass), and market demand, for new or improved varieties should be an important consideration in their decision-making.

Whether more drought tolerant barley cultivars could extend its cultivation into even drier areas, as suggested in the plenary session, must also be taken into account. However, rather than this becoming an obstacle to the potential gains in equity and efficiency in settled farming areas from such cultivars; other instruments, such as legal restraints on cultivation in environmentally inappropriate situations should be considered to prevent abuse.

- *Seed production bottlenecks and high costs limit adoption of successful new cultivars, thus frustrating breeders' efforts.* This affects both barley and food and forage legumes. Governments should examine means of encouraging private commercial and community participation in seed production to make quality seed available locally and at costs acceptable to low income farmers. The State should mainly play a supportive role in regulating seed quality and purity, and in balancing prices at levels which provide incentives both to seed producers and farmers.
- *Fertilizer costs, and uncertainties of adequate returns to its use in the risky environment of the LRAs limit farmer adoption.* In particular, the elimination of fertilizer subsidies has created a disincentive: lack of credit and unavailability of fertilizer in some local markets create further obstacles. Nevertheless the negative sign for equity was challenged in the plenary discussion since it was felt that the reasons cited related more to problems of obtaining fertilizer or benefitting from its use, than from discrimination. Policymakers and research directors should review the potential benefits to efficiency of improving accessibility of small farmers to fertilizer, in the light of experimental and on-farm evidence of positive responses to its use in the LRAs.
- *Potentially efficient and environmentally friendly cultural practices, improvements in farming systems and drought management options, are impeded by inappropriate mechanization.* Problems exist both from misuse of machinery on farms (ploughing up and down slopes with no conservation measures, and improper choice of implements) and from mechanized cultivation of steppe rangelands which should not be ploughed at all.

Whether the blame should rest primarily on the users and not on the technologists, as suggested in the plenary discussion, is a debatable issue if the only machinery available to them is inappropriate to local needs. Poor technology transfer is also seen as a contributory problem by the working

group. Particular problems of high cost and machinery design exist with mechanization of grain and forage legumes, especially with respect to harvesting; weed control is also difficult.

Machinery design at government stations does not have a stellar record of success; policies should encourage joint ventures with international or local machinery manufacturers to tackle identified problems. To help small farmers, governments should encourage the expansion of private machinery contractual services while monitoring their cost, operating efficiency, and choice of machinery in order to promote equity and prevent environmental degradation.

- *How to increase farmers' use of legumes in barley-based systems.* An apparent contradiction was noted in plenary between the positive signs awarded to legumes for each of the 3 E's, and the negative reasons identified by the group for their non-adoption by farmers. Another reason not mentioned is that while cereal prices are often supported and/or subsidized by governments, this has not been the case with legumes.

Although the potential environmental benefits of introducing food or forage legumes into cereal based farming systems appear considerable, and their contribution to human and animal nutrition is valuable, the problems noted by the working group will not easily be overcome in the LRAs. Once annual rainfall declines below 300 mm, they fade out of the system largely because of farmers risk aversion.

If progress is to be made, current research on their manifold production problems must be substantially increased, and seed production of improved cultivars expanded. In the light of past experience even this may not be enough; policymakers should examine with scientists the possible economic and environmental benefits of incentives to adoption of legumes in the LRAs. Floor prices for legume grains or acreage payments for forages might be considered.

6. FARMERS VIEWS ON THE CRUCIAL ISSUES AFFECTING THE 3 E'S: RESULTS OF VISITS BY WORKING GROUPS TO FOUR COMMUNITIES IN JORDAN

The third day of the Conference was devoted primarily to visiting four sites in Jordan, representing a range of conditions in the LRAs. Two sites were selected as exemplifying natural resource management issues, one involved a cooperative range improvement project, and one provided information on private resource management efforts.

As might be expected from their different situations and locations (some were nearer to Amman than others), numerous location-specific problems were raised by farmers at each site. More significant, however, is the wide consensus across sites on major issues and possible solutions. While these may not all apply to the same extent in the other M&M countries—for example, Jordan has probably the largest share of really low rainfall agricultural land in the region; many of them reflect problems which conference participants had already identified as of widespread concern in their own situations. Thus this review will focus principally on identifying and discussing the cross-cutting priorities, their impact on the 3 E's, and the suggestions made by the Jordanian communities, farmers and extension workers for dealing with them.

The discussions highlight the severity of the problems of reconciling efficient production growth in the LRAs, with equity, and the sustainability of the environment. They present important challenges to policymakers, particularly with respect to poverty alleviation. Major issues include:

- *The effects of the removal of feed subsidies.* From the viewpoint of efficiency and environmental sustainability, the decision to eliminate feed subsidies and price distortions was probably correct. The growth pattern that they encouraged was both inefficient in terms of raising the productivity of cereals and livestock in the LRAs, and because it encouraged damaging pressures on the natural resource base. To the extent that these economic distortions favored the better-off farmers and herders, they were also inequitable. A lesson emerging from this situation is that to

equate efficiency necessarily with growth of production can be dangerously misleading.

Nevertheless, the way in which the structural and market reforms were implemented seems to have been abrupt, and their impact on the LRAs, and particularly the small ruminant livestock sector has been devastating. It appears clear from the working groups' dialogue with communities that farmers have been forced into cut-price distress sales of around a third of their sheep, the principal source of their agricultural income and the main reserve of family assets.

- *A crisis of confidence among communities in the LRAs.* Given the absence of alternative on or off-farm earnings in those areas, and the low priorities they have received in the past in terms of social and infrastructural investments and research effort, it is difficult to see how increasing impoverishment of low-income rural people, and migration from the area can be avoided. While there is always a risk that farmers exaggerate their problems when talking to visitors, there was a disturbing air of pessimism and uncertainty about their future in the views expressed to the working groups. Particular concerns relate to: the future of the rangelands in the absence of more secure property rights and a suitable technological package; the lack of opportunities for income diversification in or outside agriculture; and the difficulties of obtaining credit without better collateral. The ever-present threat of drought is highlighted by the unfortunate conjunction of the elimination of feed subsidies with one of the worst drought years on record, emphasizing the need for development of a comprehensive national drought management strategy.
- *The need for an effective mechanism to improve policymakers' awareness of problems in the LRAs.* A lesson that emerges from these exchanges on the ground, is the inter-relations of the 3 E's (the knee-bone-connected-to-the-ankle-bone pattern) and the risks inherent in policy changes which unduly favor one component of the critical triangle, without careful assessment of their potential impact on the other two sides of the triangle.

The new tools available for modeling these options should make it easier for governments to avoid major strategic policy errors, and to foresee possible conflicts of interest among the 3 E's, thus allowing policy makers to take calculated risks, and where necessary to introduce related damage control or safety net measures.

Nevertheless, this alone will not ensure sound judgments. An effective mechanism for providing policy makers with reliable information from the grassroots on local conditions and the impact of their decisions is indispensable. This is a need which emerges clearly from these discussions.

7. ROUND-UP: SUMMATION BY THE WORKING GROUPS OF THEIR PRECEDING DISCUSSIONS, AND FINAL RECOMMENDATIONS OF PARTICIPANTS

During the final two days of the Conference the working groups drew together the threads of their previous meetings, field visits, and the plenary discussions, to develop and recommend a final set of priority issues and related actions for consideration by an invited audience at the final session of the conference. As with the first discussions on problem identification, each of the groups was asked to focus on a specific area of action. These topics were:

- Public and Private Investment
- Technology Adoption
- Crop-livestock integration
- Range rehabilitation

In each case they were asked (i) to examine how each of the four instruments (market liberalization, property rights, drought management, and appropriate technologies) could be used to achieve greater efficiency, equity, and environmental sustainability, and (ii) what might be the relevant roles of farmers, traditional social groups, the private sector, NGOs, governments, and donors (international community) in relation to those goals.

THE ROLES OF THE FOUR INSTRUMENTS IN ACHIEVING THE 3 E'S

Participants concentrated primarily on the "how" question. With respect to who does what, they mainly differentiated responsibilities between the public sector (including services such as research and extension), the private commercial sector, and local communities.

There was considerable overlapping and duplication among the working groups' conclusions concerning the answers to the first question, even though the wording of their recommendations varied. Thus, the final recommendations submitted to the invited audience by the Conference participants represent a consensus of the principal cross-cutting issues:

- *Under Market Liberalization:*
 - A need was identified for new investment in the LRAs to help diversify the product base and increase employment and value added, both pre- and post-harvest, through exploring comparative advantage. Better market information and access to local and international markets was seen as an essential adjunct to this proposal. Public and private investment are essentially complementary but the former would probably have to take the lead, for example, to improve market infrastructure, other services, and credit facilities as incentives. Market liberalization should increase returns to public investment in the LRAs.
 - More attention should be devoted to research on the social and environmental impacts of market liberalization, especially the former, as opposed to the economic ones. Consideration should be given to the establishment of a social safety net targeted to the vulnerable LRA communities, and embracing a package of support services, to help offset the policy reforms introduced under structural adjustment programs, and reduce risk.

- *Under Appropriate Technologies:*

- It was considered essential to strengthen agricultural research (especially adaptive research) and extension efforts devoted to problems of the LRAs, both qualitatively and quantitatively.
- Closer linkages should be established between policy makers, researchers, extension staff, and local communities, so as to enhance awareness of key issues and create an effective two-way transfer of information and experiences. In order to make technology more responsive to need, community involvement in decision-making should be much greater.
- High priority should be given to evaluating and monitoring the nature and state of the natural resource base (using modern technology), including water resources and the water table, as well as soils and vegetation. The results could provide valuable information to policymakers, research planners, and technology transfer, and would be an essential input to drought management, range improvement and water resource development and utilization—all rated as priority areas by the working groups.
- Adaptive research on watershed management, water harvesting, efficient water use, soil conservation, and soil-crop-water relations, especially for the LRAs, should be greatly strengthened. It should be applied to maximize water use efficiency both at the community and the farm level, and should form an integral component of range improvement, and drought management strategy. Because of its fundamental importance to the successful integration of the 3 E's under low rainfall conditions and to effective drought management, this was seen by the working groups as an important field for donor support and international research.
- In addition to conventional crop improvement through genetics, the promotion of crop and income diversification was identified as a further

priority area for technology development, and one where complementary public and private investment should play a key role. Seed production, tree nursery development, agro-processing, better use of agroindustrial by-products and crop residues for animal feed, and improved crop storage were examples of possible joint or private sector ventures.

- *Under Drought Management:*

While this was recognized by all groups as being an objective of highest priority, the effective implementation of a drought management strategy was seen as closely linked to the success of measures identified as important under the rubric of appropriate technology, income diversification, and the establishment of more secure property rights—especially for the rangelands. With respect to drought management itself, four principal priority areas were seen as crucial. These were:

- To establish national or regional drought preparedness systems, supported by early warning measures, GIS, expert systems, and resource monitoring and evaluation.
- To develop appropriate infrastructure, services, marketing/processing facilities, and price incentives, in order to encourage destocking in time of drought, maintenance of the genetic base for livestock, and subsequent restocking. Water points and feed banks should be linked to those objectives.
- To strengthen watershed management and water harvesting programs, and integrate them with current or new range technology and range management measures ("rainfall management") for range rehabilitation.
- To help promote community organizations with legal status, supported by access to capital, technical know-how and access to markets, to manage rangelands and water resources.

The working groups stressed that drought should be treated by governments as a constant feature of the agricultural environment in the M&M countries and not as a temporary crisis. Its effective management requires permanent mechanisms, trained staff, and an integrated program of supporting measures.

- *Under Property Rights:*
 - Although property rights security alone will not necessarily provide solutions to the successful development of the LRAs, in a manner consonant with efficiency, equity, and environmental sustainability, a lack of secured rights to land and water was viewed by the working groups as a principal cause of resource degradation and poverty in the LRAs, especially with respect to the rangelands. Thus some appropriate form of tenure security was seen as virtually indispensable to the successful implementation of policies and technologies to improve resource management and raise living standards there.
 - Working groups emphasized the need for better knowledge of the existing situation, through data collection, surveys, and mapping, to clarify the confusion over rights to use of the rangelands which they had noted at the sites visited in Jordan.
 - This could provide the basis for development of institutional options in participation with local communities, in order to establish legal rights to grazing land and water resources, and provide credit support to investment in their improved management. Better tenure security would also encourage farmers to evolve risk management strategies and adopt new technologies.
 - Action should be taken to discourage further fragmentation of holdings and to enhance economies of scale. It was suggested that a national authority should be established in each country to protect the resource base from further degradation and formulate rules and functional responsibilities for regulating abuse.

FINAL CONFERENCE RECOMMENDATIONS

The conference concluded its deliberations in a closing ceremony chaired by His Excellency Mr. Mijhem Al-Khraisha, Minister of Agriculture, and arrived at the following recommendations regarding four main areas:

1. *Public and Private Investment*

- i) Market liberalization has created both the need for new investment to enhance alternative employment opportunities, and it has increased the potential economic returns to new investments in LRAs.
- ii) Priority areas for public investment are:
 - agricultural research on natural resource management,
 - rural infrastructure, especially access roads, electricity and rural service centers,
 - water resource development, including water harvesting and watershed management, and
 - investment in people, especially education and training of poor people and women.
- iii. All public investments in the LRAs should be developed in close collaboration with the local communities, and local communities should co-finance and help maintain investment structures.
- iv) Private investment is essential for developing the LRAs, especially the rehabilitation of rangeland, water resource development, and diversifying the local economy to create new employment opportunities in agriculture, agroindustry, and non-farm activities. The public sector may need to create improved incentives to encourage private investment, both through its own investment in rural infrastructure, and through provision of credit, and financial incentives.

2. *Technology Adoption*

- v) Linkages between research and extension have to be strengthened in order to increase the efficiency and effectiveness of research in LRAs, and they need to be farmer driven.
 - vi) Technology development for the LRAs should focus on:
 - Crop diversification (including fruit trees).
 - The integration of efficient water harvesting with range improvement and soil conservation.
 - Agroprocessing and marketing problems.
 - vii) Social and environmental benefits should be given equal weight with economic considerations when assessing the feasibility and evaluating the impact of technologies in LRAs.
3. *Crop-livestock Integration*
- viii) Devise protective measures compatible with the GATT agreement in order to safeguard barley and livestock production.
 - ix) Discourage further land fragmentation, and secure property rights to individuals and/or communities to encourage investment and preserve natural resources.
 - x) Improve marketing systems for livestock, inputs and outputs, strengthening producer cooperatives where appropriate.
 - xi) Promote fodder conservation and the storage of feed resources at the farm level.
 - xii) Support research for development of improved drought management packages that reduce farmers' dependence on government assistance in drought years.
4. *Range Rehabilitation*
- xiii) Establish a data base for rangeland rehabilitation by creating a monitoring, evaluation, and information system using modern technologies (Resource

inventories, Geographical Information Systems, Early Warning Systems, etc.).

- xiv) Develop property rights and institutional frameworks for devolving the control and management of rangeland to local communities, and implement these arrangements.
- xv) Create and develop a national authority for protecting the resource base ensuring efficient and sustainable use of resources.

Following the presentation of these recommendations to an invited audience, there was an active discussion of their implications, especially among members of the farming community. Although speakers generally endorsed the recommendations, it was noted that they were largely aimed at the public sector. They should be focused more on farmers needs and the processes of implementation.

Attention was drawn to the potential impact of globalization on the agricultural sector. Borders would open and the need for domestic self-sufficiency would decline. This would have a great influence on farming, with related implications for research and technology transfer.

The need to strengthen farmers hands in their relations with government was emphasized by several speakers, and the emphasis of the recommendations with respect to farmers' interests was welcomed. In general farmers lack power, and the influence of those from the LRAs is the weakest of all. Not only is more help needed from the government but farmers must unite to help themselves.

The conference was formally closed by His Excellency Mr. Mijhem Al-Khraisha, Minister of Agriculture for Jordan, on behalf of His Royal Highness, Prince Hassan, Patron of the Conference.

In his address, the Minister emphasized the need for a massive effort aimed at tackling the key problems affecting the countries of West Asia and North Africa in order to cooperate in finding solutions. This effort would be able to draw on the informed

recommendations from the experts attending the conference, and he expressed his thanks to the presenters. He was honored to be able to address the final session.

He had found his presence at the conference useful. The Ministry of Agriculture had recently initiated a general union of agricultural producers, with its first meeting scheduled to be held shortly. The government was determined that this initiative would not fail; following the first meeting they would establish, for example, sectoral unions of livestock and legume producers. This would help to build future policy with the effective participation of citizens, and thus avoid past mistakes.

His preliminary review of the conference recommendations showed a good understanding of the problems and needs of the LRAs, which represent the largest area of Jordan geographically, and are the main locus of poverty.

He informed the conference that the government had established an inter-Ministerial Committee to help safeguard the local farmers from the impact of the GATT, to assist them to stay on the land, and to avoid degrading the environment. However, this effort exceeded available funding and he appealed to donors to provide additional support to the government.

A particular goal was to develop improved agricultural technology through the establishment of specialized regional institutes. They also intended to obtain the opinion of the local people in planning and implementation of this program and were seeking ways to institutionalize this cooperation.

Property rights issues were another most important area of interest to the government and they sought counsel on how to approach and rationalize these problems in dialogue with the communities.

He drew attention to the critical issue of water scarcity in the region, which was likely to worsen in the future. Thus water harvesting and crop diversification were of great importance. It was time to act to rehabilitate the LRAs, where resources are deteriorating and run the risk of getting out of hand. He noted the loss of about 30 percent of the livestock there within the last ten months, for many of the reasons identified

by the conference. A continuation of these trends would outrun the possibility of rehabilitation, and he looked to the conference for practical solutions.

In conclusion, he wished to transmit greetings from His Royal Highness, Prince Hassan to express his thanks to all participants, including those from other countries in the region and from international institutions. The recommendations of the conference would be taken seriously by his government.

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Annex 2. Conference Agenda

International Conference

Under the Patronage of His Royal Highness Crown Prince Hassan

AGRICULTURAL GROWTH, SUSTAINABLE RESOURCE MANAGEMENT AND POVERTY ALLEVIATION IN THE LOW RAINFALL AREAS OF WEST ASIA AND NORTH AFRICA

2-7 September, 1997

FINAL PROGRAMME

Monday, 01 September

Arrival of Participants

1600 - 1800
2000

Registration
Dinner

Tuesday, 02 September

Session I Opening Ceremony

Welcome Addresses

0900 - 0905

A. Taimeh, Director General NCARTT

0905 - 0910

A. El-Beltagy, Director General ICARDA

0910 - 0915

P. Pinstrup-Andersen, Director General IFPRI

0915 - 0920

H. Bühler, Director General DSE

0920 - 0925

A. Slama, Director Technical Division IFAD

0925 - 0945

Opening
His Royal Highness Crown Prince Hassan of Jordan

0945 - 1030

Coffee/Group Picture

Session II Problem Analysis

1030 - 1045

Presentation of Conference Objectives and Programme
N. Fadda

1045 - 1115

Current Situation and Outlook for WANA Agriculture and
the Low-Rainfall Areas
A. El-Beltagy

1115 - 1145	Environmental Threats to the Low-Rainfall Areas and their Causes A. Taimeh
1145 - 1215	Interrelationships among Agricultural Sustainability, Growth and Poverty Alleviation P. Pinstrup-Andersen
1215 - 1245	Plenary Discussion
1245 - 1345	Lunch
1345 - 1445	Guided Tour of Country Posters for M&M National Research Findings T. Nordblom, N. Chaherli, T. Ngaido
1445 - 1500	Working Method, Terms of Reference for Working Groups and Formation of Working Groups U. Nagel, P. Hazell
1500 - 1530	Coffee
1530 - 1800	Working Groups A - D on Problem Analysis
1930	Departure by Bus for Restaurant

Wednesday, 03 September

0830 - 0835	Introduction to the Day N. Fadda
0835 - 1000	Plenary Presentation and Discussion of Working Group Results

Session III Instruments

1000 - 1030	Impact of Market Reforms on the Low-Rainfall Areas N. Chaherli
1030 - 1100	Coffee
1100 - 1130	Property Rights and Natural Resource Management in the Low-Rainfall Areas T. Ngaido

1130 - 1200	The Experience with Drought Management Policies in WANA M. El-Mourid
1200 - 1230	Facilitating Wider Adoption of Existing and Promising New Technologies in the Low-Rainfall Areas N. Haddad
1230 - 1300	Plenary Discussion
1300 - 1400	Lunch
1400 - 1415	Terms of Reference for Working Groups
1415 - 1630	Working Groups on Instruments - WG A: Market Liberalisation - WG B: Property Rights - WG C: Drought Management - WG D: Appropriate Technologies
1630 - 1700	Coffee
1700 - 1830	Plenary Presentation and Discussion of Working Group Results
1930	Departure for Cocktail hosted by the Chargé d'Affaires of the German Embassy to Jordan

Thursday, 04 September

Session IV Field Interaction with Communities

0800 - 0830	Preparation of Field Trip and Terms of Reference for Working Groups N. Ngaido, Q. Mamdouh
0830	Departure by Bus
0830 - 1800	- WG A: Natural Resource Management Issues (Mhiyy) - WG B: Natural Resource Management Issues (Mkaifteh) - WG C: Co-operative Range Improvement Issues (Lajjun)

- WG D: Private Resource Management Efforts
(Mwagar)

2000 Dinner

Friday, 05 September

0830 - 0835 Introduction to the Day
N. Fadda

0835 - 1030 Evaluation of the Field Trip - Working Groups

1030 - 1100 Coffee

1100 - 1230 Plenary Presentation and Discussion of Working Group
Results

1230 - 1400 Break for Prayer

1400 - 1500 Lunch

Session V Recommendations

1500 - 1515 Terms of Reference for Working Groups

1515 - 1800 Working Groups on Recommendations
- WG A: Range Rehabilitation
- WG B: Crop-Livestock Integration
- WG C: Technology Adoption
- WG D: Public and Private Investment

2000 Dinner

Saturday, 06 September

0830 - 0835 Introduction to the Day
N. Fadda

0835 - 1030 Plenary Presentation and Discussion of Working Group
Results

1030 - 1100 Coffee

1100 - 1230 Rewording and Finalization of Recommendations

1230 - 1330 Lunch

Session VI Presentation of Results to Special Invitees and Closure

1330 - 1430

Introduction

N. Fadda

Recommendations on Range Rehabilitation

N. N. Participant

Recommendations on Crop-Livestock Adoption

N. N. Participant

Recommendations on Technology Adoption

N. N. Participant

Recommendations on Public and Private Investment

N. N. Participant

1430

Statement of the

Jordanian Minister of Agriculture

Closing Remarks

N. Fadda

Farewell Reception

hosted by the Ministry of Agriculture

Departure