

10/11/95  
LSM 6-199

# **AGRICULTURAL POLICY ANALYSIS PROJECT, PHASE III**

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Under contract to the Agency for International Development, Bureau for Global Programs, Field Support & Research,  
Economic Growth Directorate, Office of Agriculture & Food Security  
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**HASHEMITE KINGDOM OF JORDAN  
MINISTRY OF AGRICULTURE**

**COMPANION STUDIES**

**SEPTEMBER 1995**

**APAP III  
Technical Report  
No. 1003**

**Prepared for**

**Agricultural Policy Analysis Project, Phase III (APAP II)**

**USAID Contract No. LAG-4201-C-00-3052-00  
GTZ Contract No. 89.2067.0-01.100**

**HASHEMITE KINGDOM OF JORDAN  
MINISTRY OF AGRICULTURE**

**COMPANION STUDIES**

**Companion Study on Environmental Impact Assessment  
by  
Environmental Resources Management Consultants & Abt Associates Inc.**

**Companion Study on Quantitative Policy Analysis Methods  
for Implementation of the Agricultural Policy Charter  
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**Prepared for**

**Agricultural Policy Analysis Project, Phase III (APAP III)**

**USAID Contract No. LAG-4201-Q-00-3061-00**

**GTZ Contract No. 89.2067.0-01.100**

**HASHEMITE KINGDOM OF JORDAN  
MINISTRY OF AGRICULTURE**

**Institutional Development Support Project  
For Agricultural Policy Implementation,  
Jordan**

**COMPANION STUDY ON  
ENVIRONMENTAL IMPACT  
ASSESSMENT**

Prepared by:

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&  
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Funded by:

**GTZ/USAID**

**August 31, 1994**

**HASHEMITE KINGDOM OF JORDAN  
MINISTRY OF AGRICULTURE**

**COMPANION STUDY ON  
ENVIRONMENTAL IMPACT  
ASSESSMENT**

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## CONTENTS

Glossary .....	4
List of Acronyms .....	5
Executive Summary .....	6
I. Introduction .....	10
II. Environmental Issues Associated with Agriculture .....	13
Identification of Issues .....	13
Prioritization of Environmental Issues .....	27
Relationship Between Issues and the Policy Charter .....	30
III. Environmental Impact Assessment Capabilities in Jordan .....	55
Government Institutions .....	56
Private Institutions .....	59
Universities .....	60
Consulting Firms in the Private Sector .....	60
IV. Mechanisms for Institutionalization of EIA in Jordan .....	61
Principles of EIA .....	61
General Recommendations for the Agricultural Sector .....	68
Specific Recommendations for the MOA .....	70
Incorporating EIA into an Institutional Change Program .....	71
Incorporating an Environmental Impact Monitoring .....	71
Human Resource Needs for EIA .....	72
Relevant Guidelines for EIA in the Agricultural Sector .....	73
V. Conclusions and Recommendations .....	74
Environmental Priorities and the Policy Charter .....	74
Institutional Capabilities .....	75
Institutionalization of EIA .....	77
Appendix A. List of References .....	79
Appendix B. List of Contacts .....	82
Appendix C. Results of the Multi-objective Analysis for the Environmental Issues .....	84
Appendix D. Examples of Lists Used to Determine the Appropriate Level of EIA .....	90
Appendix E. The World Bank Operational Directive 4.00-Annex A3 .....	91

## GLOSSARY OF TERMS

**Cumulative Impacts** The combination of primary and secondary impacts (see definitions) of individual action with the impacts of past actions and reasonably foreseeable future actions.

**Eco-system** A complex system formed by the interaction of a community of organisms with its environment.

**Environmental Impact Assessment** This term has both a technical and an institutional definition. Technically, environmental impact assessment is a systematic, reproducible, transparent and interdisciplinary evaluation of the potential impacts of a proposed action and its practical alternatives on the physical, biological, cultural and socioeconomic conditions of the geographical area where the action will be implemented. Institutionally, environmental impact assessment is a decision-making process which provides decision-makers with information on environmental impacts in such a manner that they can weigh the environmental effects of a proposed action against its social, political, and economic effects.

**Mitigation Measures** Physical or management measures to avoid, minimize, rectify, or reduce the environmental impacts of a proposed action, or to compensate those impacted.

**Multi-Objective Analysis** A systematic approach that facilitates the optimal choice among available options and projects evaluated with respect to a multiple set of objectives, some of which are usually not quantifiable in monetary terms (see Appendix C for further discussion).

**Primary Impacts** Environmental effects that are caused by the proposed action and occur at the same time and place as the action.

**Scoping** A process (often a meeting) which occurs at the initiation of project planning to identify the study area, potential environmental issues, preliminary alternatives, related decisions and affected parties, and to establish time lines and responsibilities for completing an environmental impact assessment. Scoping generally involves specialists from other departments or institutions with knowledge of the technical components of the proposed action or of the geographical area where the action will be implemented. Scoping often includes some public participation.

**Secondary Impacts** Environmental effects induced by the proposed action, which occur later in time or at a different place than the action.

**Sustainable Agriculture** Stable agricultural production which provides a continuous supply of food while protecting and enhancing natural resources, especially those required for agricultural production (i.e., soil and water), where technically and economically feasible (MOA 1993, p. 6).

**LIST OF ACRONYMS**

ASAL	Agriculture Sector Adjustment Loan
DOE	Department of Environment
EIA	Environmental Impact Assessment
ERMC	Environmental Resources Management Consultants
FAO	Food and Agriculture Organization
FNF	Friedrich Naumann Foundation
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)
HCST	Higher Council for Science and Technology
IUCN	International Union for the Conservation of Nature
JES	Jordan Environment Society
JVA	Jordan Valley Authority
MMRAE	Ministry of Municipalities, Rural Affairs, and the Environment
MOA	Ministry of Agriculture
MOF	Ministry of Finance
MOH	Ministry of Health
MOP	Ministry of Planning
MOS	Ministry of Supply
MWI	Ministry of Water and Irrigation
NCARTT	National Center for Agricultural Research and Technology Transfer
NEIEP	National Environmental Information and Education Program
NGO	Non-Governmental Organization
RSCN	Royal Society for the Conservation of Nature
RSS	Royal Scientific Society
UNIDO	United Nations Industrial Development Organization
UOJ	University of Jordan
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
WAJ	Water Authority of Jordan
WHO	World Health Organization

**Currency****U.S. \$ 1 = 0.7 JD**

## EXECUTIVE SUMMARY

### *Introduction*

Jordan's proposed Agricultural Policy Charter identifies protection of the environment as an important part of agricultural development. Without adequate environmental protection, agricultural production and development is undermined. In this study, the potential environmental impacts of the actions associated with the proposed Agricultural Policy Charter in Jordan are presented. The environmental issues are defined, prioritized, and compared to the Charter. This process assisted in identifying the significant environmental issues associated with the actions of the charter as well as identifying opportunities for strengthening its environmental objectives.

The capabilities of Jordanian institutions to conduct or participate in environmental impact assessments (EIA) for programs and projects in the agricultural sector are also identified. General recommendations for applying EIA principles in the agricultural sector as well as specific recommendations for institutionalizing EIA within the Ministry of Agriculture are discussed. The study also briefly considers training needs and opportunities.

### *Environmental Issues Associated with Agriculture*

Principal environmental issues associated with agriculture in Jordan include impacts on soil, water, eco-systems, culture, the availability of agricultural land, and the quality of agricultural products. A total of sixteen distinct issues were identified.

Using a process known as multi-objective analysis, these environmental issues were prioritized for each of the five agricultural subsectors (irrigated agriculture, rainfed agriculture, forestry, livestock, low rainfall rangeland). Four objectives or criteria were used in the analysis: Health Effects, Irreversibility, Rate of Degradation, and Geographic Extent.

**Priorities of Environmental Issues in Each Subsector**

Sub-Sector	PRIORITY		
	HIGH	MEDIUM	LOW
1	Groundwater Degradation Soil Degradation Groundwater Salinization Surface water Degradation Groundwater Depletion	Soil Salinization Quality of Product Surface water Salinization Desertification Habitat Destruction	Soil Erosion Loss of Agricultural Land Plant Cover Destruction Wetland Destruction Deforestation Cultural Degradation
2	Soil Erosion Desertification Loss of Agricultural Land Soil Degradation Habitat Destruction	Groundwater Degradation Quality of Product Groundwater Salinization Surface water Degradation	Plant Cover Destruction Surface water Salinization Deforestation Cultural Degradation
3	Soil Degradation Groundwater Degradation Desertification Soil Erosion Plant Cover Destruction	Groundwater Salinization Groundwater Depletion Loss of Agricultural Land Habitat Destruction	Deforestation Quality of Product Cultural Degradation Wetland Destruction
4	Groundwater Degradation Soil Erosion Soil Degradation Desertification Plant Cover Destruction Quality of Product	GW Depletion Loss of Agricultural Land Surface water Degradation	Groundwater Salinization Deforestation Surface water Salinization Cultural Degradation
5	Soil Erosion Deforestation Desertification Habitat Destruction	Groundwater Depletion Soil Degradation Loss of Agricultural Land Plant Cover Destruction	Groundwater Degradation Groundwater Salinization

1-Irrigated Agriculture; 2- Rainfed Subsector; 3- Low Rainfall (Badia) Zone; 4- Livestock Subsector; 5- Forestry Subsector

*Relationship Between the Environmental Issues and the Agricultural Charter*

The relationship between the environmental issues identified in this study and the actions within the agricultural policy charter were elucidated using relationship matrices for each subsector. These matrices (Tables 4-8) identify and discuss the potential positive and negative impacts of each of the Policy Actions on each environmental issue. For those actions which have negative impacts, potential mitigation measures or alternatives are identified. For some of those actions which have positive impact, recommendations are made for further enhancement.

The actions proposed within the Agricultural Policy Charter were found to be, in general, environmentally beneficial. Although some proposed Charter actions were found to contain positive impacts on some environmental issues and negative impacts on others, only a small number of actions contained negative impacts on all of the environmental issues associated with them.

### *Environmental Impact Assessment Capabilities in Jordan*

To date, Jordan has no law requiring EIA, and therefore, no institutions have EIA programs or comprehensive experience in such assessments. The only EIAs which have been prepared were those required by international donors. Often these EIAs have been prepared by expatriate consultants with assistance from local counterparts. Several private and public institutions, however, have capabilities to assess environmental conditions or have some experience in environmental management or impact assessment. These capabilities could be drawn upon to prepare future EIAs.

### *Mechanisms for Institutionalization of EIA in Jordan*

To ensure that agricultural options under consideration are environmentally sound and sustainable, environmental consequences must be recognized early and taken into account in project design. The incorporation of environmental assessment procedures into the agricultural decision making process in Jordan will identify environmental issues early on, design environmental improvements into projects, and avoid, mitigate, or compensate for adverse impacts. Towards this end, the three ministries which will implement the charter (MOA, MWI, and MOS) must, in cooperation with MOP and MMRAE, develop an EIA program for the agricultural sector.

At a minimum the program should insure that environmental impacts of major actions are identified and assessed early in the decision-making process, that scoping meetings are held with representatives from affected Ministries, that the assessments include several reasonable alternatives, and that the public and other departments and Ministries are involved in developing and reviewing EIAs for agricultural projects.

To facilitate this effort, this study recommends that the agricultural council, in conjunction with the Minister of Municipal and Rural Affairs and the Environment, host two workshops for middle and upper level managers in MOA, MMRAE, MWI, MOS, and MOP. The purpose of this workshop should be to develop a shared understanding and definition of EIA. The second workshop should apply that understanding to the development of procedural and content guidelines for EIA in the agricultural sector. After these workshops, each ministry should incorporate the guidelines into its own decision-making process.

The first step in implementing these guidelines within MOA is to develop a common understanding and definition of EIA among MOA staff. This should be accomplished through an introductory workshop for mid-level managers and key professional staff on the principals of EIA. The workshop should conclude with presentation of the guidelines developed by the second inter-ministerial workshop.

Ideally, the mechanisms for incorporating EIA into MOA's decision-making process should be developed by ministry managers. To begin this process, however, this study recommends that departments within MOA conduct EIAs for major actions and include resources for EIA's in annual plans and project proposals. This study recommends that implementation of EIA within MOA be monitored by an Environmental Officer in the Monitoring and Evaluation Division who would report his findings directly to the Secretary General and the Minister, have a consultative relationship with DOE in MMRAE and the environmental unit in MOP, and be a source of information to the departments on sources of technical assistance for the development of EIAs.

## I. INTRODUCTION

The purpose of this study is to identify and prioritize environmental issues associated with the implementation of the Agricultural Policy Charter and to recommend institutional mechanisms and procedures for addressing and monitoring the environmental impacts of agricultural programs and projects.

Agriculture is intimately tied to the environment. Many of the basic inputs for agricultural production are environmental resources (e.g., soil, water and climate). Sustainable agriculture depends, in part, upon a healthy environment. Properly managed agricultural production can protect and even enhance the health of the environment, but agricultural production can also degrade the health of the environment; improper use of land, water and agricultural chemicals can cause environmental damage.

Acknowledging the relationship between agriculture and the environment, the Agricultural Policy Charter states that "the Government of Jordan will support:

an agriculture, animal husbandry and forestry sector, which is contributing to the protection of the natural environment and to the preservation of natural resources by adopting land use patterns and technologies which are sustainable and in harmony with the principles and requirements of the preservation of soils, water, flora and fauna; (MOA 1993, p. 8)

an agriculture and animal husbandry orientation which will uphold the culture, beauty and characteristic distinction of the Jordanian countryside; (MOA 1993, p.9)

The Agricultural Policy Charter also identifies environmental protection as an objective for agricultural policy in Jordan:

To manage and use agricultural production resources "with economic efficiency, while preserving the environment and ensuring the sustainability of agricultural production in the long-term". (MOA 1993, p. 9)

The environmental goals and objectives of the Charter cannot be accomplished without institutional changes within the agricultural sector. Neither the Ministry of Agriculture nor other institutions operating in the agricultural sector, systematically identify, address, and monitor environmental issues associated with agricultural development. This study offers recommendations for improving the current situation.

To gather information for this study, the authors reviewed the literature on environmental issues in the agricultural sector (see Appendix A) and interviewed key individuals in Jordanian institutions operating in the agricultural sector

and those concerned with environmental protection (See Appendix B). The individuals who were interviewed were asked to:

- Identify environmental issues associated with agriculture and provide a recognition of their relative importance;
- describe the status of and technical capacity for EIAs in their institutions;
- Identify potential mechanisms for institutionalizing EIA in the agricultural sector.

The results of these investigations are presented in the following three sections of this report. Section II, Environmental Issues Associated with Agriculture in Jordan, defines the specific environmental issues of concern in agriculture and presents a prioritized list of these issues. Section II also compares the list to the Agricultural Policy Charter, identifying the potential environmental issues associated with the actions in the charter as well as identifying opportunities for strengthening its environmental objectives.

Section III, Environmental Impact Assessment Capabilities in Jordan, presents the status of EIA in Jordan. The capabilities of Jordanian institutions to conduct or participate in EIAs for programs and projects in the agricultural sector are also identified in this section.

Section IV, Mechanisms for Institutionalization of Environmental Impact Assessment in Jordan, begins with a presentation on the principles of EIA. The section then presents general recommendations for applying those principles in the agricultural sector and specific recommendations for institutionalizing EIA within the Ministry of Agriculture. This section also identifies relevant guidelines for EIA in the agricultural sector. The implementation of EIA in the agricultural sector will have to be supported by a training program. To that end, this section also identifies human resource training needs and opportunities. The conclusions and recommendations of the study are presented in Section V.

Throughout this report the term "environmental impact assessment" is used. This term has both a technical and institutional definition. Technically, EIA is a systematic, reproducible, transparent, and interdisciplinary evaluation of the potential impacts of a proposed action and its practical alternatives on the physical, biological, cultural, and socioeconomic conditions of the geographical area where the action will be implemented. Institutionally, EIA is a decision-making process which provides decision-makers with information on the environmental impacts in such a manner that they can weigh environmental effects of a proposed action against its social, political, and economic effects. Sections II and III of this report address issues associated with the technical definition. Section IV addresses issues associated with both the institutional and technical definition.

It is important to note that with either the technical or institutional definition, EIA is focused on identifying and assessing the potential impacts of proposed actions. Environmental impacts of existing programs, projects or activities can best be assessed and addressed through other mechanisms such as environmental audits, comparative risk assessments and the promulgation of environmental standards. These mechanisms are outside the scope of this report.

## II. ENVIRONMENTAL ISSUES ASSOCIATED WITH AGRICULTURE IN JORDAN

As Jordan's population doubles within the next twenty years (at current growth rates), demands for food, fiber, and fuel will rise enormously. Meeting these demands locally will require more intensive and extensive exploitation of many natural resources, especially agricultural land, water, and forests. The more that yields can be increased by careful and sustainable management of resources that are already in use, the easier it will be to resist pressure to draw down new resources- drawdown groundwater supplies, clear forests, and encroach on wildlife habitats - and degrade existing resources.

Managing Jordan's natural resources sensibly will require a recognition of land and water scarcity, and a recognition of the significance of managing environmental problems. In this section, the environmental issues directly associated with agriculture in Jordan are identified and prioritized. A matrix of Policy Charter Actions and their impacts on the environment is also presented.

### A. Identification of Issues

Table 1 presents a list of the environmental issues associated with agriculture in Jordan as cited in the literature, identified during interviews, and identified by project the team, based upon their experiences with agriculture and environment in Jordan.

**Table 1.** Environmental Issues Associated With Agriculture in Jordan

SOIL SALINIZATION SOIL DEGRADATION SOIL EROSION SURFACE WATER SALINIZATION SURFACE WATER DEGRADATION GROUNDWATER DEPLETION GROUNDWATER SALINIZATION GROUNDWATER DEGRADATION CHANGE IN PRODUCT QUALITY CULTURAL DEGRADATION LOSS OF AGRICULTURAL LAND HABITAT DEGRADATION WETLAND DESTRUCTION DESERTIFICATION DEFORESTATION DEGRADATION OF PLANT COVER
--

Each of the environmental issues listed is described in detail below. The descriptions provide a basic definition of each of the issues and outline the significance of the issues with respect to the agricultural sector in Jordan. Since the relative importance of each of these issues differs, the issues are prioritized in the following sections.

**SOIL SALINIZATION.** This issue refers to the increase in the salt content of soil adversely impacting the productivity of the soil. Salinization occurs either as a result of agricultural practices or as part of the natural cycle. Soil salinization in Jordan is very extensive in areas of low rainfall and has a significant impact on reducing natural plant cover and soil potential productivity.

Soil salinization in Jordan is caused by several factors such as degradation of irrigation water quality (Jordan Valley and highlands), the use of saline soils (Middle Jordan Valley and Azraq area), limited salt leaching, poor farm water management, high evaporation, and over fertilization in most areas.

The analysis of salt accumulation patterns in areas such as the Jordan Valley indicates an alarming level of salt accumulation in soils. Such patterns were detected in soils of low and high indigenous salt content. The analyses indicated that accumulation of salt in the first type of soils is due to poor management, the intensive use of drip irrigation, and diminishing water allocation. In the second type of soil to be analyzed, salt accumulation at the surface was attributed to salt redistribution by drip irrigation, a process which does not allow adequate leaching.

The salinization of irrigation water and the possible reduction of irrigation water allocated for agriculture will increase the risk of soil salinization. Furthermore, the increasing demand for the use of saline waste water will place more pressure to allocate additional water for leaching. Otherwise the rate of salinization will be accelerated. Under current conditions, the availability of additional amounts of water to be used for leaching is not assured. Moreover, leaching also requires levelling of soils, the use of special equipment, and farm drainage. Such necessary activities can only be ensured by enforcing measures to raise the system efficiency and improve resource management. These activities include the selection of crops of low water demands, exclusion of soil of high indigenous salt content from the production system, proper use of fertilizers, the prevention of return flow from reaching farms, improving the quality of waste water treatment, increase ground water recharge, and forced controls of over pumping.

**GROUNDWATER DEGRADATION (other than Salinization and Depletion).** Groundwater degradation in its widest sense includes all negative changes in qualitative and quantitative parameters of groundwater. It does not necessarily imply that the groundwater cannot be used for a certain purpose, but it indicates that the water is becoming quantitatively or qualitatively loaded, which may, if circumstances persist render the water unfit for certain uses.

Groundwater degradation other than depletion and salinization incorporate contamination with certain pollutants such as trace elements, organic compounds, bacteria, viruses, biocides, and fertilizers. This form of groundwater degradation is found in Jordan along the Zarqa river, in the urban areas, and in aquifers underlying agricultural projects. Fertilizers and biocides are increasingly leaching to the groundwater resources all over the country where there are no impermeable layers separating the soil from the groundwater bodies.

In Dhuleil and Jordan Valley areas, fertilizers have been found in the groundwater resources of the area, especially high concentrations of nitrates. An example is well no. 1109 in Dhuleil area where fertilizers caused the nitrate content of the groundwater to rise from 15 ppm in 1970 to 23 ppm in 1979 and to 120 ppm in 1990 .

**DESERTIFICATION.** The process of desertification of lands involves the loss of topsoil, loss of vegetation cover, and insufficient fallow periods causing the destruction of the land's biological potential which can ultimately reduce the lands to desert-like conditions. Desertification, caused by natural or anthropogenic factors, is an expression of comprehensive changes that influence the whole spectrum of semi-arid to sub-humid ecosystems including, human, animal, plant, soil, and air resources. It can be assessed through several parameters such as risk, rate, status, and hazard.

Applying these concepts to Jordan reveals different zones with different desertification indicators of risk, rate, status, or hazard. In some zones, anthropogenic factors dominate natural factors, while in others, desertification status has reached a threshold point where anthropogenic influences play a crucial role. In addition, the risk of desertification from agro-ecological conditions influences different areas in Jordan.

Within the territory of Jordan, five distinct desertification zones can be identified, reflecting different measures of rate, risk, and status of desertification. The first zone is located in the Jordan Valley north of Deir Alla. Here, the risk indicator of desertification is improper land and water management practices and related agro-ecological conditions. The status indicator of desertification, on the other hand, reveals early stage desertification.

The second zone is the Jordan Valley south of Deir Alla to the North of the Dead Sea. The main factors contributing to desertification are the agro-ecological conditions and improper land management practices.

The third zone is located within the highlands, receiving more than 250 mm of rainfall and occupying about 9% of the total area of Jordan. Agro-ecological changes introduced during the last four hundred years coupled with agro-ecological stress, improper land use, improper use of water resources, urban development, are among the important factors that contribute to desertification in this region. In fact, the rate of desertification has accelerated during the last

200 years due to the destruction of the ecosystem which can be recognized from the remains of red soils on steep slope, or forest remains in these areas, and the occurrence of a high percentage of exposed rock in high rainfall areas. Moreover, the influence of human action is very intense in this area. Such interference is expressed in terms of the extent of urban development and related activities which adversely influence the ecological system.

The fourth zone is located within the areas which receive 100-200 mm of rain per annum. This zone occupies about 10% of Jordan. This zone is classified among the zones whose agro-ecological conditions have reached the threshold point. Human interference in this zone is crucial due to the fragility of the agro-ecological conditions. Over the years, soil conditions have deteriorated substantially, and the improper irrigation activities carried out during the last 25 years have accelerated the deterioration of soils and water resources in this zone. The natural productivity of soil has also been adversely affected.

The fifth zone is located within the area which receives less than 100 mm of rain per annum. This zone occupies about 81% of the total area of Jordan and can be subdivided into three subzones: the southern zone (which includes Wadi Araba south of Ma'an; the middle zone (North of Ma'an to Azraq); and the northern zone (North of Azraq area). The three subzones are considered natural desert habitats, not areas passing through changes caused by desertification. These areas have passed the threshold points and developed properties of desert-like conditions and changes caused by desertification have reached an advanced stage.

In sum, the assessment of the influence of desertification on the agricultural sector can be geographically correlated with irrigated activities in the first and third zones, rainfed activities in the third zone, while the degradation of range resources are associated with the fourth and fifth zones. There are short term influences in the irrigated areas, due to more intensive impact, while influence is rather long term in the second and third zones. Irreversibility of desertification also varies from one area to another depending upon the stage of desertification. For example, reversibility within the fifth zone is impossible, while it is extremely difficult in the fourth zone. Mitigation of desertification within the other areas requires a comprehensive national effort.

**SOIL DEGRADATION (other than salinization).** Soil degradation involves the accumulation of toxic materials and the development of pathogens in the soil. The accumulation of toxic material is mostly concentrated in irrigated areas. The increasing use of waste water in irrigation, the intensive use of herbicides and pesticides, the concentration of soluble organic material which reaches the water bodies by runoff, and the intensive use of fertilizers contribute to the accumulation of toxic materials in the soil. If such materials are absorbed by plants and accumulate in the fruit, they can pose serious health hazards to both animals and humans.

Another type of soil degradation could be attributed to the development of pathogens. Sources of pathogen usually include inadequately treated waste

water, solid waste disposal from urban areas in water ways, and the use of undecomposed manure. Such hazards generally occur in irrigated areas and close to urban centers.

Soil degradation could also result from poor soil management whereby soils are not replenished with required nutrients. Continuous plowing also accelerates the loss of soil organic content and contributes to further depletion of nutrients. Depletion of this type is concentrated mostly in rainfed areas of Jordan. Additional soil degradation is caused by improper use of machinery which destroys soil structure, extensive plowing, improper land use, up turning of land, construction of roads, and unattended plowing of steep slopes. These types of degradation are highly concentrated in the rainfed areas. Degradation of soil properties, in the low rainfall zone, is related to reduction of the moisture storage capacity of the soil which causes additional stress on plant life.

Degradation in irrigated areas is mainly due to improper management. For example, the accumulation of plastic residue has had negative impact on animal grazing in the irrigated areas after crop harvest. Further hazard is inflicted on the growth of crops and causes yield reduction. In addition, associated with practices in irrigated area is the random disposal of metal insecticide or herbicide containers. Residues in these containers might spread and cause build up of toxic material in the soil.

**SOIL EROSION.** Erosion is the removal of soil particles by either water or wind. Erosion is considered as one of the most important factors influencing the potential of land productivity in Jordan.

Land resources in Jordan are affected by both types of erosion. Wind erosion is very active in the low rainfall zone and influences the rainfed zone in the Western portion of the Highlands. Erosion by water is very active in both low rainfall and rainfed zones. Erosion caused by wind or water is known as geologic erosion when it occurs as a result of natural causes, but is known as accelerated erosion when human activity interferes with the natural cycle.

Geologic erosion is totally responsible for the formation of agricultural land resources in the Jordan Valley. After the formation of the Rift Valley, well developed soil was eroded from the Rainfed areas and transported to the Valley floor. The intensity of the erosion caused the partial loss of the fertile top soil on undulating topography and complete loss on steep slopes. Remains of red soil can still be recognized on steep slopes within the Eastern mountains surrounding the Valley. As a result of geologic erosion, substantial runoff was discharged towards the valley. Recently, major portions of this discharge have been controlled at the mouth of several major water ways by the construction of dams, but strong floods still occur in small side wadis and cause some damage to farms located along these wadis. Erosion within cultivated areas is negligible except for slightly steep mountains covered with bare saline marl sediment along the Jordan River.

In the rainfed areas, geologic erosion is considered the most important factor controlling the formation of soils. All the soils of this zone were transported by water erosion from high areas and deposited at lower areas. The extensive forest destruction during the last two centuries, the rapid growth of intensive agricultural practices, the improper use of machines, the rapid urban expansion, the exhaustion of soils, the reduction of vegetation cover by over grazing, the cultivation of steep slopes without adequate conservation measures, and the use of appropriate crops resulted in substantial increase in the rate of erosion (accelerated erosion).

The concentration of urban centers within the rainfed zones has been accompanied by the accumulation of waste materials around villages and cities. Since all runoff water is intercepted at the mouths of major wadis East of the Jordan Valley, the improper disposal of solid waste or wastewater effluents will eventually reach the surface and groundwater bodies.

In the low rainfall zone, geologic erosion is very active. Soil deterioration caused by water erosion has reached an advanced stage and caused lower production in many areas. The development of poor soil properties has also accentuated the influence of erosion.

Wind erosion is very active in areas of level topography and those with thin plant cover and poor surface structural stability. These conditions characterize the low rainfall zone in Jordan. Level topography ( 76% of the total area), coupled with very poor vegetation cover, due to overgrazing, and poor structural properties has contributed to the occurrence of intensive erosion by wind. Studies have indicated that wind erosion has been active for the last 5-10 thousand years and resulted in the deposition of high amounts of silt at the soil surface within the Steppe zone ( this zone is located within the area which receives 100-250mm of annual rain). The silt sediment was associated with calcium carbonate which reduced the soil moisture capacity. This property caused further drought stress conditions. The deposition of calcareous silt by wind is still active in this area and can be easily felt even within populated areas during peak time of the Khamaseen period every year.

**GROUNDWATER DEPLETION.** If the extracted amount of water from a groundwater body exceeds the average recharge in a series of years, the water body is considered to be over-exploited. This over-exploitation will, at later stages, lead to groundwater depletion. This situation is affecting various areas in Jordan, such as Jafr, Azraq, Dhuleil, Shoubak, Amman, Zarqa, Wadi Arab, Northern Badia, and Disi. In all these areas, groundwater levels are continuously declining and wells drilled in Dhuleil, Azraq, and Amman-Zarqa have to be deepened continuously.

The groundwater of Jafr basin was developed in the early sixties for both domestic and irrigation uses. After a few years of water extraction, groundwater levels began to drop and water quality to deteriorate. The same situation was repeated in Dhuleil area in the early seventies when water levels began to rapidly drop and water salinities to increase. Farmers began to deepen their wells, but

even that did not help because irrigation return flows were reaching the groundwater and raising its salinity.

In Azraq area, the shallow groundwater aquifer was utilized to provide irrigation water for the farms in that area. Hundreds of wells were drilled in that area since the mid seventies. Water levels began to drop rapidly and the water became increasingly saline. Pumping affected also the water levels of the domestic water supply fields of the Water Authority where water levels dropped by a few meters in a few years causing the more saline water of the Oasis to encroach into the well field area.

In Wadi Arab and Mukheiba areas, wells were drilled in the eighties with piezometric heads of tens of meters above the groundwater levels. The water of both areas was used for irrigation in the Jordan Valley. Wadi Arab wells are now used to supply domestic water for Irbid governorate. The water levels of all wells have dropped by tens of meters and now water has to be pumped since the wells are not flowing freely.

The last example on groundwater overexploitation is Disi Aquifer which began to be exploited for irrigation in the mid eighties. Within the past eight years, water levels dropped by up to 13 m.

**GROUNDWATER SALINIZATION.** Groundwater salinization refers to the increase in the total salinity of a groundwater body, allowing for some seasonal or secular fluctuations. Salinization may be caused by different activities, such as over-exploitation, irrigation return flows infiltration of high salinity waters, and salt water intrusions. Salinization of groundwater resources is only reversible in a very few cases and even then, the process is either very difficult to bring about or is economically limiting. Natural processes which may lead to the recovery of a salinized aquifer are very slow and may require hundreds of years of recovery.

Salinization of groundwater in Jordan is experienced in Jafr, Dhuleil, Azraq, Amman, Zarqa, Wadi Dhuleil, Jordan Valley and other areas. Salinization in Jafr area was the result of overexploitation and upflow of saline water bodies in the surrounding areas of the well fields. For example, the salinity of one well in Jafr (well no. 17), increased from 909 uS/cm in 1965 to 3,100 uS/cm in 1973 and to 4,400 uS/cm in 1992. This illustrates that the water had become at the end of the sixties unsuitable even for irrigating salt semi-tolerant crops.

Salinization due to irrigation return flows is experienced in certain areas of the Jordan Valley. In the northern Jordan Valley wells, have experienced an increase in salinity from 600 - 700 uS/cm to 2,400 uS/cm since the mid sixties. In Wadi Dhuleil both overexploitation (dropping water levels) and irrigation return flows resulted in rapidly increasing groundwater salinities, e.g., the salinity of well no. AL 1109 increased from 1,060 uS/cm in 1979 to 2,940 uS/cm in 1990. High levels of fertilizers ( $PO_4$ ,  $NO_3$ , and K) in the groundwater after the mid-eighties are indicators of the effects of irrigation return flows.

Saltwater intrusions as a source of groundwater salinization is best exemplified for the Azraq Oasis area with salinities rising rapidly in wells lying close to the Oasis. Salinization due to infiltration of saline water through soil is found along Wadi Dhuleil where the semi-treated effluent of Khirbet Es-Samra Wastewater Treatment Plant infiltrates into the groundwater. The salinity there has increased from an average of 1,700 uS/cm in 1985 to 3,360 uS/cm in 1990.

**SURFACE WATER DEGRADATION.** Surface water degradation refers to the increase in the concentration of substances considered as pollutants in the surface water. The changes of certain physical parameters such as temperature, turbidity pH, and Eh are the usual indicators of surface water quality degradation.

Degradation of surface water qualities in Jordan is the result of various activities overlapping each other. The underlying reasons include the natural scarcity of water courses and the high concentration of industrial, urban, and agricultural activities in the surrounding areas.

Although degradation of surface water quality is found throughout Jordan, the causes of the degradation are different for different areas. Agriculture adds fertilizers and biocides to the surface water. Higher nitrates and phosphates concentration are measured along the lower reaches of wadis and in the Jordan Valley side wadis. In the Jordan Valley side wadis the natural NO<sub>3</sub> concentration in the 1970s was 15-20 ppm; at present it ranges from 40-90 ppm mainly as a result of fertilizing and inflows of farm wastes into those wadis. In addition, fertilizers in surface waters increase algal activities leading to eutrophication processes and the deterioration of water qualities.

Surface water degradation caused by other activities than agriculture is very common and widely found in Jordan. All wadis are contaminated with effluents of wastewater treatment plants and cesspool leakages. Along the Zarqa River, industrial effluents contain concentrations of trace elements, suspended solids, high values of biological and chemical oxygen demands.

**DEGRADATION OF PLANT COVER.** Plant cover refers to the natural biomass production other than forest and cultivated crops. Degradation of plant cover is widely recognized in Jordan. The government realized the changes very early and launched efforts to halt the degradation of plant cover with varying level of success.

About 90% of the total area in Jordan is designated as range land, including 40% of the uncultivated areas within the rainfed zone. These areas have been subjected to different levels of stresses. The effects of desertification in the low rainfall zone during the past 5,000 years have caused complete disappearance of vegetation in some areas, and the development of properties unfavorable for plant growth. Range materials have become extremely degraded during the last two to three decades. Such degradation was sharply accelerated by the increase in the livestock number, cultivation of the land without any precaution, and periodic drought, in addition to the influence of erosion by water and wind.

Plowing for no specific purpose, excessive traffic movement, mining, cross border grazing have also contributed to the rapid plant cover reduction. Grazing on state land is also one of the leading factor contributing to plant degradation. This type of grazing is mainly organized by traditional tribal rules. Most of the tribes consider themselves as owners of the land. The government has launched several projects to improve the status of the rangeland, but most of them have not been successful due to the mounting grazing pressures.

Range reserves represent the successful effort to conserve or to improve the status of vegetation cover. Such range reserves have been established since 1940 and cover about 750.000 dunums. Restriction for grazing has been established on state rangeland. Other areas are freely grazed.

The degradation of plant cover has a profound influence on animal health. Livestock numbers have increased dramatically during the last 50 years. This increase has not been accompanied with improvement in the vegetation cover.

Deterioration of plant cover in the rainfed zone has accelerated during the last few decades. The intensive erosion on steep land and overgrazing has adversely affected the plant cover. Plant degradation in this zone was also caused by the rapid expansion of urban activities (1.7 million dunums), construction of roads without attention to environmental requirements and industrial activities. The destruction of the forest in many areas has deprived several plant species from protection against grazing or erosion. Over- pumping of groundwater has also reduced flows from springs which has caused the disappearance of several plant species in many areas, accelerated erosion, and consequently, total loss of plant cover. The influence of plant cover removal has obvious effect on the health of the wildlife and livestock. The contribution of plant cover to the ecological balance is not to be under- estimated and is considered crucial. The influence of vigorous vegetation cover had a positive influence on the wellbeing of the local population who suffer from the loss of medicinal plants, widely used by inhabitants, as well as on the local economy.

In irrigated areas the natural plant cover also suffers from intensive human activities. The extensive conversion of land from conventional cultivation to intensive irrigated agriculture which is accompanied by repeated plowing , the extensive use of herbicides, continuous weeding, and uprooting of shrubs has it's toll on the natural plant cover. Ecological balance, consisting of plant, animal, wildlife had been disrupted in favor of more intensive returns from the land. The sustainability of the ecosystem, such as the one prevalling under irrigated areas, is to be re-evaluated to comprehend its consequences on our life.

**DEFORESTATION.** Deforestation is the act of cutting down forests for economic gain and converting the land to other uses such as grazing or human settlement. Forests typically have poor quality soil, and within two to three years after being cleared, soil that once supported dense vegetation becomes too nutrient-poor to provide much grass for grazing, allowing soil erosion and sedimentation of water bodies to occur.

Jordan has a total area of 1,508,620 dunum of forest land, 87% of which is designated as government forest land. The forest land of Jordan is limited to the mountainous areas where annual rainfall exceeds 200 mm. The forests can have an impact on production by influencing soil moisture availability and soil conservation. Deforestation releases minerals into drainage water, and the effects of increased sediment levels are usually serious. Studies have shown that, in certain areas, forests can reduce the sediments and erosion by as much as 75%.

In Jordan, forests are managed primarily for their environmental and social values. It is estimated that the current volume of standing timber is approximately 2.3 million m<sup>3</sup>. The annual cutting in the forest currently produces about 12,000 tons of wood and fuel. Another very important way by which forest trees contribute to food production in Jordan is by providing fodder for livestock. The amount of fodder material extracted from forest in Jordan is estimated at 30,000 tons of dry matter.

Agro-forestry has been practised in Jordan for conservation purposes such as maintaining soil organic matter, promoting nutrients cycling, reduction of soil erosion, and improving the micro climate. This has played a useful role in watershed management and stability. The conversion of forests to agricultural land has resulted in high rates of erosion and increased sediment load. This is very clear in the case of the Zarqa River Basin.

The area of forest land remained relatively stable during the last 30 years (1,3090,000 dunum). However, due to population increase, pressure to extend cultivation into private forest land became acute. The extension of cultivation into these areas has resulted in the destruction of vegetation covers and increasing soil erosion. It is estimated that about 15% of the private forest was converted to other agricultural uses or urbanization, while more than 50,000 dunums of government forest land was transferred to non-agricultural purposes. Free grazing in the forest land is prohibited by Agricultural law No. 20 of 1973. The same law however, gives the right to the government to issue grazing permits in forest areas that are more than 15 years old. In Jordan only lands and water of very poor quality are allocated to forestry activities. This limitation is a serious constraint to forestry development.

**LOSS OF AGRICULTURAL LAND.** The loss of agricultural land refers to the natural or artificial conversion of productive agricultural land into other uses. The total land area of Jordan is 89,945,000 dunums, 90% of which receives less than 200 mm of annual rainfall and is classified as arid land. The remaining 10% is considered the main area of rainfed agriculture. Not all this area is cultivated because it is occupied by villages, population centers and related infrastructure. About 93% of the cultivated land is located in the highlands where most of the population centers are located.

The total area of registered agricultural land holdings decreased from 3.666 million dunums/year in 1975 to 3.404 million dunums in 1983, resulting in a net loss of 3,200 dunum/year from agriculture to other uses. Most of this land

was used for urban development. Inheritance law and free land sale has resulted in increased land fragmentation in rainfed areas. The available figures indicate that the number of holdings with an area of less than 40 dunums (50% of the number of holdings) increased by 28%, and that of holdings with an area of less than 20 dunums also increased by the same magnitude. The government issued law No. 9, in 1969, limiting the size of holdings outside village and city boundaries to 4 dunums. The limit was raised to 10 dunums in 1982.

Urbanization, land fragmentation, and erosion of arable land are the major threats to land resources in Jordan. It is estimated that the area within villages and cities is 1.7 million dunums. This area includes some of the most productive land in Jordan. A substantial portion of this land is still registered as agricultural land. However, the inclusion of such land within urban boundaries legalizes its conversion from agricultural to non-agricultural uses. The first step in this conversion is achieved through the division of land to small plots (250-1000 sqm) which facilitates commercial sales. Consequently, most of this land, though not occupied by buildings or infrastructure, is registered as agricultural land. Because of the size of the holding, such parcels are not suitable for cultivation any more.

The conversion of agricultural land to other uses has had great impact on the whole ecological system. Construction of roads on unstable slopes, loss of plants coverage, loss of soil surface and reduction of the water absorption capacity is destroying the ecological equilibrium and accelerating the erosion within and around urban areas. The loss of agricultural land is also accentuated by accelerated erosion caused by improper agricultural practices, use of improper tools, cutting of trees, and overgrazing of steep slopes.

**DEGRADATION OF (WILDLIFE) HABITAT.** Diversity of wildlife in Jordan exhibits pronounced regional differences due to climate variation and topography. However, the number of wildlife species is limited and vulnerable to land use impact development and the fact that most of the land in Jordan is classified as semi-desert to desert. Throughout recorded history, Jordan has been known for its forest and plants and was described by many historians and travellers as green and rich in wildlife. Old mosaics and stone inscription in Jawa and Wade Qatif show pictures of oryx, capre ibex, wolves, and oxen. The mosaics in Madaba show the richness of wildlife during the Byzantine era. These mosaics represent various species like the wild pigs, leopard, asian lions and birds. The Ummayyed desert castles also depict the richness of wildlife. The visitors to Amra castle can see fresco paintings which illustrate dramatic hunting scenes of deer, wild rabbits, and other species.

Many of the species appearing in the historical records are now extinct or threatened. The main factor that led to this state of affairs is habitat degradation, and the deterioration of the vegetation cover and urbanization. The period during the First World War had witnessed the most destruction in wildlife habitat. The construction of railroad built between Gnelaz and Shouback resulted in the destruction of trees used as train fuel. Other factors such as over-grazing and high rainfall variability also contributed to the

deterioration of wildlife. During the Second World War, human population increased dramatically. The availability of rifles and vehicles accelerated the rate of animal depletion to the point of extinction. Some species left their natural habitat and moved to other unsuitable areas which had weak environmental and biological capacity to absorb additional numbers of the same species.

In Jordan, the use of chemicals to control insects and diseases in fruit orchards, mostly established close to or between forest areas, has caused a severe reduction in the vegetation intensity and biodiversity of wild plants. Urban centers are established close to wild animal habitats and have destroyed the existing environmental equilibrium. Groundwater over-pumping practised lately to meet increasing demand has had a negative impact on the number and the discharge of springs. The springs system in the mountainous areas of Jordan had played a significant role in supporting wildlife in these areas by providing drinking water, food, and sometimes shelter.

In the Jordan Valley, pollution of natural resources has substantially increased in recent years. The intensive use of chemicals such as herbicides and insecticides, pollution of surface water, salinization of springs, and the establishment of major population centers, have all combined to cause severe disturbances in the ecosystem rendering it not supportive of a favorable wildlife environment.

In recent years, wildlife protection has begun to enjoy special attention from the government and special agencies such as the Ministry of Agriculture which is entrusted with protecting, monitoring, and establishing agricultural reserves, eradicating the use of pest problems and governing the use of insecticides, protection of trees and plant cover by increasing public awareness, preservation of soil and forest, protection of wildlife habitats, organizing hunting, providing services to improve the health of wildlife, and veterinary quarantine. Another agency involved with wildlife protection is the Royal Society for the Conservation of Nature. The Society supervises natural wildlife reserves in Jordan within different ecological regions. The society has played a leading role in the protection of some wildlife species and the reintroduction of others to their native habitat.

**CHANGE IN THE QUALITY OF PRODUCTS.** Quality of agricultural products refers to plant and animal products influenced directly by agricultural or related activities. The accumulation of substances hazardous to human or animal health can occur as these substances reach the food chain. Such issues have gained a great deal of attention in recent years due the serious direct effects on quality of life and economic well being.

The goal of obtaining higher yields has forced farmers to use more fertilizers to maintain soil fertility, and herbicides or insecticides to control weeds and pests. The improper uses of these materials facilitate their incorporation in the biological system whereby they accumulate in humans, animals, water, and land resources.

In recent years, rapid expansion in the cultivation of land under irrigation has placed tremendous pressure on available water resources. Treated waste water now has to be used to compensate for the shortage in irrigation water. The inclusion of waste water in the agricultural system has brought a new dimension to quality of agricultural product. Treated waste water is not purified of organic or inorganic content, but rather treated for reducing the hazards of pathogens and sediment loads. The repeated use, or the increasing proportion of this water in irrigation will eventually lead to its accumulation to harmful levels in soils and, consequently, in plants. In addition, the concentration of industry close to the waterways plays a significant role in increasing the level of toxic substances in irrigation water.

The improper and intensive use of chemical spraying has raised special concerns with regard to chemical residues being observed on the vegetables or fruit brought to the markets directly after the application of chemicals. The hazards of chemicals used within irrigated areas are not only restricted to produce, but to the livestock grazing within these areas, as well. Chemicals occurring at the surface or within the plant tissues will concentrate within the animal's body and some appear in animal products such as milk.

The processing of animal products such as dairy and meat products have also been adversely affected by the concentration of chemicals in the animal's surroundings. It has been reported that the high concentrations have caused some animal diseases transmitted to humans through dairy products. With regard to the quality of meat products, no solid data are available, since national self sufficiency in meat is equal to only about 20%. Future projections indicate that reliance on meat imports is increasing.

The production of poultry substantially multiplied over the last few decades. The use of feed concentrates and the concerns about animal health were important factors behind the utilization of chemicals to provide better hygienic conditions. Such materials, sooner or later, reach surrounding soils and water. Waste produced from the poultry sector is used in irrigated farming, while waste from slaughter houses is dumped with municipal waste. Because of its organic nature it represents a potential source of disease if not properly disposed of.

**WETLAND DESTRUCTION.** Destruction of wetlands is referred to as the deterioration of a special ecological system where naturally flowing water plays a clear role in controlling the biological life. In Jordan, wetland sites occupy small areas and are located within the arid zone. The significance of this area has been for its non-agricultural value and as tourist attraction centers because of the presence of wild animals e.g., local and rare migrating birds.

The Azraq area is a prime example of a site that has had its water resources pumped across the desert to satisfy increasing municipal demand. The intensive over pumping of drinking water has caused the recession of water. With rainfall in this area ranging from 50-70 mm/yr, providing little recharge, the ecological system is quickly being destroyed. The soil has become dry, the organic materials accumulated over the years have dried out, and several plant species have

disappeared. Furthermore, the site is not a refuge for local or migrating birds anymore.

**CULTURAL DEGRADATION.** Cultural degradation refers to the negative impact of development on cultural resources. Archaeological and historical remains in Jordan reveal human presence in the area as far as the Paleolithic Period (10,000 -14,000 B.C.). The preservation of cultural resources is a necessary component of national environmental protection. Just as biological diversity is sought to be protected, so is cultural diversity and indigenous cultures.

Changes in agricultural practices brought about by technological advances have contributed to cultural degradation. In the low rainfall zone, for example, the life of local inhabitants has dramatically changed. While the people of that area were considered, over centuries to be the best at co-existing with their natural surroundings, the prime resources of these area, namely the range resources have been badly abused.

In the rainfed areas, abandoned land caused by labor forces migrating towards cities for work, resulted in increasing erosion. This was due to the collapse of protective measures employed while using indigenous farming practices. The change in the fragile eco-system as a result of higher erosion rates affected soil productivity and plant cover.

Among the most interesting examples of cultural changes which vividly demonstrate the attitude of people towards the environment can be observed from the location of old villages in comparison with modern cities and towns. While the old villages were located on the tops of hills, where land is bare (runoff is reduced), at the present time, villages are located mostly on level more water absorbent surfaces leaving steep slopes under the mercy of runoff which also devastates lower land.

**SURFACE WATER SALINIZATION.** This refers to increases in the total dissolved solids content of a surface water resource. This increase can have different degrees from normal conditions of natural salinity up to thousands of parts per million of dissolved solids rendering the water unfit for certain uses.

Surface water in different areas in Jordan suffers slight to heavy salinization due to various human activities, e.g., along the Zarqa River, the salinity in the last four decades has increased from an average of around 500 ppm up to 1,200 ppm at present. King Talal Dam, whose waters in 1978 had a salinity of 500 ppm, now have an average salinity of 1,300 ppm

Irrigation return flows are the main cause of increasing surface water salinities along the lower reaches of all wadis pouring into the Jordan River. This fact is best illustrated by Wadi Zarqa downstream of Deir Alla and the upper reaches of Wadi Mallaha where the salinity of the water reaches 3,000 to 4,000 ppm in the summer months.

## B. Prioritization of Environmental Issues

Not all of the environmental issues appearing in Table 1 and discussed above are equally important in each of the five subsectors of the Agricultural Policy Charter: Irrigated Agriculture, Rainfed Agriculture, Low Rainfall (Badia) Zones, Livestock Production and Forestry. In order to prioritize the issues, their evaluation can proceed in terms of single objective or multiple objective analysis. In the case of single objective analysis, the most important environmental issue would be well-defined; namely the issue that maximizes or minimizes a well-defined, all encompassing, scalar valued objective. In most cases, however, no single objective can adequately serve to compare the difference in desirability among feasible solutions. In such cases, multi-objective analysis has proven to be of substantial use, especially in natural resources policy analysis. The World Bank has included multi-objective analysis as a feasible solution method, as cited in Volume I of the World Bank Environmental Assessment Sourcebook. For more details on these methods, see Appendix C and Abu-Taleb (1992), Abu-Taleb *et al.* (1992), and Abedrabboh (1988).

For the purposes of conducting a simple multi-objective analysis, the subsectors were defined as follows (see Charter for details):

**Irrigated Agriculture:** all areas of irrigated agriculture -- those with surface water and groundwater sources of irrigation water, in the Jordan Valley, highlands and desert.

**Rainfed Agriculture:** all non-irrigated croplands in regions which receive over 200 mm/yr of rainfall.

**Low Rainfall (Badia) Zones:** all non-irrigated croplands and rangelands in regions which receive less than 200 mm/yr of rainfall.

**Livestock Production:** livestock processing such as slaughterhouses, dairies and poultry houses. This subsector overlaps considerably with the Low Rainfall (Badia) subsector and to a lesser extent with the Irrigated Agriculture and Rainfed Agriculture subsectors. The charter includes actions in this subsector aimed at optimizing feed production, but these actions are not analyzed for this subsector because they are covered by the analyses for the Irrigated Agriculture, Rainfed Agriculture, and Low Rainfall subsectors.

**Forestry:** the 1,508,620 dunums registered as forestland.

Four objectives or criteria were used in the analysis: Adverse Health Effects, Irreversibility Potential, Rate of Degradation and Geographic Extent of Problem. The criteria were developed by a consensus of the team members following their interaction through interviews with the officials from different Ministries and Departments. Each environmental issue was scored for each of the four criteria within the context of each subsector. A simple procedure was then adopted: a

composite score for each issue was generated using a weighted average of the four individual scores. The weighting reflected the relative importance of each criterion to the overall environmental health of Jordan.

The results of the analysis, using a weighting scheme which the authors perceive best represents the relative importance of the criteria and the results of interviews, are presented in Table 2. A more detailed explanation of the analysis, including the actual scoring for each subsector, is reported in Appendix C.

To obtain results for the overall agricultural sector, the results for each of the subsectors above were aggregated in the following way. Each subsector was assigned a relative importance based upon the contribution of each sector to the national economy (high for irrigated agriculture, livestock, and low rainfed zones; medium for rainfed subsector; and low for forestry subsector). The numerical ranking of each of the issues was then multiplied with the relative importance of each subsector the issue appears in, and an average calculated. In this way, the results directly reflect the relative ranking of the issues for each subsector, presented in Table 3. As can be observed, for example, groundwater degradation, having been ranked near the top for each of the subsectors, is again ranked near the top for the agricultural sector.

It should be noted, however, that the aggregate ranking is presented for illustrative purposes only and is not intended to provide more information than the ranking for each subsector. The latter case imparts more direct and meaningful results for each individual subsector.

**TABLE 2. Priorities of Environmental Issues in Each Subsector**

Sub-Sector	PRIORITY		
	HIGH	MEDIUM	LOW
1	Groundwater Degradation Soil Degradation Groundwater Salinization Surface water Degradation Groundwater Depletion	Soil Salinization Quality of Product Surface water Salinization Desertification Habitat Destruction	Soil Erosion Loss of Agricultural Land Plant Cover Destruction Wetland Destruction Deforestation Cultural Degradation
2	Soil Erosion Desertification Loss of Agricultural Land Soil Degradation Habitat Destruction	Groundwater Degradation Quality of Product Groundwater Salinization Surface water Degradation	Plant Cover Destruction Surface water Salinization Deforestation Cultural Degradation
3	Soil Degradation Groundwater Degradation Desertification Soil Erosion Plant Cover Destruction	Groundwater Salinization Groundwater Depletion Loss of Agricultural Land Habitat Destruction	Deforestation Quality of Product Cultural Degradation Wetland Destruction
4	Groundwater Degradation Soil Erosion Soil Degradation Desertification Plant Cover Destruction Quality of Product	Groundwater Depletion Loss of Agricultural Land Surface water Degradation	Groundwater Salinization Deforestation Surface water Salinization Cultural Degradation
5	Soil Erosion Deforestation Desertification Habitat Destruction	Groundwater Depletion Soil Degradation Loss of Agricultural Land Plant Cover Destruction	Groundwater Degradation Groundwater Salinization

1. Irrigated Agriculture
2. Rainfed Subsector
3. Low Rainfall (Badia) Zone
4. Livestock Subsector
5. Forestry Subsector

**Table 3. Environmental Priorities for the Overall Agricultural Sector**

PRIORITY		
HIGH	MEDIUM	LOW
Soil Salinization Soil Degradation Groundwater Degradation Desertification Soil Erosion	Groundwater Salinization Groundwater Depletion Plant Cover Destruction Surface water Degradation Habitat Destruction	Surface water Salinization Loss of Agricultural Land Quality of Products Deforestation Wetland Destruction Cultural Degradation

**C. Relationship Between Environmental Issues and the Agricultural Policy Charter**

Tables 5 through 9 are matrices which list the Agricultural Policy Charter actions for each subsector with their corresponding environmental issues. These matrices also identify and briefly discuss the potential positive and negative impacts of the actions on each environmental issue. For those actions which have negative impacts, potential mitigation measures or alternatives are identified. For some of those actions which have positive impact, recommendations are made for further enhancement.

**Table 4. ENVIRONMENTAL ISSUES ASSOCIATED WITH THE IRRIGATION SUBSECTOR**

Proposed Action in Policy Charter	Environmental Issue	Environmental Impact
<ul style="list-style-type: none"> <li>• Adjust the price of water to cover O&amp;M costs. (WAJ, JVA)</li> <li>• Tax relief for manufacturers of water saving technologies. (MOF)</li> <li>• Replace low return per cubic meter of water crops with high return per cubic meter crops. (MOA &amp; JVA)</li> </ul>	<ul style="list-style-type: none"> <li>• Surface Water Degradation <i>High Priority</i></li> <li>• Groundwater Depletion <i>High Priority</i></li> <li>• Soil Salinization <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Implementing the actions concerned with the adjustment of water prices would reduce the water use which in turn would reduce the return flow contamination.</li> <li>• <b>Positive</b> Implementing these actions would have a positive impact on groundwater resources by reducing pumping from these resources.</li> <li>• <b>Recommendations</b> Optimum on-farm water management should be used to ensure the use of enough water for successful farming and soil leaching.</li> <li>• <b>Negative</b> Increases incentives to use less water which could lead to further soil salinization.</li> <li>• <b>Mitigation</b> Make leaching water available free or at a lower price. Ensure that soil salinity management needs are incorporated into crop water requirements and water efficient crop regimes.</li> </ul>

**IRRIGATED SUBSECTOR**

<ul style="list-style-type: none"> <li>• Convert to closed pipe conveyance systems. (MOA, MWI)</li>   <li>• Replace basin and furrow irrigation with drip irrigation. (MOA, JVA)</li> </ul>	<ul style="list-style-type: none"> <li>• Surface Water Degradation <i>High Priority</i></li>   <li>• Groundwater Depletion <i>High Priority</i></li>   <li>• Surface Water Salinization <i>Medium Priority</i></li>   <li>• Soil Salinization <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Minimizes risks of surface water degradation and evaporation.</li>   <li>• <b>Positive</b> Increases efficient use of water</li>   <li>• <b>Positive</b> Reduces water use, which should reduce return flow contamination.</li>   <li>• <b>Negative</b> Using drip irrigation or closed pipe conveyance systems would reduce the use of water which could result in soil salinization.</li>   <li>• <b>Mitigation</b> Make leaching water available free or at a lower price. Ensure that soil salinity management needs are incorporated into crop water requirements and water efficient crop regimes</li> </ul>
<ul style="list-style-type: none"> <li>• Generate and distribute information on crop water requirements.</li>   <li>• Generate and disseminate water saving technologies.  (MOA, JVA, NCARTT, UOJ)</li> </ul>	<ul style="list-style-type: none"> <li>• Groundwater Salinization <i>High Priority</i></li>   <li>• Groundwater Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Reduces water use, which would reduce return flow contamination. Allows the use of optimum water quantities necessary for successful farming and soil leaching.</li>   <li>• <b>Positive</b> Reduces water use, which would reduce return flow contamination and minimize low quality water infiltrating to the groundwater.</li> </ul>

31

**IRRIGATED SUBSECTOR**

<ul style="list-style-type: none"> <li>• Same as previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Wetland Degradation <i>Low Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Reduces water use whereby return flow contamination would be reduced and less contamination would reach wetland bodies and less water would be pumped from them.</li> </ul>
<ul style="list-style-type: none"> <li>• Develop water storage structures. (MWI)</li> </ul>	<ul style="list-style-type: none"> <li>• Groundwater Salinization <i>High Priority</i></li> <li>• Groundwater Degradation <i>High Priority</i></li> <li>• Soil Salinization <i>Medium Priority</i></li> <li>• Wetland Degradation <i>Low Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Storing good quality water would increase the opportunity of groundwater recharge.</li> <li>• <b>Positive</b> Storing good quality water would result in recharging groundwater aquifers with minimum degradation and reduce pumping from aquifers.</li> <li>• <b>Positive</b> Increased storage will allow for better water management and will result in good soil leaching practices and less soil salinization.</li> <li>• <b>Positive</b> Enhances the recovery of wetland areas by reducing water pumping and return flow contamination.</li> </ul>
<ul style="list-style-type: none"> <li>• Enact wastewater treatment policies to protect groundwater quality. (MWI,MMRAE)</li> </ul>	<ul style="list-style-type: none"> <li>• Surface Water Degradation <i>High Priority</i></li> <li>• Groundwater Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Reduces toxic and pathogenic contamination by improving the quality of the effluent water.</li> <li>• <b>Positive</b> Reduces toxic and pathogenic contamination whereby the water reaching groundwater would be of acceptable quality that might undergo natural treatment while infiltrating the soils.</li> </ul>

32

## IRRIGATED SUBSECTOR

<ul style="list-style-type: none"> <li>• Same as the previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Change in Quality of Products <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Maintains low level of residue in vegetables and plants and probably eliminates any adverse effects if properly managed.</li> </ul>
<ul style="list-style-type: none"> <li>• Develop new products and explore innovative ways of processing. (MOA, JVA, UOJ, NCARTT)</li> </ul>	<ul style="list-style-type: none"> <li>• Change in Quality of Products <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Helps in finding better markets, higher values, and increases the demand for good quality products if processed, packed, and sold in innovative ways.</li> </ul>
<ul style="list-style-type: none"> <li>• Develop crop regimes which maximize output per cubic meter. (MOA, JVA, UOJ, NCARTT)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Salinization <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Increases water availability for leaching of soils, and gives better crop yields as well as decreases the demand for water.</li> </ul>
<ul style="list-style-type: none"> <li>• Help farmers increase production efficiency. (MOA, JVA, NCARTT)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Salinization <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Makes more water available for leaching of soils by reducing water losses, maximizing output per cubic meter, as well as increases income return per dunum.</li> </ul>
<ul style="list-style-type: none"> <li>• Enhancing post-harvest technical services including monitoring of pesticides, residues, and quality control standards. (MOA, NCARTT)</li> </ul>	<ul style="list-style-type: none"> <li>• Change in Quality of Products <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Maintains good quality products of low chemical residues, promotes marketing for international markets, and increases public acceptance.</li> </ul>
<ul style="list-style-type: none"> <li>• Strengthen the generation and dissemination of technical information of pest and pest risks. (MOA, NCARTT)</li> </ul>	<ul style="list-style-type: none"> <li>• Surface Water Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Reduces surface water contamination by chemicals and biocides resulted from return flows of drainage and excess water.</li> </ul>

## IRRIGATED SUBSECTOR

<ul style="list-style-type: none"><li>• Same as the previous action.</li></ul>	<ul style="list-style-type: none"><li>• Groundwater Degradation <i>High Priority</i></li> <li>• Change in Quality of Products <i>Medium Priority</i></li></ul>	<ul style="list-style-type: none"><li>• <b>Positive</b> Reduces groundwater contamination by chemicals and biocides carried out to groundwater resources through infiltrating water.</li> <li>• <b>Positive</b> Reduces level of residues in products, increases product yields, decreases excessive use of pesticides, and increases food export.</li></ul>
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**Table 5. ENVIRONMENTAL ISSUES ASSOCIATED WITH RAINFED SUBSECTOR**

Proposed Action in Policy Charter	Environmental Issue	Environmental Impact
<ul style="list-style-type: none"> <li>• Encourage planting fruit trees on slope over 8% in areas with over 400mm/yr of rainfall. (MOA, NCARTT)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Erosion <i>High Priority</i></li>   <li>• Soil Degradation <i>High Priority</i></li>   <li>• Habitat Degradation <i>High Priority</i></li>   <li>• Surface Water Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Allows reduction of erosion by horizontal plowing, and strengthens the holding capacity of soils by constructing stone walls and terraces.</li>   <li>• <b>Positive</b> Soil fertility can be preserved by reducing runoff allowing for better infiltration and plant cover.</li>   <li>• <b>Negative</b> Increases accumulation of chemicals and biocides used to protect and improve trees.</li>   <li>• <b>Mitigation</b> Reduce the use of chemical fertilizers and biocides by using efficient on-farm management.</li>   <li>• <b>Negative</b> Results from the increased use of chemicals for the control of insects which results in destroying the natural habitats and beneficial bees.</li>   <li>• <b>Mitigation</b> Use biological control to replace the use of chemicals, and more education for farmers.</li>   <li>• <b>Positive</b> Decreases flood hazards, toxicity, sediments, and chemicals in surface water resources by reducing the amount of runoff water.</li> </ul>

**RAINFED SUBSECTOR**

<ul style="list-style-type: none"> <li>• Same as previous action</li> </ul>	<ul style="list-style-type: none"> <li>• Groundwater Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Increases infiltration to groundwater.</li> </ul>
<ul style="list-style-type: none"> <li>• Encourage shift from wheat to barley livestock farming systems in medium rainfall locations (200-350mm/yr) (NCARTT, MOA)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Degradation <i>High Priority</i></li>   <li>• Desertification <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Negative</b> Reduces plant residues in soils and destroys soil structure by animals accelerating erosion.</li>   <li>• <b>Mitigation</b> Maximize plant residues and control grazing after harvesting.</li>   <li>• <b>Positive</b> Improves agro-ecological system. Helps combat desertification through proper land use.</li> </ul>
<ul style="list-style-type: none"> <li>• Five years freeze on expansion of urban boundaries. (MMRAE)</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of agricultural Land <i>High Priority</i></li>   <li>• Soil Erosion <i>High Priority</i></li>   <li>• Surface Water Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Preserves agricultural land by restricting the expansion of urban areas towards agr. lands.</li>   <li>• <b>Positive</b> Reduces erosion due to urban development by maintaining low runoff levels outside urban areas</li>   <li>• <b>Negative</b> Increases amount of runoff inside urban areas due to loss of agr. land of high infiltration capacity, thus increases hazards of floods and pollution of water ways.</li>   <li>• <b>Mitigation</b> Control the selection of waste disposal sites. Install rainfall drainage systems.</li> </ul>

**RAINFED SUBSECTOR**

<ul style="list-style-type: none"> <li>• same as the previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Groundwater Depletion <i>Low Priority</i></li> <li>• Plant Cover Degradation <i>Low Priority</i></li> <li>• Deforestation <i>Low Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Preserves soil capacity to absorb water, hence increases infiltration in agricultural lands.</li> <li>• <b>Negative</b> Accelerates destruction of plant cover inside boundaries as expansion intensifies.</li> <li>• <b>Mitigation</b> Adopt proper land use, enact forestry protection measures, prevent building on deep soils. Enhance afforestation on government lands, along streets, and encourage the participation of public.</li> <li>• <b>Negative</b> Increases destruction of forests due to concentration of urban activities within urban areas.</li> <li>• <b>Mitigation</b> Involve schools, universities and public in afforestation activities especially for protecting steep slopes.</li> </ul>
<ul style="list-style-type: none"> <li>• Levy a high land use conversion tax on agricultural land (MOF)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Erosion <i>High Priority</i></li> <li>• Loss of Agricultural Land <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Reduces runoff by preventing the agricultural land from being converted into urban areas.</li> <li>• <b>Positive</b> Preserves agricultural land by reducing the conversion into urban areas.</li> </ul>

**RAINFED SUBSECTOR**

<ul style="list-style-type: none"> <li>• Same as the previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Groundwater Depletion <i>Low Priority</i></li> <li>• Surface Water Degradation <i>Low Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Preserves agricultural land of high infiltration capacity which permits higher water infiltration which in turn increases groundwater recharge.</li> <li>• <b>Positive</b> Reduces areas covered by urban activities, thus reducing the amounts of polluted runoff to water bodies hence decreases contamination.</li> </ul>
<ul style="list-style-type: none"> <li>• Allocate adequately treated urban wastewater for irrigation, especially for rainfed agriculture / Supplemental irrigation (MWI)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Degradation <i>High Priority</i></li> <li>• Habitat Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Negative</b> Introduces new toxic materials and pathogens which did not exist before in rainfed areas.</li> <li>• <b>Mitigation</b> Select soils of appropriate properties and good drainage systems. Use in areas that are less likely to affect groundwater resources. Improve treatment of wastewater and enforce strict regulations. Decrease effluent of industrial wastes.</li> <li>• <b>Negative</b> Imposes health hazards on wildlife by increasing levels of toxic chemicals and biocides.</li> <li>• <b>Mitigation</b> Enforce strict regulations and high standards for wastewater treatment. Convey wastes by closed pipe lines. Irrigate plants that are less likely to be picked by wild animals. Mix with good quality water.</li> </ul>

38

## RAINFED SUBSECTOR

<ul style="list-style-type: none"> <li>• Same as previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Desertification <i>High Priority</i></li>   <li>• Soil Erosion <i>High Priority</i></li>   <li>• Quality of Products <i>Medium Priority</i></li>   <li>• Groundwater Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Negative</b> If not mixed with good quality water, this action may cause an increase in the risks of desertification by irrigation with saline low quality water, and increases eco-system fragility.</li>   <li>• <b>Mitigation</b> Improve treatment to meet high standards and wastewater must be mixed with good quality water before being used for irrigation.</li>   <li>• <b>Positive</b> Reduces soil erosion in areas where irrigation is practiced due to reduction of surface runoff.</li>   <li>• <b>Negative</b> Increases chemical and biological contaminants soils and increases pesticides and insecticides.</li>   <li>• <b>Mitigation</b> Use for crops that are not for immediate consumption. Prevent industrial wastes from being mixed with municipal wastes.</li>   <li>• <b>Negative</b> Repeated use of treated wastewater might cause infiltration of chemicals into groundwater .</li>   <li>• <b>Mitigation</b> Use good water management, avoid irrigation in areas of high infiltration rates, and avoid draining to water ways of good quality water.</li> </ul>
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**RAINFED SUBSECTOR**

<ul style="list-style-type: none"> <li>• Same as previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Salinization <i>Low Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Negative</b> Increases soil salinity above current levels due to high salinity of wastewater and evaporation.</li> <li>• <b>Mitigation</b> Mix with good quality water. Plant low water consuming crops. Use good drainage practices and soils. Avoid areas of potential ground-water contamination.</li> </ul>
<ul style="list-style-type: none"> <li>• Enact land subdivision regulations which arrest fragmentation of agricultural lands. (MMRAE)</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of Agricultural Land <i>High Priority</i></li> <li>• Soil Erosion <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Reduces land fragmentation and maintains adequate farm size which is suitable for agricultural production.</li> <li>• <b>Positive</b> Reduces runoff and soil erosion due to deployment of associated agricultural activities which helps to maintain good soil conditions.</li> </ul>
<ul style="list-style-type: none"> <li>• Introduce land consolidation measures. (MMRAE)</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of Agricultural Land <i>High Priority</i></li> <li>• Soil Erosion <i>High Priority</i></li> <li>• Habitat Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Reduces land fragmentation and maintains adequate farm size which is suitable for agricultural production.</li> <li>• <b>Positive</b> Reduces runoff and soil erosion due to deployment of associated agricultural activities which help maintain good soil conditions and are more economical.</li> <li>• <b>Positive</b> Increases biodiversity, improves plant cover, and wildlife eco-system.</li> </ul>

**RAINFED SUBSECTOR**

<ul style="list-style-type: none"> <li>• Same as the previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Plant Cover Degradation <i>Low Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Improves soil condition, increases biodiversity which helps intensify natural plant cover.</li> </ul>
<ul style="list-style-type: none"> <li>• Encourage private sector participation in soil conservation. (MOA, JVA)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Erosion <i>High Priority</i></li> <li>• Habitat Degradation <i>High Priority</i></li> <li>• Groundwater Depletion <i>Low Priority</i></li> <li>• Plant Cover Degradation <i>Low Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Reduces soil erosion due to more intensive soil conservation measures to protect and sustain soil productivity because of private investment.</li> <li>• <b>Positive</b> Improves habitat survival chances due to good soil conditions and plant cover biodiversity.</li> <li>• <b>Positive</b> Increases water infiltration due to better and intensive soil protection measures.</li> <li>• <b>Positive</b> Improves soil condition that maintains better plant growth and biodiversity.</li> </ul>
<ul style="list-style-type: none"> <li>• Enact wastewater treatment policies to protect groundwater quality. (MWI, MMRAE)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Degradation <i>High Priority</i></li> <li>• Change in Quality of Products <i>Medium Priority</i></li> <li>• Groundwater Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Minimizes chemical inputs to the soil through proper irrigation practices.</li> <li>• <b>Positive</b> Decreases risks of toxic chemicals entering the soil structure that might be absorbed by vegetables and fruit tissues.</li> <li>• <b>Positive</b> Reduces amounts of chemicals and biological contaminants in the soil structure and water ways, thus reducing groundwater contamination.</li> </ul>

41

**RAINFED SUBSECTOR**

<ul style="list-style-type: none"> <li>• Same as previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Salinization <i>Low Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Negative</b> Reduces amount of water available for leaching, increasing the rate of salinization if not mixed with good quality water.</li> <li>• <b>Mitigation</b> Introduce efficient water use measures. Mix with good quality water. Intensify water harvesting where possible. Use in areas with minimum risk of contamination to groundwater.</li> </ul>
<ul style="list-style-type: none"> <li>• Develop new products and exploring innovative ways of processing.</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Degradation <i>High Priority</i></li> <li>• Habitat Degradation <i>High Priority</i></li> <li>• Change in Quality of Products <i>Medium Priority</i></li> <li>• Groundwater Degradation <i>Medium Priority</i></li> <li>• Surface Water Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Decreases the use of chemicals by introducing resistant varieties, biological control, better agro-ecological adaptability.</li> <li>• <b>Positive</b> Improves habitat ecosystem through reduction in the use of chemicals by using biological control, thus improving plant growth.</li> <li>• <b>Positive</b> Reduces the need for chemical protection measures, reduces build-up of chemicals in soil and plant tissues, and reduces health hazards</li> <li>• <b>Positive</b> Reduces risk of groundwater contamination due to the less need to control pests.</li> <li>• <b>Positive</b> Reduces the need for chemicals by relying on other means, thus reducing runoff to SW.</li> </ul>

## RAINFED SUBSECTOR

<ul style="list-style-type: none"> <li>• Formulate and establish entities to enforce policies which maximize quality and quantity objectives including quality control of chemicals and pesticides residue testing. (MOA)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Degradation <i>High Priority</i></li> <li>• Habitat Degradation <i>High Priority</i></li> <li>• Change in Quality of Products <i>Medium Priority</i></li> <li>• Groundwater Degradation <i>Medium Priority</i></li> <li>• Surface Water Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Reduces levels chemicals used in agricultural practices by educating farmers which is the most effective mean to control disease. Introduces innovative methods such as biotechnology which reduces soil contamination.</li> <li>• <b>Positive</b> Improves wildlife habitat by reducing level of chemicals in the eco-system.</li> <li>• <b>Positive</b> Avoids accumulation of toxic materials in vegetables and plant tissues by reducing use of chemicals.</li> <li>• <b>Positive</b> Reduces amounts of chemicals and toxic materials infiltrating to groundwater resources.</li> <li>• <b>Positive</b> Prevents contaminants from reaching surface water, thus reducing surface water contamination</li> </ul>
<ul style="list-style-type: none"> <li>• Help farmers increase production efficiency. (MOA, JVA, NCARTT)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Degradation <i>High Priority</i></li> <li>• Change in Quality of Products <i>Medium Priority</i></li> <li>• Soil Salinization <i>Low Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Efficient use of inputs reduces contamination.</li> <li>• <b>Positive</b> Helps in producing high quality products.</li> <li>• <b>Positive</b> Planting low water consuming crops and using proper amounts of water reduce salinization.</li> </ul>

**Table 6. ENVIRONMENTAL ISSUES ASSOCIATED WITH THE LOW RAINFALL SUBSECTOR**

Proposed Action in Policy Charter	Environmental Issue	Environmental Impact
<ul style="list-style-type: none"> <li>• Improve the enforcement of relevant sections of agricultural law of 1973 (dealing with uprooting of shrubs and trees, plowing and overgrazing). (MOA)</li> </ul>	<ul style="list-style-type: none"> <li>• Plant Cover Degradation <i>High Priority</i></li> <li>• Desertification <i>High Priority</i></li> <li>• Habitat Degradation <i>Medium Priority</i></li> <li>• Deforestation <i>Low Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Improves and maintains good vegetation cover by controlling the grazing, prevention of unattended plowing and shrubs cutting.</li> <li>• <b>Positive</b> Reduces the risk of desertification by reducing erosion, improving vegetation cover, and increasing recovery of agricultural land.</li> <li>• <b>Positive</b> Improves density and biodiversity of plant cover thus wildlife ecosystem becomes more favorable</li> <li>• <b>Positive</b> Reduces amounts of shrubs' cutting by local residents for cooking and fuel.</li> </ul>
<ul style="list-style-type: none"> <li>• Integrate production of forage from range and croplands to promote livestock production. (MOA, NCARTT)</li> </ul>	<ul style="list-style-type: none"> <li>• Plant Cover Degradation <i>High Priority</i></li> <li>• Soil Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Negative</b> Reduces the density and biodiversity of plant cover if current grazing pattern prevails.</li> <li>• <b>Mitigation</b> Employ proper land use rules which advocate the use of soil according to its potential. Employ grazing management according to land carrying capacity.</li> <li>• <b>Positive</b> Improves soil quality, permeability, structure, and organic matter content, therefore increasing soil productivity</li> </ul>

USA

## LOW RAINFALL SUBSECTOR

<ul style="list-style-type: none"> <li>• Same as the previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Erosion <i>High Priority</i></li> <li>• Habitat Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Improves soil condition, and plant density which reduce soil erosion hazards.</li> <li>• <b>Positive</b> Increases biomass cover and diversity and improves conditions for wildlife survival.</li> </ul>
<ul style="list-style-type: none"> <li>• Implement a three phase program to halt desertification;             <ol style="list-style-type: none"> <li>1. Create public awareness and define appropriate land use;</li> <li>2. Adjust livestock numbers to carrying capacity;</li> <li>3. Forage development and range management. (MOA)</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• Desertification <i>High Priority</i></li> <li>• Plant Cover Degradation <i>High Priority</i></li> <li>• Soil Erosion <i>High Priority</i></li> <li>• Soil Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Helps combat desertification by increasing plant density, reducing erosion by water and wind, and increasing the recovery capability of land.</li> <li>• <b>Negative</b> Reduces biomass production temporarily, affects farmers' economy by reducing milk, and adversely affects animal health.</li> <li>• <b>Mitigation</b> Provide feed from outside the system until the plant density reaches adequate level and soil reaches maximum carrying capacity.</li> <li>• <b>Positive</b> Improves soil carrying capacity, maintains good plant density and reduces hazards of erosion.</li> <li>• <b>Positive</b> Reduces soil degradation by improving soil structure and organic matter content, decreases the loss of fertile top soil surface, and the loss of soil by wind erosion.</li> </ul>

*SS*

**LOW RAINFALL SUBSECTOR**

<ul style="list-style-type: none"> <li>• Same as in the previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Habitat Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Improves ecosystem and increases biomass production.</li> </ul>
<ul style="list-style-type: none"> <li>• Provide more funding for range-land development programs. (MOA, MOS)</li> </ul>	<ul style="list-style-type: none"> <li>• Plant Cover Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Improves carrying capacity of the land, reduces destruction of plant cover, and improves plant biodiversity.</li> </ul>
<ul style="list-style-type: none"> <li>• Train more specialized range management staff. (MOA, UOJ, NCARTT)</li> </ul>	<ul style="list-style-type: none"> <li>• Plant Cover Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Improves carrying capacity of the land, better management of range resources, and improves plant density.</li> </ul>

**Table 7. ENVIRONMENTAL ISSUES ASSOCIATED WITH THE LIVESTOCK SUBSECTOR**

Proposed Action in Policy Charter	Environmental Issue	Environmental Impact
<p>• Maximize feed production. (MOA, UOJ, NCARTT)</p> <p><b>Note:</b> The first environmental issue associated with this action is based on the clearly specified action in the Charter which calls for proper land use. The second and the third environmental issues are based on the policy recommendation on page 46 of the charter which calls for increasing feed production by depending on the range and agricultural byproducts including byproducts of irrigated vegetables in the J.V., and the highlands. No incentives have been proposed to increase forage production from the proposed sources.</p>	<p>• Soil Degradation * <i>High Priority</i></p> <p>• Soil Salinization * <i>High Priority</i></p> <p>• Change in Quality of Products* <i>Medium Priority</i></p>	<p>• <b>Positive</b> Reduces deterioration of physical and chemical properties of soil by managing soils according to its potential, increases area where controlled grazing is practical.</p> <p>• <b>Negative</b> Increases risk of soil salinization because more irrigation water will be allocated for livestock subsector, and the development of more costly water resources schemes.</p> <p>• <b>Mitigation</b> Implement water harvesting technology to substitute for water losses wherever possible.</p> <p>• <b>Negative</b> Introduces residues of pesticides and herbicides, used heavily in irrigated agriculture, into the Animal husbandary feed chain, and then into the milk and meat.</p> <p>• <b>Mitigation</b> 1- Enforce and strengthen laws with regard to quantity and timing of pesticides application. 2- Introduce rotations including forage in irrigated and highland areas to increase forage production.</p>

87

**LIVESTOCK SUBSECTOR**

<ul style="list-style-type: none"> <li>• Increase milk production from goats and sheep as well as dairy cows. (MOA)</li> </ul>	<ul style="list-style-type: none"> <li>• Change in Quality of Products <i>Medium Priority</i></li>   <li>• Plant Cover Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Negative</b> Increases human and animal health hazards due to the increased use of concentrated feeds, increases number of animals, deterioration of housing condition for animals which would affect human health.</li>   <li>• <b>Mitigation</b> Enforce efficient hygienic production systems. Establish stringent laws with regard to quality control of types of feed, housing conditions of animals and persons working in the production system.</li>   <li>• <b>Negative</b> Destruction of vegetation cover due to high needs for feeds which must lead to overgrazing or over utilization of land potential.</li>   <li>• <b>Mitigation</b> Improve carrying capacity of the land. Subsidize some of the feed requirement. Control grazing in fragile areas. Increase natural plant reserves.</li> </ul>
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**LIVESTOCK SUBSECTOR**

<ul style="list-style-type: none"> <li>• Same as the previous action</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Erosion <i>High Priority</i></li>   <li>• Groundwater Depletion <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Negative</b> Increases erosion by wind and water due to destruction of vegetation cover and soil surface properties which are caused by overgrazing practiced to meet the demand of number of animals greater than carrying capacity of the land</li>   <li>• <b>Mitigation</b> Control grazing over low production areas. Increase carrying capacity and control grazing, increase protected plant reserve, and revegetate areas with adaptable plants.</li>   <li>• <b>Negative</b> Additional water quantity will be needed, as well as over-pumping to sustain the increase in production with regards animal needs for drinking and to improve housing conditions.</li>   <li>• <b>Mitigation</b> Employ a nation wide recharge of groundwater resources program to provide additional water for animal use.</li> </ul>
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**LIVESTOCK SUBSECTOR**

<ul style="list-style-type: none"> <li>• Same as the previous action</li> </ul>	<ul style="list-style-type: none"> <li>• Habitat Degradation <i>Low Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Negative</b> Destruction of wildlife ecosystem due to destruction of vegetation cover which might result from overgrazing, absence of certain plant species and shelter.</li> <li>• <b>Mitigation</b> Increase number of natural reserves. Improve range management, control overgrazing, revegetate with adaptable plant species, increase land carrying capacity by proper management.</li> </ul>
<ul style="list-style-type: none"> <li>• Improve efficiency of processing livestock products. (MOA, NCARTT)</li> </ul>	<ul style="list-style-type: none"> <li>• Change in Quality of Products <i>Medium Priority</i></li> <li>• Soil Degradation <i>High Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Negative</b> Increases amount of waste, and pathogens in surrounding areas which might have negative health hazards and pollute the products.</li> <li>• <b>Mitigation</b> Establish efficient disposal and treatment systems with high hygienic standards. Enforce and enact waste disposal regulations.</li> <li>• <b>Negative</b> Increases chemical residues, pathogens that could reach surface water and soils and could accumulate in areas surrounding livestock processing plants.</li> <li>• <b>Mitigation</b> Establish efficient disposal and treatment systems whereby more water might be needed to maintain high hygienic standards.</li> </ul>

52

**LIVESTOCK SUBSECTOR**

<ul style="list-style-type: none"> <li>• Same as the previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Surface Water Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Negative</b> Increases amount of waste and pathogens in surrounding areas which could reach surface water if located close to water ways.</li> <li>• <b>Mitigation</b> Establish efficient disposal and treatment systems of high standards. Enforce and enact waste disposal regulations in adequate sites.</li> </ul>
<ul style="list-style-type: none"> <li>• Improve poultry processing. (MOA,NCARTT)</li> </ul>	<ul style="list-style-type: none"> <li>• Change in Quality of Products <i>Medium Priority</i></li> <li>• Groundwater Depletion <i>Medium Priority</i></li> <li>• Surface Water Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Reduces contamination of products with toxic chemicals, provides better hygienic conditions, reduces pathogens transmitted from animals to humans.</li> <li>• <b>Negative</b> Increases demand for groundwater resources in order to provide highly hygienic conditions for products and housing.</li> <li>• <b>Mitigation</b> Employ nationwide groundwater recharge and water harvesting programs.</li> <li>• <b>Negative</b> Increases amount of organic residues, pathogens and chemicals discharged to surface waters if processing plants were located close to SW.</li> <li>• <b>Mitigation</b> Establish efficient disposal systems and better regulations.</li> </ul>

57

**Table 8. ENVIRONMENTAL ISSUES ASSOCIATED WITH FORESTRY SUBSECTOR**

Proposed Action in Policy Charter	Environmental Issue	Environmental Impact
<ul style="list-style-type: none"> <li>• Expand forest areas. (MOA, Others)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Erosion <i>High Priority</i></li>   <li>• Deforestation <i>High Priority</i></li>   <li>• Habitat Degradation <i>High Priority</i></li>   <li>• Groundwater Depletion <i>Medium Priority</i></li>   <li>• Plant Cover Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Reduces hazards of erosion on soils located below forest land and reduces sediment load to dams and water ways.</li>   <li>• <b>Positive</b> Increases area covered with forest and improves forest biodiversity.</li>   <li>• <b>Positive</b> Improves biodiversity in forests due to the increase in the areas covered by trees which provides good shelter and living conditions.</li>   <li>• <b>Positive</b> Reduces surface runoff, increases water infiltration and increases groundwater recharge.</li>   <li>• <b>Positive</b> Improves plant density and biodiversity for plants living within forest areas, and improves soil conditions which favors better plant growth.</li> </ul>
<ul style="list-style-type: none"> <li>• Improve forest management (MOA)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil Erosion <i>High Priority</i></li>   <li>• Soil Degradation <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Decreases surface runoff by providing good surface cover, reduces cutting, overgrazing and minimizes fire hazards.</li>   <li>• <b>Positive</b> Improves soil quality, permeability, and structure. Improves vegetation cover, increases organic matter and soil condition.</li> </ul>

## FORESTRY SUBSECTOR

<ul style="list-style-type: none"> <li>• Same as in the previous action.</li> </ul>	<ul style="list-style-type: none"> <li>• Plant Cover Degradation <i>Medium Priority</i></li> <li>• Change in-Quality of Products <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Improves plant density and biodiversity, reduces grazing and improves soil condition.</li> <li>• <b>Positive</b> Good forest management provides good shelter for medicinal plants which positively influence the health of local inhabitants.</li> </ul>
<ul style="list-style-type: none"> <li>• Improve national capacity for forestry development (MOA)</li> </ul>	<ul style="list-style-type: none"> <li>• Desertification <i>High Priority</i></li> <li>• Soil Erosion <i>High Priority</i></li> <li>• Groundwater Depletion <i>Medium Priority</i></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Positive</b> Improves agro-ecological system by reducing environmental fragility.</li> <li>• <b>Positive</b> Reduces soil erosion, decreases sediment load which might reach reservoirs, and sustains adequate soil conditions.</li> <li>• <b>Positive</b> Reduces surface runoff and increases the capacity to absorb water as well as increasing the recharge rate.</li> </ul>

### III. ENVIRONMENTAL IMPACT ASSESSMENT CAPABILITIES IN JORDAN

Jordan does not have a law which requires environmental impact assessment. National environmental laws were drafted in 1981, 1987 and 1989. These laws contained provisions of EIA, but they did not garner sufficient cabinet support for passage.

The lack of a national EIA program has often been cited as a critical problem in Jordan. The National Environmental Strategy for Jordan called for creation of "a national Environmental Impact Assessment process that would ascertain the environmental impact of all new development and construction projects and other activities that might have an adverse impact on the environment of Jordan, before they are approved and initiated." (MMRAE 1991, pg. xiii) The Higher Council for Science and Technology identified the development of a national environmental impact assessment program as a priority for Jordan (HCST 1992). The Council called for consistent mechanisms for the production and review of environmental impact assessments.

In 1992, the Ministry of Municipal and Rural Affairs and the Environment (MMRAE) drafted a national environmental law. A version of this law is currently under consideration by the Parliament. The proposed law would create an environmental unit in the MMRAE to establish national policies for the protection of the environment. Article 5 of the proposed law gives the environmental unit authority to establish the principles and procedures for environmental impact assessment. If the law passes in its present form, a national environmental impact assessment program may soon be established in Jordan.

Although no law requires environmental impact assessment (EIA), some Jordanian institutions have experience and capabilities in EIA. EIAs are prepared for projects funded by international donors, and although they are often prepared by expatriate consultants, some Jordanian institutions have been involved in their preparation and review. Some institutions have permit review procedures which include some components of environmental impact assessment (MMRAE, MOH, MOA). Other institutions have laboratories which generate information on environmental quality or personnel with training in disciplines used in EIAs.

The Jordanian institutions with experience and capabilities relevant to environmental impact assessment are:

- Ministry of Agriculture (MOA)
  - Forests and Afforestation Department
  - Plant Protection Department
  - Pesticide Formulation and Residue Control Laboratories
- Environmental Health Section, Ministry of Health (MOH)

- Central Laboratories, Ministry of Health (MOH)
- Department of Environment (DOE), Ministry of Municipal and Rural Affairs and the Environment (MMRAE)
  
- Ministry of Planning (MOP)
  
- Ministry of Supply (MOS)
  
- Ministry of Water and Irrigation (MWI)
  - Water Authority of Jordan (WAJ)
  - Jordan Valley Authority (JVA)
  - Water Quality Laboratories
- Higher Council for Science and Technology (HCST) and Royal Scientific Society (RSS)
  
- Jordan Environment Society (JES)
  
- Royal Society for the Conservation of Nature (RSCN)
  
- Universities
  
- Consulting firms in the private sector

The extent of the experience and capabilities of these institutions regarding to environmental impact assessment are discussed below.

### **A. Government Institutions**

#### *Ministry of Agriculture*

**FORESTS AND AFORESTATION DEPARTMENT.** The Forests and Afforestation Department establishes, protects and monitors new forests and manages natural forests and grazing reserves. It does not prepare EIAs for its activities, but it has a planning and studies division which carries out watershed/erosion evaluation for forests and rangelands.

**PLANT PROTECTION DEPARTMENT.** The Plant Protection Department is responsible for pesticides registration. MOA has a Committee of Pesticide Registration which reviews applications for pesticide registration in Jordan and makes recommendations to the Minister of Agriculture on which pesticides should be registered and the labelling requirements for those pesticides. The Committee has eight members: the Director of the Plant Protection Department (chairman), an agricultural engineer from the Plant Protection Department, and one representative each from the Pesticide Formulation Control Laboratory in MOA, MMRAE, MOH, the Agriculture Department of University of Jordan, NCARTT, and the private agriculture industry. The committee uses standards set by WHO/FAO (CODEX standards) and the results of bans and prohibitions in other countries (e.g., USA, European Community, other Arab countries). The

committee only deals with registration and labelling. It is not involved in handling and application issues. This is dealt with by the Plant Protection Department and Agricultural Extension.

**PESTICIDE FORMULATION CONTROL LABORATORY.** The mission of the Pesticide Formulation Control Laboratory is to test for pesticide residues in food. The laboratory has the capability to test for pesticide residues in soil and water as well as food, and has had some experience in these areas. Other than its involvement on the pesticide registration committee, the Pesticide Formulation Control Laboratory is not involved in forecasting environmental impacts from pesticide use.

### *Ministry of Health*

**ENVIRONMENTAL HEALTH SECTION.** The mission of MOH is to promote and enhance health. To that end, the Environmental Health Section monitors the quality of food and domestic water. MOH has two laboratories. The Environmental Health Laboratory has equipment and experience in analyzing chemical, heavy metal and microbiological parameters in water and air. This laboratory is primarily used by the Environmental Health and Health and Safety sections of MOH. Through the laboratory, the Environmental Health Section monitors ambient water quality, domestic water quality, and the quality of wastewater effluent. MOH conducts these analyses independent of MWI. The Central MOH Laboratory has equipment and experience in analyses associated with health care and food safety. Although the laboratory has equipment for pesticides analyses, its personnel are not trained in its use to detect pesticides in food or other media.

MOH has a representative on the MMRAE committee which reviews applications for industrial facility licenses (discussed below under MMRAE). To support this activity, MOH has its own committee which reviews the health and safety impacts of the proposals and recommends appropriate permit requirements. Other than a few cases involving licensing applications for poultry houses and slaughter houses, MOH has not been involved in assessing environmental impacts from agricultural sector activities.

### *Ministry of Municipal and Rural Affairs and the Environment*

**DEPARTMENT OF ENVIRONMENT.** This department is responsible for regulating and enforcing environmental protection measures. It has a committee which reviews applications for industrial facility licenses, including agricultural industries (poultry houses, feedlots, food processing, etc.). The committee has representatives from other ministries on it, including the Ministry of Health. DOE has Chemical Engineers, Environmental Engineers, Agricultural Engineers and Geographers who are involved in assessing the environmental impacts of proposed industrial projects. It has no laboratories for environmental monitoring. DOE does not license or review the

environmental impacts of agricultural projects, forestry projects or irrigation projects.

### *Ministry of Planning*

MOP coordinates, prioritizes and seeks donor funding for the plans and projects of ministries and other governmental institutions. It allocates funds for EIAs which are required by donor agencies, but it does not conduct EIAs.

### *Ministry of Supply*

MOS is involved in the agricultural sector in that it is responsible for maintaining a continuous supply of basic food commodities (e.g., vegetables, cereals, meat and dairy products) for the population of Jordan. It is interested in the quality of the food supply, both domestic and imported, but it has no laboratories to monitor food quality. It depends upon the results from the laboratories in other ministries (MOA and MOH).

### *Ministry of Water and Irrigation*

MWI is responsible for all water supply and wastewater treatment in Jordan. The ministry has authority for water conservation, prioritizing water use, improving water quality and enforcing restrictions on water uses to prevent its waste. MWI has the necessary laboratories and the manpower to perform many types of water quality analyses, but it is only involved in environmental impact assessments for major projects funded by donors.

**WATER AUTHORITY OF JORDAN.** WAJ monitors both the quantity and quality of water. It has seven water quality laboratories, with capabilities to monitor hydrochemicals, trace metals, organic chemicals (VOCs, pesticides, carcinogens, etc.), microbiology, biochemical, and isotopes. WAJ monitors water quality of domestic water (before the meter), industrial effluent, wastewater treatment plant effluent and some streams and side wadis (both upstream and downstream of effluent discharge points). The laboratories have strict sampling protocols and quality control, and have won international awards for their quality control. Data at WAJ have been used for water quality modeling and could be used in the future for modeling associated with EIAs. WAJ has wastewater effluent quality standards for irrigation water and wastewater treatment plant discharges and water quality standards for domestic water. It also has standards for industrial pretreatment regulating the quality of industrial discharges to municipal wastewater treatment systems.

**JORDAN VALLEY AUTHORITY.** The Jordan Valley Authority monitors and analyzes salinity and Sodium Absorption Ratio (SAR) in soil and irrigation water in the Jordan Valley. It does not monitor other impacts of agriculture on the environment.

JVA has four employees assigned to environmental issues, three in the Valley and one in Amman. These employees are supposed to identify environmental

problems and work with other JVA staff to solve them. These employees have received training in EIA at a workshop in Amman sponsored by Washington State University, the University of Jordan and USAID. Other staff in JVA (40 employees) attended an environment workshop in the Jordan Valley put on by the Jordan Environment Society. Before implementation of any project, JVA requires a feasibility study which includes an environmental component. The provisions for the environmental component are spelled out in the terms of reference for feasibility studies. They require the consultant to identify environmental problems arising from a project and "advise on the possible ways and means to minimize any adverse effects resulting from the project." The terms of reference do not require the development of alternatives or other critical components of environmental assessment.

#### *The Higher Council for Science and Technology and the Royal Scientific Society*

The mission of HCST is to stimulate, coordinate, finance and follow up scientific research and development in the country. One of the six sectors in which it works is the environment. HCST promotes environmental research through commissions with universities and research centers. The environmental sector in HCST is currently seeking funding to produce a handbook for EIA. A major arm of the HCST is the Royal Scientific Society which has a Department of Environment. This department possesses laboratory facilities for water analyses and gas emissions. The department produces reports about the findings of the laboratories which are usually financed by HCST, MOP or other ministries. RSS does not conduct EIAs.

#### **B. Private Institutions**

**JORDAN ENVIRONMENT SOCIETY.** The Jordan Environment Society (formerly the Jordan Society for the Control of Environmental Pollution) is a non-governmental organization (NGO) with members throughout the country. It acts as a forum for discussing environmental issues facing Jordan and as a pressure group for environmental protection. JES currently has two public awareness programs, one funded by the Friedrich Naumann Foundation (FNF) and the other by USAID. The FNF project is called the National Environmental Information and Education Program (NEIEP). Its purpose is to spread environmental awareness to all strata of Jordanian society, with special emphasis on decision makers. The activities have been aimed at teachers and students, leaders of NGOs, clerics, and governmental decision makers. The project has developed educational materials including films, publications, proceedings of symposia, a newsletter and posters, all of which are distributed free or at a very low price. The USAID program is directed at water issues and is coordinated with MWI. It will be similar to the NEIEP but with more emphasis on training locals to be environmental educators. The Society does not possess laboratories or trained personnel for EIA, but their activities may secure public participation in EIAs.

**ROYAL SOCIETY FOR THE CONSERVATION OF NATURE.** The RSCN is a non-governmental organization which focuses primarily on the establishment and management of natural reserves and protection of endangered species. RSCN has a staff specialized in issues related to wildlife protection and natural reserves and is often assisted by experts from government ministries, universities and research centers. RSCN recently established a Research and Survey section which will prepare environmental impact assessments for projects initiated and managed by RSCN. The first project which will have an environmental impact assessment is the management plan for the Dana Wildlife Reserve. RSCN can supply information on endangered species and potential impacts on the six wildlife reserves, for use in EIAs. RSCN focuses on endangered species, so it does not have general information on wildlife populations, wildlife habitats or general ecosystem conditions.

### **C. Universities**

In Jordan there are 6 public universities and at least 10 recently licensed private universities. Three of the public universities have programs dealing with environmental issues: the University of Jordan, Yarmouk University and Jordan University of Science & Technology. These universities have laboratories for soil, air and water analyses, which are capable of carrying out specialized tests on environmental elements. Due to the diversity of specializations within these universities, they are capable of producing comprehensive research which could support EIAs.

### **D. Consulting Firms in the Private Sector**

Several consulting firms in Jordan possess the know-how or have at their disposal, through relationships with universities and research centers, personnel highly qualified to be entrusted with EIA. Many of these firms have experience in EIA through joint ventures with foreign firms involved in assessments for donor projects.

#### **IV. MECHANISMS FOR INSTITUTIONALIZATION OF EIA IN JORDAN**

##### **A. Principles of Environmental Impact Assessment**

In the past 30 years, nations around the world have implemented environmental impact assessment programs. The common goal of these programs is to ensure that the negative environmental impacts of private and public actions are kept to their practicable minimum. To achieve this goal, environmental impact assessment programs require private and public institutions to assess and address environmental impacts in the earliest stages of activity planning, and to incorporate the assessment into the decision making process.

Environmental impact assessment is both a technical document and a decision making tool. As a technical document, environmental impact assessment is a systematic, reproducible, transparent and inter-disciplinary evaluation of the potential impacts of a proposed action and its practical alternatives on the physical, biological, cultural and socioeconomic conditions of the geographical area where the action will be implemented.

As a decision making tool, environmental impact assessment provides decision makers with information on environmental impacts in such a way that they can weigh environmental effects against social, political and economic effects. To achieve this purpose, many environmental impact assessment programs have fundamentally changed the decision making processes in government institutions. Most programs have expanded the definition of environment to include social, political and economic components, requiring that these components be assessed and presented along with impacts on human health and the natural environment. In this way the decision maker can weigh tradeoffs within a common framework. As a result, environmental impact assessment laws and regulations have improved the quality of planning and decision making by government agencies, private organizations, and individuals.

To be an effective decision making tool, EIA cannot be the responsibility of one government institution, rather, it must be incorporated into the decision-making procedures of all government institutions. To ensure uniformity, most programs empower a central government institution to develop procedures and criteria for environmental impact assessment and monitor implementation. Other government agencies are required to incorporate the procedures into their decision-making processes. Private institutions and individuals are required to incorporate assessments of environmental impacts into their decision making procedures via permitting and licensing requirements.

## **1. Components of an EIA Program**

Environmental impact assessment programs have certain common components:

- Identification of the types of activities requiring EIAs and the levels of assessment.
- Requirements for the timing, procedure and content of EIAs.
- Specification of the procedures for review, comment and approval of EIAs.
- Requirements for public participation.
- Monitoring requirements.

Each of these components of EIA programs are described in detail below.

**IDENTIFICATION OF THE TYPES AND ACTIVITIES REQUIRING EIAs AND THE LEVEL OF ASSESSMENT.** Not all decisions require environmental impact assessment. An environmental impact program must identify which decisions require assessment and which do not. Most programs, such as those in the United States, the European Community and The World Bank, also identify decisions which require limited environmental impact assessment. The World Bank and the European Community identify three types of actions via lists (see Appendix D for The World Bank lists). In the United States<sup>1</sup>, each government agency produces a list of activities which do not require environmental impact assessments (Categorical Exclusions). All other activities are subject to environmental impact assessment, although if the agency believes that a decision will not have a significant environmental impact, it can conduct a limited assessment (Environmental Assessment) rather than the more rigorous Environmental Impact Statement.

Whether the identification of activities requiring environmental impact assessment is done via lists or a procedure, the decision about which actions require environmental impact assessment are based upon the significance of the impacts on the environment. If the impacts are significant, then an environmental impact assessment is necessary. Significance is determined by the extent or intensity of the potential impacts, the value of the impacted environment, the level of uncertainty about the impacts and the level of controversy surrounding the proposed action.

In addition to actions involving physical projects, many environmental impact assessment programs require assessments of proposed administrative policies.

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<sup>1</sup> The procedures described in this paragraph are for activities within the United States. The procedure used by USAID for activities outside of the United States relies more heavily upon lists of types of projects (see Appendix D) and inserts a fourth level of analysis, between Categorical Exclusions and Environmental Assessment -- Initial Environmental Review.

plans and programs. In these cases, the programmatic assessments address broad implications of the policies, plans and programs. Subsequent assessments for specific physical projects are tied to the programmatic assessments and are not required to re-address issues covered by those assessments.

**REQUIREMENTS FOR THE TIMING, PROCEDURE, AND CONTENT OF EIA.** In all programs, environmental impact assessment is required in the earliest stages of planning and decision-making. By incorporating environmental impact assessment into the earliest stages of decision making, it is less apt to become an after-the-fact justification for a decision.

To be effective, each agency must determine how to incorporate environmental impact assessment into its decision making process. But to ensure uniformity in assessment, all agencies must meet set procedural and content requirements. Procedural requirements usually specify the steps which must be followed in preparing environmental impact assessments and the institutions which should be involved. Most programs also specify the contents of an environmental impact assessment document. A general table of contents is shown in Table 9. The following subsection of this report provides further discussion on the typical procedures used to prepare environmental impact assessments.

**Table 9. Table of Contents for a Typical EIA**

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Summary of Assessment and Identification of Preferred Alternative

Purpose and Need For Proposed Action

Presentation of Alternative Actions

Description of the Environmental Setting

Environmental Impacts of Each Alternative

Mitigation Measures

Monitoring Plan

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**SPECIFICATION OF THE PROCEDURES FOR REVIEW, COMMENT, AND APPROVAL OF EIAs.** Because environmental impact assessment is done by many different public and private institutions, it is necessary to have clear procedures for review and approval. For assessments prepared by private institutions to comply with permit or licensing requirement, review and approval is usually housed in the government institution which issues the

permit or license. In these cases, approval is required for the contents of the assessment as well as the decision on the activity.

For assessments prepared by government institutions in the course of their own decision making, review and approval takes a different form. A central, environmental agency may have the authority to approve or disapprove the assessment of impacts and often the institution is required to solicit and respond to comments on its assessment from other government agencies and the public, but approval of the proposed activity remains with the institution which prepares the assessment.

**REQUIREMENTS FOR PUBLIC PARTICIPATION.** Public participation can identify critical environmental issues, provide the decision maker with information on political considerations and garner support for decisions. The public, or at least some pressure groups within the public, are interested in protecting the environment. Therefore, an environmental impact assessment program must define the role of the public in the assessment process.

In many EIA programs, including those in the United States and the European Community, public participation is considered to be critical. These programs require that the assessment process be open and transparent and that the public have opportunities for participation early and throughout the process.

Public participation can also be used as an enforcement mechanism for compliance with environmental impact assessment laws and regulations. In the United States, the public is given administrative and legal standing to challenge the quality of environmental impact assessment. Some have argued that this standing has only increased the costs and time needed for decision making. Others, however, point out that public appeal has improved the quality of assessment and insured much greater enforcement of environmental impact assessment laws and regulations than could have been expected if enforcement were left to environmental institutions within the government (In this case the U.S. Council on Environmental Quality and the U.S. Environmental Protection Agency).

**MONITORING REQUIREMENTS.** Monitoring is often the weakest component of environmental impact assessment programs. Although most programs require compliance monitoring, few programs require follow-up impact monitoring. Compliance monitoring generally includes requirements that the design and mitigation measures developed in the environmental impact assessment be incorporated into the contracts which implement the action. Contract monitoring, then, ensures compliance with the environmental impact assessment.

Impact monitoring involves monitoring the environmental impacts of the project, as identified in the EIA. Such monitoring can determine if design and mitigation measures are performing as predicted and provide for corrective measures if necessary. Impact monitoring can also provide valuable information for future EIAs for similar actions or mitigation measures.

## **2. Procedures and Content of EIAs**

In addition to being a decision making tool, environmental impact assessment is a technical document -- a systematic, reproducible, transparent, and interdisciplinary evaluation of the potential impacts of a proposed action and its practical alternatives on the physical, biological, cultural and socioeconomic conditions of the geographical area where the action will be implemented. An EIA is systematic in that it compares the impacts of the proposed action and alternatives within the same framework and using the same criteria. It is reproducible in that it is based on the best available science, and that the assumptions used in the analyses are clearly stated. It is transparent in that it is an open process allowing for participation from other institutions and the public. It is interdisciplinary because the scope of issues included in an environmental impact assessment is so broad that it is impossible for them to be assessed by one discipline.

Although specific requirements for environmental impact assessment vary from country to country, the technical procedure used to prepare an assessment can be generalized into nine steps:

- Identification of the purpose and need for the proposed action.
- Scoping, to identify the study area, critical issues, potential alternatives and technical needs.
- Creation of an interdisciplinary team to conduct the assessment.
- Identification of practical alternatives, including the no-action alternative.
- Description of the environmental setting within the study area.
- Assessment of the impacts of each alternative on the environmental setting.
- Identification of mitigation measures to reduce potential environmental impacts.
- Comparison of alternatives.
- Identification of preferred alternative (proposed action).

**PURPOSE AND NEED.** A clear statement of the purpose and need of a proposed project is needed to guide the development of alternatives and assessment of impacts. The statement must identify the end use purpose and

need, and not just describe a proposed action. For instance, a purpose and need of a project may be to increase the availability of irrigation water in the Jordan Valley, rather than to build a particular dam in a particular location. In this example, the former statement includes the latter as well as other potential sites and water conservation alternatives.

**SCOPING.** Scoping is a process (often a meeting) which occurs at the initiation of project planning to identify the study area, potential environmental issues, preliminary alternatives, related decisions and affected parties. During scoping time lines and responsibilities for completing an environmental impact assessment are also established. Scoping generally involves specialists from other departments or institutions with knowledge of the technical components of the proposed action or of the geographical area where the action will be implemented. Scoping often includes some public participation. Usually the results of scoping are summarized in a scoping report.

**INTERDISCIPLINARY TEAM.** Most environmental impact assessments are prepared by a team of experts. Some programs even require that assessments be prepared by interdisciplinary teams of experts. No one discipline can assess all of the potential environmental impacts of a proposed action. The types of disciplines necessary depends upon the specific action, but it is not uncommon to draw upon experts in engineering, ecology, chemistry, biology, watershed management, wildlife management, and hydrology. These experts may come from within the institution preparing the assessment or from other government institutions, universities or private consulting firms. Some programs allow for public participation through interest group representation on interdisciplinary teams.

**ALTERNATIVES.** Alternatives are often called the heart of environmental impact assessment. It is a mockery to call environmental impact assessment a decision making tool if it is only assessing the impacts of one alternative. For this reason, most programs require that several practical (reasonable, viable and feasible) alternatives be assessed including the no-action alternative. Each alternative should provide the decision maker with a different means of meeting the purpose and need of the activity (different location, design, etc.). The no-action alternative gives the decision-maker information on the consequences of not implementing any of the alternatives.

**ENVIRONMENTAL SETTING.** To assess the impacts of a proposed activity, the team must first establish the current environmental setting within the study area identified during scoping. The description of the environmental setting should be analytic rather than encyclopedic -- that is, it should only identify those components of the environment which are most likely to be significantly impacted by the proposed activity and provide only the information necessary to assess those impacts. The description of the environmental setting may include: geology, topography, soils, groundwater resources, surface water resources, terrestrial communities, aquatic communities, environmentally sensitive areas, air quality, land use, demography, sound levels, socioeconomic characteristics, existing infrastructure and cultural resources.

**ASSESSING ALTERNATIVES.** The impacts of each alternative on the environmental setting must be assessed in the same manner to allow comparison. The assessment should include primary, secondary and cumulative impacts.

**Primary --** effects that are caused by the action and that generally occur at the same time and place as the action.

**Secondary --** indirect or induced changes in the environment, population, economic growth and land use, and other environmental effects resulting from these changes occur later in time or at a different place.

**Cumulative --** primary and secondary impacts of individual action in combination with past actions and reasonably foreseeable future actions.

Many techniques are available for assessing the potential impacts of alternatives including habitat evaluation methods, ecological indices, mathematical modeling, simulation modeling, statistical analyses, graphical overlays, risk assessment, benefit/cost analysis, multi-objective analysis, delphi techniques and professional judgement. The techniques used will depend upon the type of activity as well as the importance of the activity and the size of the budget. No matter what techniques are used, they must be applied equally to all alternatives.

**MITIGATION MEASURES.** Mitigation measures are measures taken to avoid, minimize, rectify or reduce the environmental impacts of a proposed action, or to compensate those impacted. The measures may be identified during the development of alternatives or after the assessment of impacts. The measures may apply to one, some or all of the alternatives. Once mitigation measures are identified, the impacts of the affected alternatives must be reassessed.

**COMPARISON OF ALTERNATIVES.** Once the impacts of each alternative with its corresponding mitigation measures have been assessed, the alternatives must be compared. To do this, the impacts must be displayed in a manner which allows comparison. Although some assessments may lend themselves to risk assessment or benefit/cost techniques, the most common way of comparing the impacts of alternatives is in matrices with the alternatives on one axis and assessment issues (environmental, economic and social) on the other axis.

**SELECT PREFERRED ALTERNATIVE.** The experts who prepare the environmental impact assessment can recommend which alternative should be selected, but the ultimate decision rests with the decision maker. Most programs do not require that the decision maker choose the alternative with the least environmental impact (in many instances this would be the no-action

alternative); they do, however, require that the decision maker explain in writing his rationale for selecting the preferred alternative.

## **B. General Recommendations for the Agricultural Sector**

The Agricultural Policy Charter includes strategies which will be implemented by many different ministries, including the Ministry of Agriculture (MOA), the Ministry of Water and Irrigation (MWI) and the Ministry of Supply (MOS). The Ministry of Planning (MOP) and the Ministry of Municipal and Rural Affairs and the Environment (MMRAE) will also be involved in the implementation of the charter.

Although these ministries have some environmental management procedures in place<sup>2</sup>, none of them have environmental impact assessment programs. In order to fulfil the objective of the charter to manage and use agricultural production resources efficiently "while preserving the environment and ensuring the sustainability of agricultural production in the long-term," the three implementing ministries (MOA, MWI and MOS) must, in cooperation with MOP and MMRAE, develop environmental impact assessment programs.

Environmental protection is currently the responsibility of MMRAE. Under its current authorizing legislation, MMRAE cannot require environmental impact assessment. This could change, however, with passage of the environmental law now before the Parliament. The proposed law gives an environmental unit within MMRAE authority to establish principles and procedures for environmental impact assessment (Article 5). This authority may extend to the establishment of a national EIA program.

Whether the law is passed or not, the five ministries should cooperate in establishing an EIA program for the agricultural sector. The ministries should agree upon common guidelines for procedures and contents of EIAs. Each ministry should have its own procedures for implementing EIA within its decision making process, but the guidelines should be uniform for activities in the agricultural sector. Procedures also should be developed for cooperation between ministries in the development of assessments and for review and comment on assessments.

It is beyond the scope of this study to recommend specific procedures for incorporating environmental impact assessment into the decision making procedures of each of the ministries. This study can, however, recommend a proposed framework for environmental impact assessment and a process for developing assessment procedure.

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<sup>2</sup> Environmental management procedures are in place in MOA in regards to donor projects and the registration of pesticides; in MWI in regards to donor projects and environmental terms of reference for feasibility studies undertaken for Jordan Valley Authority projects; and in MMRAE in regards to industrial siting licenses.

At a minimum, environmental impact assessment in the agricultural sector should require that:

- Environmental impacts of major actions be identified and assessed early in the planning process, and be presented to the decision maker before a decision is made.
- Scoping meetings be held with representatives from affected Ministries at the earliest stages of planning, and that scoping identify the study area, potential environmental issues, preliminary alternatives, related decisions, affected parties, sources of information and opportunities for inter-departmental and inter-ministerial cooperation.
- Several reasonable alternatives be identified and assessed.
- The assessment of the impacts of each alternative be presented in a manner which informs and facilitates decision making.
- That the public be involved in developing and reviewing assessments.
- Other departments and ministries have an opportunity to review and comment on EIAs before decisions are made, and that their comments be made available to the decision maker.

To develop guidelines for an EIA program in the agriculture sector, the Agriculture Council, in conjunction with the Minister of Municipal and Rural Affairs and the Environment, should host two workshops for middle and upper level managers in MOA, MMRAE, MWI, MOS and MOP.

The first workshop should be an introductory workshop on the principles of environmental impact assessment. The purpose of this workshop should be to develop a shared understanding and definition of EIA.<sup>3</sup> This would be a one to three-day workshop with hands-on (case study based) training. USEPA, in conjunction with USAID, has developed a three-day workshop on the principles of EIA for use in developing countries, and has presented the workshop to officials in several countries. The workshop is designed to be taught by three facilitators, and USEPA has a program for training local facilitators. UNIDO may also be a source for such a workshop, through its environmental action planning training program.

The second workshop should occur shortly after the introductory workshop, possibly even within the same week. The purpose of the second workshop should be to apply the information gained from the introductory workshop to the Jordanian agriculture sector. The output would be procedural and contain

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<sup>3</sup> During the interviews conducted for this study it became evident that there is not a common understanding of environmental impact assessment within the Ministry of Agriculture or among ministries.

guidelines for EIAs in the agricultural sector. This workshop should be attended by the same individuals who participated in the introductory workshop. The workshop should be a one to two-day facilitated working session which would actually produce draft guidelines. The Agriculture Council should be responsible for finalizing the guidelines, in consultation with the participants and their ministries.

After these workshops, each ministry should incorporate the guidelines into its own decision making process.

### **C. Specific Recommendations for the Ministry of Agriculture**

It is within the scope of this study to recommend specific mechanisms for incorporating EIA into the decision making process of the Ministry of Agriculture. As with the process recommended for sectoral guidelines, it is necessary for MOA to first develop a common understanding and definition of EIA. To do this, the ministry should host an introductory workshop for mid-level managers and key professional staff. The workshop should be the same as the inter-ministerial introductory workshop, but should conclude with a presentation of the guidelines developed by the second inter-ministerial workshop. The workshop could be facilitated by Jordanian facilitators trained at the inter-ministerial workshop, under the guidance of one of the expatriate facilitators from that workshop.

Once a common understanding of EIA is developed, and procedural and content guidelines are established, the Ministry should incorporate those procedures into its decision making process. Ideally, the mechanisms for accomplishing this should be developed by ministry managers. To facilitate this, the following is recommended.

- Require Departments to conduct EIAs for major actions (at a minimum for donor financed programs and projects and those projects and project components tracked by the Department of Projects and the Monitoring and Evaluation Division in AEPD).
- Require Departments to include resources for EIA in annual plans and project proposals.
- Establish an Environmental Officer in the Monitoring and Evaluation Division with responsibility to review annual plans and project proposals for compliance with EIA requirements. Specific tasks of this officer should include:
  - The Environmental Officer should report the results of his reviews directly to the Secretary General and the Minister.
  - The Environmental Officer should have a consultative relationship with DOE in MMRAE and

the environmental unit in MOP.

- The environmental officer should also be a source of information on capabilities of other government agencies and private institutions to assist in EIA.

### **1. Incorporating EIA Into an Institutional Change Program**

In December 1993, the World Bank conducted a mission on the institutional needs of the Ministry of Agriculture for implementation of ASAL. The mission concluded that the Ministry did not have well defined procedures for policy formulation, planning, or decision-making. The mission recommended that a facilitated, participatory, institutional change program be undertaken by the ministry.

The management component of the implementation program for the Agricultural Policy Charter is assessing the need for this type of institutional change program. If MOA pursues the recommendations of the World Bank or a modified version of the recommendation, it should include in the process the development of institutional procedures for institutionalizing EIA. As a base, it could start with the specific recommendations made above and solicit input on how to improve it.

### **2. Environmental Impact Monitoring**

As mentioned previously, both compliance monitoring and impact monitoring are critical components of an EIA program. To implement its EIA program, MOA will need to develop an environmental impact monitoring program. This monitoring program should have both compliance and an impact component.

The purpose of compliance monitoring is to ensure that mitigation measures developed in EIAs are actually being implemented. Each department within MOA should be responsible for conducting compliance monitoring on its projects. Compliance monitoring on each project should be integral to other project monitoring, such as construction and financial monitoring. The environmental officer, should conduct periodic oversight of compliance monitoring activities.

The purpose of impact monitoring is to determine if mitigation measures are performing as predicted and to provide information for the design of mitigation measures in future EIAs. Because the information generated from impact monitoring will be of use to the ministry as a whole, it should be conducted under the guidance of the environmental officer.

To be able to conduct impact monitoring, targets must be set against which ongoing implementation may be compared. It is beyond the scope of this study to develop detailed targets for an impact monitoring scheme for the MOA.

However, the study identifies the major characteristics of a monitoring scheme that can be implemented by the environmental officer at the MOA. The impact monitoring program should:

- Be operated by specialists.
- Have a clear work plan and a clear definition of data sources.
- Be analytical and systematic so that the results can guide decisions.
- Be able to capture intended and unintended impacts.
- Collect data to respond to problems.
- Use simple formats to ensure that field information is easy to collect, and code.
- Establish a data bank on past impact monitoring activities.

### **3. Human Resource Development Needs for EIA**

It is beyond the scope of this study to perform a needs analysis for the human resource component at the MOA, which may include limited facilities and resources for education and training of professional and technical personnel. However, two types of training schemes are envisaged, one for general training and one for technical training. General training needs would involve training in the concepts and procedures involved in EIAs. For more information on this, see institutional recommendations for 3-day workshop on principles of environmental impact assessment.

With respect to technical training needs, the MOA will need to demonstrate a commitment to environmental training and natural resource policy making before a full scale human resource development program is initiated. Technical needs will arise as MOA implements its EIA program, MOA will have to determine to what extent these needs should be met by training.

#### **D. Relevant Guidelines for EIA in the Agricultural Sector**

Several publications exist which can provide guidelines for the development and implementation of environmental impact assessment programs. The following publications provide guidance on general program content:

The World Bank. 1991. *Environmental Assessment Sourcebook, Volume I, Policies, Procedures, and Cross-Sectoral Issues*. World Bank Technical Paper Number 139, Washington, DC. 227 p.

USEPA. 1992. *Principles of Environmental Assessment*. Environmental Services Division, USEPA, Pennsylvania.

The World Bank and GTZ have produced specific guidelines for assessing environmental from proposed agricultural projects:

The World Bank. 1991. Environmental Assessment Sourcebook. Volume II, Sectoral Guidelines. World Bank Technical Paper 140, Washington, DC. 282 p.

GTZ. 1994. Draft Handbook for Environmental Impact Assessment for the Agricultural Sector. 153 p.

These guidelines can serve as a starting place for the preparation of EIAs for agricultural projects in Jordan. As MOA implements an assessment program, it will soon determine the applicability of these guidelines and make necessary modifications.

## VI. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The conclusions for each of the three substantive sections of this report are compiled below. Where relevant, recommendations are included at the end of each subsection.

### A. Environmental Priorities and the Agricultural Policy Charter

Sixteen environmental issues are associated with agriculture in Jordan:

soil salinization	product quality
soil degradation	cultural degradation
soil erosion	loss of agricultural land
surface water salinization	habitat degradation
surface water degradation	wetland destruction
groundwater depletion	desertification
groundwater salinization	deforestation
groundwater degradation	degradation of plant cover

The relative significance of these environmental issues varies with subsectors. A multi-objective analysis methodology was applied to rank the relevant environmental issues for each agricultural subsector and for the agricultural sector as a whole. The analysis used four criteria: human and animal health, irreversibility of processes related to the issues, rate of degradation, and extent of area where impact of the issues is detected. Different weights were given to each of these criteria based on the consensus of the team members and drawing upon interview responses with department officials. The results are shown in Table 10.

Multi-objective analysis was also employed to rank the issues for the agricultural sector as a whole. The analyses suggested that soil and ground water degradation, desertification, and soil erosion were among the issues to be considered of highest priority.

The environmental impacts of each of the relevant policy actions were identified for each agricultural subsector. Such impacts are given in Tables 5 through 9 in the text of this report. The actions proposed within the Agricultural Policy Charter were found to be, in general, environmentally beneficial.

The identification of environmental impacts revealed that no policy actions are proposed to correct some high priority environmental issues, such as soil salinization in the irrigated sector. Other high priority issues are inadequately addressed such as desertification in the low rainfall zone. These issues play a significant role in agricultural sustainability. It is highly recommended that specific actions be added to the policy charter to address these issues.

**Table 10. Priorities of Environmental Issues in Each Subsector**

Sub-Sector	PRIORITY		
	HIGH	MEDIUM	LOW
<b>1</b>	Groundwater Degradation Soil Degradation Groundwater Salinization Surface water Degradation Groundwater Depletion	Soil Salinization Quality of Product Surface water Salinization Desertification Habitat Destruction	Soil Erosion Loss of Agricultural Land Plant Cover Destruction Wetland Destruction Deforestation Cultural Degradation
<b>2</b>	Soil Erosion Desertification Loss of Agricultural Land Soil Degradation Habitat Destruction	Groundwater Degradation Quality of Product Groundwater Salinization Surface water Degradation	Plant Cover Destruction Surface water Salinization Deforestation Cultural Degradation
<b>3</b>	Soil Degradation Groundwater Degradation Desertification Soil Erosion Plant Cover Destruction	Groundwater Salinization Groundwater Depletion Loss of Agricultural Land Habitat Destruction	Deforestation Quality of Product Cultural Degradation Wetland Destruction
<b>4</b>	Groundwater Degradation Soil Erosion Soil Degradation Desertification Plant Cover Destruction Quality of Product	Groundwater Depletion Loss of Agricultural Land Surface water Degradation	Groundwater Salinization Deforestation Surface water Salinization Cultural Degradation
<b>5</b>	Soil Erosion Deforestation Desertification Habitat Destruction	Groundwater Depletion Soil Degradation Loss of Agricultural Land Plant Cover Destruction	Groundwater Degradation Groundwater Salinization

1-Irrigated Agriculture; 2- Rainfed Subsector; 3- Low Rainfall (Badia) Zone;  
4- Livestock Subsector; 5- Forestry Subsector

### **B. Institutional Capabilities**

Jordan has no law requiring EIA, and therefore, no institutions have EIA programs or comprehensive experience in producing EIAs. The only EIAs which have been prepared for projects in Jordan were those required by international donors. Often these EIAs have been prepared by expatriate consultants in cooperation with Jordanians working in the private sector.

Several private and public institutions, however, have capabilities to assess some environmental conditions or have some experience in environmental management or impact assessment. These capabilities could be drawn upon to prepare EIAs as required. The institutions with some capabilities in EIA include:

Ministry of Agriculture  
Environmental Health Section, Ministry of Health

Department of Environment in MMRAE  
Ministry of Water and Irrigation  
Royal Scientific Society  
Jordan Environment Society  
Royal Society for the Conservation of Nature  
University of Jordan  
Yarmouk University  
Jordan University of Science & Technology  
Consulting firms in the private sector.

Based upon the survey of organization and capabilities, a number of recommendations follow.

#### *Institutional Setting*

A wide range of environmental issues are to be dealt with in order to sustain agricultural production in Jordan. These issues cover a wide array of environmental processes which have variable impacts on agricultural resources. It is difficult to perceive that one institution could provide all the specialists to cover such a wide array of issues. Some combination of the above institutions could complement each other since they carry different responsibilities and could conceivably form a national framework to deal with environmental issues. The Agriculture Council, responsible for the implementation of the Policy Charter, could have the responsibility for setting program requirements, standards, monitoring requirements, and compliance within such a national framework.

#### *Training*

Agricultural sustainability will depend upon implementing environmental protection measures for the future. This cannot be achieved without the availability of well trained human resources. The type and level of training should be determined on the basis of responsibility of each department.

#### *Data Support*

Adequate EIAs are possible if appropriate quantitative data are available on projects and programs in the agricultural sector. It is highly recommended that relevant environmental data be compiled through the use of modern equipment and qualified staff to provide necessary information upon request. Such a database would be important in initializing EIA's early in project designs (with data being immediately available), and in monitoring compliance with mitigation measures at later stages (with data analysis that could provide environmental monitoring targets).

### **C. Institutionalization of Environmental Impact Assessment**

In the absence of a national environmental impact assessment program, the three ministries which will implement the agricultural policy charter (MOA, MWI and MOS) must, in cooperation with MOP and MMRAE, develop an EIA program for the agricultural sector.

The overall recommendations for the Agricultural Sector are that (i) a common understanding of EIA be developed; (ii) EIA guidelines and procedures be prepared; and (iii) EIA procedures incorporated into the decision making process of each ministry. These recommendations are outlined below.

#### *Develop A Common Understanding of EIA*

At a minimum, EIAs in the agricultural sector should require that:

- Environmental impacts of major actions be identified and assessed early in the planning process.
- Scoping meetings be held with representatives from affected Ministries at the earliest stages of planning.
- Several reasonable alternatives be identified and assessed, and presented in a manner which informs and facilitates decisions.
- The public be involved in developing and reviewing EIAs.
- Other departments and ministries have an opportunity to review and comment on EIAs before decisions are made.

#### *Develop Guidelines for EIA in Jordan*

To develop guidelines for an EIA program in the agriculture sector, the Agriculture Council, in conjunction with the Minister of Municipal and Rural Affairs and the Environment, should host two workshops for middle and upper level managers in MOA, MMRAE, MWI, MOS and MOP.

The first workshop should be an introductory workshop on the principles of environmental impact assessment. The purpose of this workshop should be to develop a shared understanding and definition of EIA. The second workshop should occur shortly after the introductory workshop, possibly even within the same week. The purpose of the second workshop should be to use the information gained from the introductory workshop to develop guidelines for EIAs in the Jordanian agriculture sector. The Agriculture Council should be responsible for finalizing the guidelines, in consultation with the participants and their ministries. Each ministry should be responsible for incorporating these guidelines into its decision making process.

### *Incorporate EIA Into Decision Making Process in MOA*

Once a common understanding of EIA is developed, and procedural and content guidelines are established, MOA should incorporate those procedures into its decision making process. Ideally, the mechanisms for accomplishing this should be developed by ministry managers. To facilitate this, the following is recommended.

- **Require Departments to conduct EIAs for major actions**
- **Require Departments to include resources for EIA in annual plans and project proposals.**
- **Establish an Environmental Officer in the Monitoring and Evaluation Division with responsibility to review annual plans and project proposals for compliance with EIA requirements. Specific linkages of this officer with other departments include:**
  - **The Environmental Officer should report the results of his reviews directly to the Secretary General and the Minister.**
  - **The Environmental Officer should have a consultative relationship with DOE in MMRAE and the environmental unit in MOP.**
  - **The environmental officer should also be source of information on capabilities of other government agencies and private institutions to assist in EIA.**



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**APPENDIX B**  
**LIST OF CONTACTS**

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81

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## APPENDIX C

### RESULTS OF THE MULTI-OBJECTIVE ANALYSIS FOR ENVIRONMENTAL ISSUES

Multi-objective analysis was conducted for each subsector to identify the relevant environmental issues and to establish the relative priority of the issues within the subsector. Four criteria were used in the analysis: Health Effects, Irreversibility, Rate of Degradation, and Geographic Extent. Each issue was scored for each of these criteria within the context of each subsector. A composite score for each issue was generated using a weighted average of the four individual scores. The weighting reflected the relative importance of each criteria to the overall environmental health of Jordan.

#### Description of the Criteria and Scoring Methodology

The scores for the health effect criterion reflect the extent to which the environmental issue increases risks to human or animal health, with higher scores for those issues posing greater health risks.

The scores for the irreversibility criterion measure the extent to which the impacts are irreversible or difficult to correct. Those environmental issues for which the impacts are irreversible received the highest scores for this criterion, and those issues for which the impacts are more difficult to reverse received higher scores than those which can be corrected more easily.

The rate of degradation criterion measures the historic rate of deterioration for each environmental issues. Those issues which have experienced more rapid rates of deterioration received higher scores than those which have been deteriorating at a slower rate.

The final criterion is geographic extent, a measure of the geographic extent of the impacts for an environmental issue. The larger the geographic extent of an environmental issue, the larger the score for that issue.

Through a process of interactive group techniques, the authors were able to reach a consensus on the relative weights for each of the criteria. The relative weights were as follows:

Adverse Health Effect	0.30
Irreversibility	0.25
Rate of Degradation	0.25
Geographic Extent	0.20

**Evaluation Matrices**

Table C1.a. SCORES OF EACH ENVIRONMENTAL ISSUE IN THE IRRIGATED SUBSECTOR

Environmental Issue	CRITERIA			
	Health 30%	Rate of Degradation 25%	Irreversibility 25%	Geographic Extent 20%
Soil Salinization	5.00	12.00	15.00	15.00
Soil Degradation	17.00	13.00	14.00	15.00
Soil Erosion	4.00	2.00	2.00	5.00
SW Salinization	7.00	12.00	10.00	10.00
SW Degradation	20.00	18.00	10.00	12.00
GW Depletion	15.00	15.00	22.00	16.00
GW Salinization	20.00	15.00	22.00	15.00
GW Degradation	22.00	20.00	22.00	18.00
Cultural Degradation	1.00	2.00	2.00	1.00
Loss of Agricultural Land	2.00	2.00	5.00	2.00
Habitat Degradation	2.00	5.00	8.00	2.00
Wetland Destruction	1.00	2.00	8.00	1.00
Desertification	5.00	10.00	10.00	12.00
Deforestation	2.00	1.00	3.00	1.00
Quality of Product	5.00	15.00	13.00	10.00
Plant Cover Destruction	3.00	2.00	2.00	2.00

Table C1.b. RELATIVE RANKING OF ENVIRONMENTAL ISSUES IN THE IRRIGATED SUBSECTOR

- HIGH PRIORITY**
  - Groundwater Degradation
  - Groundwater Salinization
  - Soil Degradation
  - Surface Water Degradation
  - Groundwater Depletion
  
- MEDIUM PRIORITY**
  - Soil Salinization
  - Quality of Products
  - Surface Water Salinization
  - Desertification
  - Habitat Degradation
  
- LOW PRIORITY**
  - Soil Erosion
  - Loss of Agricultural Land
  - Plant Cover Destruction
  - Wetland Destruction
  - Deforestation
  - Cultural Degradation

84

Table C2.a. SCORES OF EACH ENVIRONMENTAL ISSUE IN THE RAINFED SUBSECTOR

Environmental Issue	CRITERIA			
	Health 30%	Rate of Degradation 25%	Irreversibility 25%	Geographic Extent 20%
Soil Degradation	3.00	12.00	15.00	12.00
Soil Erosion	7.00	15.00	17.00	15.00
Surface Water Salinization	1.00	1.00	3.00	2.00
Surface Water Degradation	3.0	2.00	4.00	4.00
Groundwater Depletion	2.00	2.00	20.00	3.00
Groundwater Degradation	3.00	2.00	20.00	4.00
Cultural Degradation	1.00	1.00	3.00	1.00
Loss of Agricultural Land	2.00	15.00	23.00	16.00
Habitat Degradation	5.00	5.00	20.00	5.00
Desertification	5.00	13.00	18.00	19.00
Deforestation	1.00	2.00	5.00	1.00
Quality of Product	5.00	5.00	2.00	5.00
Plant Cover Destruction	2.00	5.00	5.00	5.00

Table C2.b. RELATIVE RANKING OF ENVIRONMENTAL ISSUES IN THE RAINFED SUBSECTOR

**HIGH PRIORITY**  
 Soil Erosion  
 Desertification  
 Loss of Agricultural Land  
 Habitat Degradation  
 Soil Degradation

**MEDIUM PRIORITY**  
 Groundwater Degradation  
 Quality of Product  
 Surface Water Degradation  
 Groundwater Salinization

**LOW PRIORITY**  
 Plant Cover Destruction  
 Deforestation  
 Surface Water Salinization  
 Cultural Degradation

65

Table C3.a. SCORES OF EACH ENVIRONMENTAL ISSUE IN THE LIVESTOCK SUBSECTOR

Environmental Issue	CRITERIA			
	Health 30%	Rate of Degradation 25%	Irreversibility 25%	Geographic Extent 20%
Soil Degradation	8.00	3.00	5.00	6.00
Soil Erosion	3.00	3.00	20.00	15.00
Surface Water Salinization	2.00	3.00	5.00	3.00
Surface Water Degradation	5.00	3.00	7.00	4.00
Groundwater Depletion	5.00	3.00	20.00	1.00
Groundwater Salinization	5.00	1.00	18.00	3.00
Groundwater Degradation	7.00	2.00	22.00	4.00
Cultural Degradation	2.00	1.00	0.00	1.00
Loss of Agricultural Land	2.00	2.00	20.00	17.00
Desertification	5.00	5.00	22.00	18.00
Deforestation	2.00	3.00	5.00	2.00
Quality of Product	18.00	2.00	8.00	5.00
Plant Cover Destruction	18.00	16.00	20.00	18.00

Table C3.b. COMPLETE RANKING OF ENVIRONMENTAL ISSUES IN THE LIVESTOCK SUBSECTOR

**HIGH PRIORITY**

- Plant Cover Destruction
- Desertification
- Groundwater Degradation
- Soil Erosion
- Soil Degradation
- Quality of Product

**MEDIUM PRIORITY**

- Groundwater Depletion
- Surface Water Degradation
- Loss of Agricultural Land

**LOW PRIORITY**

- Groundwater Salinization
- Surface Water Salinization
- Deforestation
- Cultural Degradation

86

Table C4.a. SCORES OF EACH ENVIRONMENTAL ISSUE IN THE LOW RAINFALL SUBSECTOR

Environmental Issue	CRITERIA			
	Health 30%	Rate of Degradation 25%	Irreversibility 25%	Geographic Extent 20%
Soil Degradation	1.00	20.00	20.00	18.00
Soil Erosion	3.00	20.00	2.00	18.00
GW Depletion	7.00	8.00	15.00	10.00
GW Salinization	7.00	10.00	18.00	10.00
GW Degradation	10.00	12.00	20.00	12.00
Cultural Degradation	2.00	1.00	2.00	3.00
Loss Agricultural Land	0.00	10.00	22.00	10.00
Habitat Degradation	8.00	4.00	15.00	13.00
Wetland Destruction	0.00	2.00	10.00	2.00
Desertification	7.00	15.00	22.00	15.00
Deforestation	0.00	8.00	15.00	10.00
Quality of Product	1.00	2.00	3.00	3.00
Plant Cover Destruction	4.00	15.00	20.00	19.00

Table C4.b. COMPLETE RANKING OF ENVIRONMENTAL ISSUES IN THE LOW RAINFALL SUBSECTOR

**HIGH PRIORITY**

- Desertification
- Soil Erosion
- Groundwater Degradation
- Plant Cover Destruction
- Soil Degradation

**MEDIUM PRIORITY**

- Groundwater Salinization
- Habitat Degradation
- Groundwater Depletion
- Loss of Agricultural Land

**LOW PRIORITY**

- Deforestation
- Quality of Products
- Cultural Degradation
- Wetland Destruction

Table C5.a. SCORES OF EACH ENVIRONMENTAL ISSUE IN THE FORESTRY SUBSECTOR

Environmental Issue	CRITERIA			
	Health 30%	Rate of Degradation 25%	Irreversibility 25%	Geographic Extent 20%
Soil Degradation	2.00	4.00	10.00	5.00
Soil Erosion	5.00	12.00	15.00	8.00
Groundwater Depletion	1.00	2.00	20.00	1.00
Groundwater Salinization	0.00	0.00	15.00	1.00
Groundwater Degradation	0.00	0.00	17.00	0.00
Loss of Agricultural Land	0.00	0.00	20.00	0.00
Habitat Degradation	7.00	4.00	15.00	3.00
Desertification	5.00	5.00	10.00	5.00
Deforestation	4.00	8.00	10.00	7.00
Plant Cover Destruction	7.00	5.00	7.00	3.00

Table C5.b. COMPLETE RANKING OF ENVIRONMENTAL ISSUES IN THE FORESTRY SUBSECTOR

**HIGH PRIORITY**

- Soil Erosion
- Habitat Degradation
- Deforestation
- Desertification

**MEDIUM PRIORITY**

- Plant Cover Destruction
- Groundwater Depletion
- Soil Degradation
- Loss of Agricultural Land

**LOW PRIORITY**

- Groundwater Degradation
- Groundwater Salinization

**APPENDIX D**

**EXAMPLES OF LISTS USED TO DETERMINE  
THE APPROPRIATE LEVEL OF EIA**

U.S. Code of Federal Regulations. 1980. International Development Cooperation Agency, Agency for International Development (USAID), Environmental Procedures. 22 CFR Part 216.

216.2 (d) Classes of Actions Normally Having a Significant Effect on the Environment.

Programs of river basin development

Irrigation or water management projects, including dams and impoundments

Agricultural land leveling

Drainage projects

Large scale agricultural mechanization

New lands development

Resettlement projects

Penetration road building or road improvement projects

Power plants

Industrial plants

Potable water and sewerage projects other than those that are small-scale.

**APPENDIX E**

**The World Bank Operational Directive 4.00--Annex A3  
(October 1989)**

THE WORLD BANK OPERATIONAL MANUAL

## Operational Directive

October 1989  
OD 4.00--Annex A3  
Page 1 of 2

## Environmental Screening

## Introduction

1. The task manager, in consultation with the Regional environment division, is responsible for screening a proposed project to determine the appropriate type of environmental analysis, based on the nature, potential magnitude, and sensitivity of the issues. The categories below, based upon prior Bank staff experience, are strictly illustrative. Alternatives to EA are acceptable where they are expected to result in an environmentally sound project.

2. *Category A: Projects/Components Which May Have Diverse and Significant Environmental Impacts—Normally Require EA<sup>1</sup>*

- (i) Aquaculture/Mariculture (large scale);
- (ii) Dams and Reservoirs;<sup>2</sup>
- (iii) Electrical Transmission (large scale);
- (iv) Forestry;
- (v) Industrial Plants (large scale) and Industrial Estates;
- (vi) Irrigation and Drainage (large scale);
- (vii) Land Clearance and Leveling;
- (viii) Mineral Development (including oil and gas);
- (ix) Pipelines (oil, gas, and water);

(x) Port and Harbor Development;

(xi) Reclamation and New Land Development;

(xii) Resettlement;<sup>3</sup>

(xiii) River Basin Development;

(xiv) Rural Roads;

(xv) Thermal and Hydropower Development;

(xvi) Tourism (large scale);

(xvii) Transportation (airports, railways, roads, waterways);

(xviii) Urban Development (large scale);

(xix) Urban Water Supply and Sanitation (large scale);

(xx) Manufacture, Transportation, and Use of Pesticides or other Hazardous and/or Toxic Materials;<sup>4</sup> and

(xxi) Projects which Pose Serious Accident Risks.<sup>5</sup>

3. *Category B: Projects/Components which may Have Specific Environmental Impacts—More Limited Environmental Analysis Appropriate*

Projects in this category normally require more limited environmental analysis than an EA.

1. Except generally for projects directed to rehabilitation, improved operation and maintenance, and limited upgrading of facilities

2. See OD 4.00, Annex B, *Environmental Policy for Dam and Reservoir Projects*.

3. While OMS 2.33, *Social Issues Associated with Involuntary Resettlement in Bank-Financed Projects* (to be reissued as OD 4.30, *Involuntary Resettlement*), covers the social aspects of resettlement, the environmental implications of the resettlement itself can be major.

4. In some cases, adherence to existing directives is an acceptable alternative to an EA (e.g., OPN 11.01, *Guidelines for the Selection and Use of Pesticides in Bank-Financed Projects and Their Procurement when Financed by the Bank*, to be reissued as OD 4.00 Annex C, *Agricultural Pest Management, and Selection and Use of Pesticides*). Certain materials (e.g. PCBs) are not to be used in Bank projects and other materials (e.g. asbestos) are to be used only under extremely restricted conditions. A Restricted Toxic Materials List (RTMIL) will be available from ENV and updated periodically.

5. See *Techniques of Assessing Industrial Hazard—A Manual*, World Bank Technical Paper No. 55.

al

October 1989  
 OD 4.00--Annex A3  
 Page 2 of 2

THE WORLD BANK OPERATIONAL MANUAL

## Operational Directive

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A wide range of environmental guidelines, developed by a number of organizations, are applicable. In addition, specific environmental pollution standards or design criteria can be developed for individual projects.

- (i) Agroindustries (small scale);
- (ii) Aquaculture and Mariculture (small scale);
- (iii) Electrical Transmission (small scale);
- (iv) Industries (small scale);
- (v) Irrigation and Drainage (small scale);
- (vi) Mini Hydro-Power;
- (vii) Public Facilities (hospitals, housing, schools, etc.);
- (viii) Renewable Energy;
- (ix) Rural Electrification;
- (x) Telecommunications;
- (xi) Tourism (small scale);
- (xii) Urban Development (small scale); and
- (xiii) Rural Water Supply and Sanitation.

#### 4. *Category C: Projects/Components which Normally Do Not Result in Significant Environmental Impact—Environmental Analysis Normally Unnecessary*

Opportunities to enhance environmental benefits should be sought in these projects.

- (i) Education (except school construction);
- (ii) Family Planning;
- (iii) Health (except hospital construction);
- (iv) Nutrition;
- (v) Institutional Development; and
- (vi) Technical Assistance.

#### 5. *Category D: Environmental Projects*

Projects with a major environmental focus may not require a separate EA, as environment would be a major part of the project preparation.

#### 6. *Emergency Recovery Projects*

Because emergency recovery projects (a) need to be processed rapidly, and (b) seek mainly to restore existing facilities, they normally would not require a full EA. However, the extent to which the emergency was precipitated and/or exacerbated by inappropriate environmental practices should be determined, and corrective measures built into either the emergency project or a future lending operation.<sup>6</sup>

INSTITUTIONAL DEVELOPMENT SUPPORT FOR AGRICULTURAL  
POLICY IMPLEMENTATION, PLANNING, AND EVALUATION

COMPANION STUDY

*on*

QUANTITATIVE POLICY ANALYSIS METHODS  
FOR IMPLEMENTATION OF THE  
AGRICULTURAL POLICY CHARTER

*Final Report*

*by*

Dr. Mahmoud Ali-Salem  
Dr. Michael S. Hanrahan  
Dr. Abdul-Hamid Musa

*March 20, 1995*

93

# INSTITUTIONAL DEVELOPMENT SUPPORT FOR AGRICULTURAL POLICY IMPLEMENTATION, PLANNING, AND EVALUATION

## TABLE OF CONTENTS

- I. BACKGROUND AND ASSESSMENT OF EXISTING SITUATION IN  
QUANTITATIVE AGRICULTURAL POLICY ANALYSIS
  - A. Assessment of Existing Quantitative Agricultural Policy Analysis Activities and  
Capabilities
    - 1. Assessment of Needs and Deficiencies
    - 2. Assessment of Data Needed and Available for Quantitative Agricultural  
Policy Analysis
  
- II. POST REFORM TASKS OF GOVERNMENT AND QUANTITATIVE POLICY  
ANALYSIS
  - A. At Sectoral Level
    - 1. Water
    - 2. Markets, Trade, Prices, and Subsidies
    - 3. Natural Resources and the Environment
  
  - B. At Sub-Sectoral Level
    - 1. Irrigated Agriculture
      - a. Analytical Questions and Indicated Quantitative Methods for  
Irrigated Agriculture.
    - 2. Rainfed Agriculture
      - a. Analytical Questions and Indicated Quantitative Methods for Rainfed  
Agriculture.
    - 3. Low Rainfall Zones (*Badia*)
      - a. Analytical Questions and Indicated Quantitative Methods for Low  
Rainfall Zones (*Badia*)
    - 4. Livestock and Livestock Products
      - a. Analytical Questions and Indicated Quantitative Methods for  
Livestock and Livestock Products
    - 5. Forestry
      - a. Analytical Questions and Indicated Quantitative Methods for  
Forestry

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### III. PRIORITIES FOR QUANTITATIVE POLICY ANALYSIS

- A. The Decision Criteria: What Makes a Policy or Issue Important to Analyze?
- B. The Priority Areas Where the Application of More Refined Quantitative Analysis Methods Would Be Useful and Advisable
  - 1. Water Allocation in General
  - 2. Output Procurement - Price Floors -- Wheat, Barley, Lentils, Chick Peas, Tomatoes
  - 3. Feed Subsidy
  - 4. Non-Price Trade Barriers
  - 5. Market Price Ceilings -- Flour, Fresh Fruits, Vegetables, Milk

### IV. TRAINING

- A. Key Training Aspects
  - 1. Audience
  - 2. Nature and Kind of Training Courses
  - 3. Trainee Needs and Sample Syllabuses
  - 4. Who Can Conduct the Training and Where Might It Take Place?
  - 5. An Idea About Costs
- B. Training Plan Outline

### APPENDIX I. SAMPLE SYLLABUSES FOR TRAINING COURSES

## **I. BACKGROUND AND ASSESSMENT OF EXISTING SITUATION IN QUANTITATIVE AGRICULTURAL POLICY ANALYSIS**

Implementation of the Agricultural Policy Charter will cause many changes in the tasks and functions of the Government of Jordan. These changes will occur across sectors and within agricultural sub-sectors. Even after reforms, Government will still play a large role in the agricultural sector. The determination of agricultural policy should be informed by analysis. The need for analysis may be even greater after reforms than at present.

This companion study seeks to anticipate some of the main tasks and functions of Government after reforms occur, to anticipate the questions and needs for quantitative policy analysis that those tasks imply, to prioritize the needs, and to identify a corresponding range of quantitative methods useful and specific to the coming analytical needs. It also seeks to establish present Government analytical capabilities, and to set forth a training plan, as a part of the overall policy implementation planning frame, to upgrade Government capabilities in quantitative policy analysis.

In this companion study, the agricultural sector includes at least the Ministries of Agriculture, Planning, Supply, and Water; the para-statal corporations and organizations AMPCO, the Agricultural Credit Corporation, the Agricultural Marketing Organization, the National Center for Agricultural Research and Technology Transfer, the Water Authority of Jordan, the Jordan Valley Authority, and other water organizations; and the agriculturally related Jordanian Universities, especially the University of Jordan.

### **A. Assessment of Existing Quantitative Agricultural Policy Analysis Activities and Capabilities**

During the preparation of this companion study, the quantitative agricultural policy analysis methods team visited all of the following institutions: Ministry of Agriculture (MOA) - Department of Agricultural Economics and Policy Analysis -- Divisions of Policy, Data Bank, and Statistics; MOA - Department of Animal Production; MOA - Department of Forestry and Afforestation; Ministry of Supply - Department of Studies; Ministry of Planning - Department of Statistics; Ministry of Water and Irrigation - Water Authority of Jordan -- Strategic Planning Group; Ministry of Water and Irrigation - Jordan Valley Authority -- Department of Studies; Agricultural Credit Corporation - Department of Studies; Agricultural Marketing Organization - Department of Studies and Statistics.

Concerning staff capabilities to undertake and interpret quantitative agricultural policy analysis, the authors found good to high staff quality in the planning, policy, studies, and analytic departments we visited. Most professional staff had Bachelor's, Master's, or Doctor's degrees, while a few had post-secondary school diplomas. These staff are aware of

numeric analysis and capable of applying at least basic descriptive statistical tools. Most had learned the tools during the course of their degree or diploma studies. The training and capabilities of MOA staff have been described in the management assessment portions of the planning frame.

We found the following quantitative methods in use: Elementary statistics but not statistical analysis beyond the calculation of means. In particular, there is little applied analysis that uses variance or interval estimation, little or no goodness of fit measurement; and little or no hypothesis testing. We found budgeting with financial and economic (or social) prices and discounted cash-flow methods used in just three departments. We found an application of the Policy Analysis Matrix (PAM) method in one department. We found one department using an elementary, univariate forecasting equation. In general, none of these methods is widely applied: Quantitative methods are little used. Their analytic power is not appreciated in practical applications tied to daily duties.

An exception is found at the University of Jordan, where quantitative methods are extensively applied to agricultural policy analysis and to other kinds of studies. Both the Faculty of Agriculture and the Center for Consultation, Technical Services, and Studies apply a full range of methods. These include basic descriptive statistics; budgeting at financial and economic prices for gross margin, discounted cash-flow, and PAM applications; multivariate single equation econometrics; mathematical programming, especially linear programming; and simulation models of several types. Multivariate, multiple equation econometrics that involves the endogenous estimation of testable parameters was not found.

We found the Ministry of Water engaged on several sophisticated water modeling studies. These did not appear to include economic or social elements. We found one private consulting company working with an international donor on an advanced engineering, economic, and geo-hydrological water allocation model. We found a number of Jordanians who had prepared theses for advanced degrees outside of Jordan and analyzed issues of Charter interest.

#### 1. Assessment of Needs and Deficiencies

The conduct of Government benefits greatly from analysis, as is evidenced by the many kinds of information requested of studies and planning departments by decision makers. These requests include, for example, commodity forecasts and situation and outlook reports; water pricing; orientation on trade policy; impact of subsidy on the Treasury; land valuation for swap and exchange programs and urban expansion; water forecasting; impacts of subsidy, tax, and license policies; and like requests (see Tables One to Three). At the present time, response tends to be reactive: Studies and planning units do not systematically anticipate the kinds of requests that they will receive. Their personnel resources are not managed to be ready with responses informed by appropriate analytics.

If quantitative tools may have been learned, they are not systematically applied. Staffs are limited by all of the following: A lack of computer hardware and software needed to apply the methods; a lack of training in computer applications using quantitative methods hardware and software; and the tendency of decision makers to focus on administrative duties as opposed to use of the technical training possessed by their staff. The link between Government functions and tasks and appropriate analytical methods is not clearly perceived by many, especially some mid-level managers.

As a result, staff who are well trained when they began their jobs lose their ability to apply and interpret quantitative tools because these skills are not used. This problem is especially important when employees receive a one-time short course which they do not apply when they return to their jobs: When this happens, the training and ability to apply it are quickly lost.

GOJ employees have extensively participated in short course training, both within and outside of Jordan. Short-course training is only useful to GOJ employees if the material learned is used in the daily conduct of a GOJ job and regularly applied when the employee completes the course and returns to her or his job. When Government employees are trained, they should learn methods that are immediately applicable to their daily jobs, and apply the methods regularly once trained. Courses designed for Government employees should require the employee to analyze a practical problem, taken from a situation encountered in the daily conduct of work. Analysis of a practical problem situation should be a major part of in-service training courses for Government employees (say one-half). Application of the course material should form part of the job description of the employee who receives the training.

## 2. Assessment of Data Needed and Available for Quantitative Agricultural Policy Analysis

The statistics portion of the planning frame contains an extensive discussion of the availability and quality of agricultural statistics in Jordan. The monitoring and evaluation sections of the planning frame also discuss data needed for impact measurement. Extensive use of data and agricultural statistics to monitor implementation of policy reforms are discussed in Strobel and Durr<sup>1</sup>.

If data sets needed for certain topics listed as subjects for quantitative agricultural analysis are potentially large, the large majority of the medium to higher priority study topics require measurements on a relatively small number of variables. Very important variables include input and output prices; areas planted and yields; livestock numbers, offtake rates, and weights; population and income; measurements on the use of critical inputs, such as water, fertilizers, labor, and pesticides; and data on the stocks and consumption of

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<sup>1</sup>. Strobel, H. and G. Durr, "Review of Proposals for the Design of a Monitoring System for the Agricultural Structural Adjustment Loan", GTZ, Amman, March, 1994.

98

agricultural commodities. Much of this information is now published but subject to important deficiencies. These are discussed in the statistics portions of the planning frame.

Good analysis results from high quality data that are rapidly published or otherwise made quickly available, and disaggregated below governorate level. Quantitative agricultural policy analysis benefits most from that type of data, as opposed to extensive measurements on large numbers of variables which are of suspect quality and delayed in their publication.

In short, relatively little new data collection and measurement methods will be needed to systematically incorporate numeric analysis into policy decisions. Rather, existing data collection efforts should be restructured to:

- \* Make data available in a timely manner;
- \* Produce quality data, that permit consistent estimation that is free from bias;  
and
- \* Permit disaggregation of results below the Governorate level.

## II. POST REFORM TASKS OF GOVERNMENT AND QUANTITATIVE POLICY ANALYSIS

The Policy Charter implies a need for informed decision making at sectoral and sub-sectoral levels. Ongoing and coming policy changes that affect all of agriculture need to be informed by quantitative policy analysis. They will occur in the following economic sectors:

- \* Water allocation and use, including the value and pricing of water;
- \* Markets and trade in agricultural and livestock products, including price and subsidy policies for these products;
- \* Natural resources and the environment.

Within agriculture, the following sub-sectors are of special interest:

- \* Irrigated agriculture;
- \* Rainfed agriculture;
- \* Low rainfall zones (*badia*);
- \* Livestock production;
- \* Forestry.

### A. At Sector Level

The Policy Charter singles-out water, markets and market incentives, and natural resources and the environment as cross-cutting issues affecting all of agriculture. Within each of these sectors there is a basis for Government interest and involvement. Government will still perform tasks during and after reforms. These tasks raise policy questions that must be informed by quantitative analysis, and each question is suited to one or more types of quantitative methods.

All of the quantitative methods applicable to water, markets, and the environment require an improvement in basic data and descriptive statistics, specifically as follows: Data must be quickly available and timely. Data disaggregated below the Governorate level should be available. Data should be of the highest quality possible, and permit consistent and unbiased estimation. Those using the data must be familiar with basic descriptive statistical analysis, including the estimation of means, variances, confidence intervals, goodness of fit indicators, and basic hypothesis testing. So, sector-wide the greatest aid to quantitative

methods will be to improve the quality and timeliness of agricultural statistics and for users to be skilled in the application of basic descriptive statistical methods.

## 1. Water

During and after the implementation of the Policy Charter, Government will still concern itself with the price, value, and allocation of both surface and ground water. Jordan will still face serious issues of the depletion and degradation of its surface and ground water resources.

The engineering costs to capture and deliver surface water have recently been estimated. Jordan is committed, under terms of the Agriculture Sector Adjustment Loan, to charge enough to cover at least the operation and maintenance (O&M) costs of water capture and delivery. Engineering cost is, however, not the same as the value of water in use, and O&M cost recovery is merely the first of several steps needed to address the limited quantity and declining quality of Jordan's water. O&M cost recovery does not address demand growth and does not differentiate between seasons when water is relatively more or less abundant. The value of water is determined (in part) by its demand in production and consumption uses. Policy should be informed by knowing the prices at which water balance can be achieved, that is, the prices that will balance the available quantity of water with its demand in production and consumption. There is presently no seasonal water price differentiation, yet water is scarcer in some seasons than others. All water is sold at a single price, with no mechanism (such as block pricing) to encourage efficiency in water use. It is also important to know how pricing will change the welfare of water consumers: Some who are now receiving abundant water will receive much less after reforms, and some who now receive little will receive more later.

Similar considerations affect the price and value of ground water. Costs are different, uses in agriculture may be different, and the considerations of depletion and degradation may be more significant.

Water allocation is likely to become increasingly important because the total quantity of water available is limited and certain to become more so. As scarcity becomes progressively more acute, so will allocative efficiency. Allocative efficiency -- implying the economic criteria that the value of the marginal product of water equal its price -- may be determined in single uses, for example, the production of tomatoes, or wheat, or permanent crops. Allocative efficiency may be determined across multiple competing uses, for example across alternative uses in agriculture or between its use in agriculture and other sectors such as cities. Re-allocation of water implies that some will gain and others will lose. Who gains and loses by change, and who pays the costs and enjoys the benefits from change, are important policy questions.

Jordan also faces water sector environmental issues. Among others, these concern overdraft, degradation, loss of quality, and depletion of non-renewable water sources. There appears to be no policy concerning optimal rates of extraction for non-renewable water. Decline in the quality of a resource may be valued, but no such valuation studies appear to have been done in Jordan. Setting quality and abatement standards is also associated with costs, but the costs of alternative standards do not appear to have been estimated, nor standards set. Main issues in water, questions implied by the issues, indicated quantitative methods, and who might use the methods are summarized on Table One.

## 2. Markets, Trade, Prices, and Subsidies

Government now operates a complex system of subsidies, price ceilings, and price floors. Government provides market data, news, and information. Government also maintains monopolies and issues permits and licenses to private and para-statal traders. Government itself engages in the export and import of commodities such as wheat, barley, maize, fruits, vegetables, live animals, and milk. Government taxes and regulates trade. The number, magnitude, and nature of these market interventions is expected to diminish considerably with reforms. A move away from quantity restrictions is expected, in favor of market mechanisms, for example. But, Government will still be involved: Government's interest in markets will not disappear with reforms.

After reforms, questions related to markets, trade, prices, and subsidies will include wholesale and retail price levels and the extent to which Government should attempt to control them. Tariffs may become a mechanism used to protect domestic producers from unfair competition (dumping). Continued government intervention in cereals, animal feeds, livestock and livestock products, and fresh fruits and vegetables is likely and involves policy questions: What is the cost to Treasury? Who benefits from the intervention, and who loses or pays the cost? What import price is fair, what level of tariff exposes domestic producers to efficient world market conditions? What is the magnitude of the benefits transferred and what is the amount of the costs paid? Here, there is interest in the amount of prices and payments; in quantities of goods produced, offered for sale, and consumed; and in commodity flows between sectors (i.e. flows between regions of the country or flows between national consumption and foreign trade).

Questions related to non-price market interventions (that is, licenses, permits, tariffs, and taxes) include the effect of these restrictions on costs and quantities supplied; the effect on commodity demand; and the effect on trade. In trade, accurate situation and outlook information is an urgent necessity. For example, Government may decide how much wheat to import and when to import it. Or, Government may require an accurate forecast of milk or meat supply and disappearance before allowing the import of live dairy animals, sheep, or goats. Changes in supply and disappearance affect prices and incomes of both commodity producers and consumers: Government must make decisions in an informed manner because the impact of its decisions on producers and consumers can be dramatic.

Main issues in markets and market incentives, questions implied by the issues, indicated quantitative methods, who is interested in the issues, and who might use the methods are summarized on Table Two.

### 3. Natural Resources and the Environment

All of Jordan's agriculture -- crops, forestry, and livestock -- depend on the quantity and quality of the Kingdom's soil and water resources. Presently, these are being seriously degraded and depleted, with little policy level attention to either the value of the loss or the short- or long-term consequences and costs of the degradation and depletion.

The Government of Jordan now monitors the volume of surface water extraction. It may, after reforms, license and monitor both surface and ground water extraction and use. It seeks to conserve soil through forestry and range programs. It treats and discharges waste water that is subsequently used in agriculture. It plants trees on areas with eight percent or greater slope. Government is drafting a 3-phase program to reverse desertification in low rainfall zones. Government prices and allocates water. Human and animal health and commodity exports are affected by toxic and pathogenic substances used in and deriving from agriculture. Government seeks to manage, control, abate, and mitigate salinity in part because it affects agricultural productivity and potable water quality. During and after reforms, Government will increasingly need to limit the depletion of non-renewable soil and water resources.

Questions of interest to the Government of Jordan that are raised by the decline in quality and quantity of Jordan's soil and water resources are related to the productivity of these resources in their agricultural uses. What is the value of soil as a production input? If erosion, salinization, or contamination cause cropland to degrade or disappear outright, what are the long term value and volume of the agricultural output that will be lost? What is the difference in productivity between topsoil and subsoil of lower quality? In short, what is the value of soil and what is it worth to conserve it?

Similar considerations relate to water in agricultural use. The productivity of water is affected by changes in toxicity to plants, animals, and humans as quality declines. The quality differential can be valued and the economic value of quality calculated. In addition to valuing water quality, efforts to mitigate and abate should be informed by comparing the costs of controls with the value of higher quality water. Economic criteria are needed, to relate quality standards to the costs of agricultural water.

Main issues in natural resources and the environment as they relate to water, questions implied by the issues, indicated quantitative methods, who is interested in the issues, and who might use the methods are summarized on Table Three.

## **B. At Sub-Sector Level**

The Policy Charter has singled-out irrigated agriculture, rainfed agriculture, low rainfall zones, livestock production, and forestry for special interest. After reforms, Government will continue to be interested and involved in each of these sub-sectors. Government will still perform tasks during and after reforms. These tasks raise policy questions whose answers require quantitative analysis, and each question is suited to one or more types of quantitative methods.

All of the quantitative methods applicable to the agricultural sub-sectors of interest require an improvement in basic data and descriptive statistics, specifically as follows: Data must be quickly available and timely. Data disaggregated below the Governorate level should be available. Data should be of the highest quality possible, and permit consistent and unbiased estimates. Those using the data must be familiar with basic descriptive statistical analysis, including the estimation of means, variances, confidence intervals, goodness of fit indicators, and basic hypothesis testing. So, the greatest need for quantitative methods across all of the sub-sectors is for an improvement in the quality and timeliness of agricultural statistics and for users to be skilled in the application of basic descriptive statistical methods.

### 1. Irrigated Agriculture

Irrigated agriculture, especially fruits and vegetables for fresh, processed, and export markets, accounts for more than 25% of the value added in Jordanian agriculture. Government is involved in capture, delivery, and drainage. Government seeks to deliver water under efficient technologies and promotes water uses that return as much value added as possible. The State has an interest in both allocative and technical efficiency in the use of its increasingly limited water resources. Available water should help achieve other government objectives, such as increased agricultural exports.

During and after reforms, Government will continue to be involved in irrigation infrastructure. It will install, repair, and drain systems. It will license wells and issue permits for them. Government now taxes inputs to water saving technologies, but is under pressure to eliminate those taxes. Under reforms, Government seeks to allocate water on a preferential basis to high value crops, and maximize returns per cubic meter of water. Jordan will continue to face quality deterioration in its surface and ground water resources. The Government should also realize that the allocation and use of water will change with reforms: Some who now receive very low priced irrigation water will receive less and pay more for it. Others who now receive little will benefit.

Related questions include the costs of alternative capture, delivery, and conveyance systems vs. the value of water saved. As water becomes increasingly scarce, Government will increasingly seek to value and allocate water across alternative uses: Examples of alternatives include water use on individual crops, water use in cropping systems, and water

104

use across sectors. What is the value of water in these alternative uses? Certain mechanisms to value and allocate water are now under discussion, such as seasonal price differentials for water and block pricing. What is the value and availability of water in different seasons? Where should the blocks be defined, what price for each block? What will be the effect of total revenues to the State (they might fall or rise)? Which sectors gain or lose, and by how much are questions with social, political, and economic dimensions of large interest to the State. The effect of taxation, the number and cost of licenses, and the returns to water across alternative uses are policy questions. The state must soon seek to value and limit increasing salinity and the presence of contaminants that degrade water quality and lower the productivity of water in agricultural use.

a. Analytical Questions and Indicated Quantitative Methods for Irrigated Agriculture

Policy, Strategy, or Question to Analyze	Indicated Method
1. What is the value of water in individual uses (eg. tomato or wheat)? How to maximize output per m <sup>3</sup> of water? How do value, O&M costs compare?	Basic statistics. Budgeting at financial, economic prices. PAM. Single equation econometrics. Optimization for shadow prices.
2. What is the value of water across agricultural uses (eg. cereals vs. vegetables vs. fruits)? How should irrigation water be allocated to maximize the value of agricultural output?	Basic statistics. Single and simultaneous equation econometrics. Math programming models. Budgeting and PAM.
3. Which policy works most easily and best: quantity rationing to preferred crops, or price rationing?	Budgeting analysis of costs to gather water use data and enforce controls, vs. econometric estimation of water demands at alternative prices.
4. How do taxes, subsidies, and price controls affect the uses of water saving technologies?	Basic statistics. Budgeting. PAM. Single equation econometrics.
5. What is the value of quality decline in irrigation water? Level of tariff for pumping permits? How to set quantity limits on pumping?	Non-market valuation methods, using budgeting, econometrics, and simulation models.
6. What about block prices, seasonal price differentials for water: Levels? Effect on GOJ revenues? Impact on crop choice, crop rotations, farm gross margins? Will these measures save water? If so, how much?	Basic statistics and budgeting. Single equation econometrics for demand, VMP, use across crops, sectors. Math programming for water use, allocation.

## 2. Rainfed Agriculture

Rainfed agriculture -- crops, livestock, and trees -- is identified with the highlands, plains, and mountains that typify the traditional agriculture of Jordan. It accounts for more than 35% of gross domestic agricultural product. The majority of the farmers and agricultural workers are Jordanian. Socio-economic and environmental reasons and the interests of coming generations require the continued sustainable development of rainfed areas. Land fragmentation, soil erosion, land misuse, urbanization, and a generally low level of technology are major problems.

Prior to policy reforms, the government has concentrated its efforts on the irrigated areas. With reforms, emphasis is likely to shift to the rainfed areas, where major changes will occur. Cereal procurement might be abolished. Land fragmentation must be halted and legislation will be developed to consolidate land and to stipulate minimum plot sizes. Farming systems may restructure towards more diversified fruit tree production, and shift from lower yielding wheat to higher yielding and more profitable barley-legume rotations.

Government will continue to promote on-farm water harvesting (water retention) and soil conservation. Treated waste water will be utilized for supplementary irrigation. In addition, Government may seek to halt an urbanization process whereby cities and towns continue to expand onto Jordan's more fertile rainfed agricultural lands. Agriculture development will constitute the core of integrated rural development and means for increasing farmers income will continue to be sought.

Problems of crop selection, technology adoption, and farm structure will be addressed here. The impact of using treated waste water on land value, crop productivity, and farmer incomes need to be quantified and analyzed. The impact of lifting cereal subsidies on cropping patterns, farm structure, and farm incomes is of major concern. Questions like the consequences of freeing dairy milk prices and lifting quantitative restrictions on dairy cow import will concern policy makers because of their rural social and economic impacts. The effects of variable input and output prices on the economies of scale of different farming systems, optimal farm size, and production risks should receive analytical attention. Because of rainfall uncertainty, profit maximizing and risk minimizing farming systems under the different agro-climatic and topographic zones have to be identified. The economic feasibility of water retention and soil conservation mechanisms should be calculated. The government requires an informed quantitative analysis of the economic consequences of urban expansion onto Jordan's prime agricultural lands.

a. Analytical Questions and Indicated Quantitative Methods for Rainfed Agriculture

Policy, Strategy, or Question to Analyze	Indicated Method
1. Profitability and factor returns to different rainfed agricultural activities (fruit trees, livestock, cereals), under different technologies?	Basic statistics. Budgeting at financial, economic prices. DCF analysis.
2. Impact of subsidy, price, trade, incentive policies on profitability, factor returns?	Basic statistics and budgeting. Multivariate econometrics. Math programming.
3. Profit maximizing and risk minimizing farm structure? Cropping pattern? Technologies?	Math programming and simulation models.
4. Impact of subsidy, price, trade, incentive policies on farm structure, cropping pattern, technology level?	Math programming, simulation models. Multivariate econometrics.
5. Incentives to promote desired policy outcomes?	All above methods. PAM.

108

### 3. Low Rainfall Zones (*Badia*)

*Badia* are defined as areas receiving less than 200 mm annual rainfall and comprise 90% of Jordan's total area. Ten percent receives 0 to 100 mm annual rainfall, while 80% receives 100 to 200 mm annual rainfall and has greater long-term survival potential. The *badia* are continually threatened by overgrazing and desertification, and these problems are partially induced by overstocking and the ambiguous land tenure and land use systems. Current productivity is a fraction of original potential. Productivity can, however, be four to five times higher than at present.

After reforms, the government will have to implement policies to reduce, halt, or reverse the degradation and desertification problems. It will seek to establish a sustainable rangeland management system. Laws and regulations protecting rangelands from opportunistic misuse (eg. plowing for barley cultivation) will be enforced. The government will be interested in improving fodder production in these areas. Achievement and maintenance of forage-livestock balance will be sought in order to curb overstocking and hence overgrazing.

Questions of importance are those of quantifying and monitoring rangelands productivity and developing and testing alternative strategies to improve productivity. Policy should seek to identify the optimal herd size (stock) and herd management practices. Of great interest are the economic and social impacts of discouraging or prohibiting plowing. The government is under pressure to reduce or abolish feed subsidies, which led partly to the overgrazing problem. This may negatively affect farmer incomes. Quantifying risk alleviation strategies is necessary.

a. Analytical Questions and Indicated Quantitative Methods for Low Rainfall areas (Badia)

Policy, Strategy, or Question to Analyze	Indicated Method
1. What is rangeland productivity?	Basic statistics. Single equation econometrics to estimate production functions.
2. Value added by alternative rangeland improvement scenarios? Long term value of rangeland preservation?	Basic statistics. Budgeting. Simulation models.
3. Impact of feed subsidy removal: On herd size? On farmer incomes? On range productivity?	Basic statistics. Budgeting. Econometrics.
4. What are the most cost efficient and profit maximizing herd management systems? Live animal market weights? Marketing strategies?	Basis statistics. Budgeting. Simulation and math programming models.
5. Incentive measures to promote rangeland improvement? How to reduce negative impact of feed subsidy? Induce adoption of better herd management systems?	Basic statistics. Budgeting. Multivariate and multi-equation econometrics. Math programming.
6. Impacts of combination: open access range and borders, feed subsidy: How long will the range last?	Multi-period math programming and simulation models.

#### 4. Livestock and Livestock Products

Livestock and livestock products -- including live sheep, goats, poultry, and cattle as well as meat, milk, milk products, and eggs -- account for more than 45% of the value added in Jordanian agriculture. During and after reforms, Government will continue to be interested in feed production, cost, quality, and supply. The production, marketing, processing, and trade of animals and animal products will be very important to Jordan's farmers and consumers, and therefore of great interest to Government.

Structural reforms may limit the current quantity control system, where Government licenses feed imports, trades in feedstuffs, and fixes wholesale price ceilings for barley, wheat bran, and maize. License-enforced quantity restrictions on the import and export of red meat may disappear. Taxes, standards, and price mechanisms for imports of feeds, meat, milk, and live animals may remain. Government controls on milk prices may disappear.

Government will measure and seeks to enlarge and improve the processing of animal products. Suggested mechanisms for this include bonuses for the use of licensed slaughterhouses, bonuses for animals weighing 35 kilograms or more, and penalties for the slaughter of females. Government will seek a livestock industry where production, imports, processing, supply, demand, and exports are in balance. It will seek to export more livestock and livestock products. It will encourage range management and fodder production programs, and may limit open grazing on public lands. It will encourage the use of feedstuffs derived from agricultural processing. It will research and extend productivity-enhancing technologies, such as the development of female sheep and goats that birth twins.

In the area of feed production, trade, and supply, it would be well to know the cost and value of existing rangelands and the cost of enriching them with fodder shrubs. How and at what cost can by-products from vegetable and animal processing be used in rations? How can feeds be better managed? Least-cost balanced ration formulations will change as subsidies and ingredient prices and availabilities change. The effect fattening programs, twinning programs, and the use of by-products on feed costs, offtake, and livestock productivity is important. Government must know feed and livestock situation, outlook, and disappearance, and forecast shortages or surpluses in the feed and livestock sub-sector.

With reforms, questions of interest to the livestock sub-sector include analysis of the technical and economic results of current vs. alternative livestock feed regimes, including present regimes vs. the increased use of by-products, the use of fodder shrubs in range areas, and the reduced use of concentrates following on the lowering of feed subsidies. What will be the technical and economic results of bonuses for bringing 35 kg. animals to slaughter? Of reducing the slaughter of females? Of twinning programs? Government may expect resource flows between agro-ecological zones. What effect on regional economies within Jordan as livestock programs change? Will incentive payments for the use of licensed slaughterhouses cause a higher proportion of licensed slaughter?

How will gross margins at farm level change with changes in subsidies, price controls, and trade? How will the demand for milk and milk products change as farm gate prices fluctuate after reforms?

a. Analytical Questions and Indicated Quantitative Methods for Livestock and Livestock Products

Policy, Strategy, or Question to Analyze	Indicated Method
1. Should Government intervene in the import of live animals, frozen meat, milk, or feed, when, and for what quantity?	Situation and outlook reports. Single equation econometric forecasts.
2. Effect of bonuses and penalties on slaughter live weights, female populations, and licensed slaughtering?	Basic statistics. Budgeting at financial, economic prices. Discounted Cash-Flow (DCF) analysis.
3. Demand for feed, live animals, and livestock products?	Econometric estimation of commodity demand functions.
4. Livestock sector resource flows between agro-ecological zones?	Math programming and simulation models.
5. Can available processing capacity handle expected production plus imports? Effect of an improvement in processing method? Of twinning, feeding, fattening programs on processing?	Simulation models.
6. Value of fodder shrubs in rangelands, forages in crop rotations, by-products? Least cost rations?	Budgeting, estimation of financial, economic prices. DCF and PAM. L. programming.

## 5. Forestry

Most of Jordan is arid or semi-arid, and the Kingdom seeks to maintain and expand its forested areas. Forests hold soil and trap water. They provide recreational benefits enjoyed by many Jordanians. They seasonally extend the Kingdom's limited grazing areas. And they provided a limited supply of valuable timber and other extractive and non-extractive forest products.

The Department of Forestry plants and protects forests on public lands. Trees, shrubs, and grasses in forests conserve soil. Government licenses extraction and grazing in forests. Forest species are used in attempts to reclaim saline areas. Multiple use is the guiding management principle: A multiple use forest might involve limited extraction of fuel wood, limited grazing, mushroom cultivation, honey bees, management to conserve soil, recreation, and perhaps other uses. Damaged or felled trees may be replaced with fruit trees. In certain areas, fruit trees or forage shrubs may be important forest species.

After reforms, Government will continue to focus on forest management and improve the national forestry development capability. It will expand forest areas by acquiring and developing potential forest land, and may operate a program to exchange public lands suited to agriculture for private lands suited to forestry. In the protection and expansion of forests, there may be conflict with grazing. The Department of Forestry will continue to study forestry related topics, such as the use of sewage water to plant and irrigate seedlings; mushroom cultivation; honey bee husbandry; reclamation of saline areas (such as Azraq and the Dead Sea); and land use management (for example, in the Zarka River Basin). The Department will monitor, register, survey, and report. It uses its own data as well as the statistics of other departments.

Policies and strategies that should be informed by quantitative policy analysis are resource related. They include estimation of the benefits of multiple use forests; of the costs, damages, and benefits of soil conservation programs; and of the value of soil and timber products. Also of interest are the economics associated with incorporating forages, fruit trees, and grazing in multiple use forests: What use pattern will maximize forest benefits? In land exchange programs, what are the respective values of the parcels to be exchanged? Government will seek to improve its monitoring, land use planning, registry, and reports.

a. Analytical Questions and Indicated Quantitative Methods for Forestry

Policy, Strategy, or Question to Analyze	Indicated Method
1. What is the value of the benefits that multiple use forests provide?	Basic statistics. Budgeting at financial, economic prices. Simulation models and non-market valuation techniques.
2. Do forages and fruit trees enhance the value of multiple use forests? Impact of grazing? How much extraction of timber products?	Basic statistics. Budgeting at financial, economic prices. Simulation models and non-market valuation techniques.
3. What is the long-term value of conserved soil?	Basic statistics. Simulation and math programming.
4. Terms of trade for land exchange: Value of ag. land vs. value of multiple use forests?	Basic statistics. Econometric estimation of input demand, ex. for land in ag. uses. Valuation techniques for multiple use forests, as above.
5. Monitoring, land use planning, registry, reports.	Basic statistics and computer applications.

### III. PRIORITIES FOR QUANTITATIVE POLICY ANALYSIS

Societies often use state mechanisms to favor some groups over others. Such mechanisms usually have social or political rationale that are judged to outweigh their net economic effects which, on balance, always result in a sub-optimal performance of the economy. Such is the case in Jordan, and this is why water, land use, and market policies are given so much attention in this companion study. Implementation of the Policy Charter should be informed by accurate estimation of economic impacts provoked by agricultural policies: Knowing who gains and loses and by how much helps policy makers decide whether the desired social and political gains are achieved and whether they outweigh the negative economic consequences of the mechanisms. However, not all policies cause economic impacts equally, some are much more significant than others.

This chapter seeks to prioritize areas where the application of more refined quantitative analysis methods would be useful and advisable to inform the policy reform process and the implementation of the Policy Charter. The issues, questions, and government functions described in Chapter II are subject to prioritization. First, we set forth decision criteria: What makes a particular issue or policy of high priority? Then, applying the decision criteria, we identify broad issues where the application of more refined quantitative analysis methods would be useful and advisable.

#### A. The Decision Criteria: What Makes A Policy or Issue Important to Analyze?

We set forth four criteria and suggest a relative weight for each. Any given policy (such as those listed on Tables One to Three) can be measured against the criteria and assigned up to the maximum number of points. The higher the point score, the more important the issue and the higher the priority for more refined quantitative policy analysis.

The criteria:

1. The policy implies or is believed to cause a *significant deviation from economic efficiency*: The magnitude of the distortive effect caused by the policy is believed to be large, economy-wide.

Weight: First. Say, up to 30 of 100 points.

2. The effect of the policy is to *transfer significant income/welfare to already privileged social groups*. That is, the policy benefits a small, already relatively well-off group, rather than a large, average, or underprivileged group.

Weight: Second (tie). Say, up to 25 of 100 points.

3. The policy induces or is believed to cause a *significant (positive or negative) income impact* across large groups or numbers of people. This criteria is linked to the first

two. It focuses on income, but leaves the state room to decide which groups to favor or to penalize.

Weight: Second (tie). Say, up to 25 of 100 points.

4. The policy causes a *significant long-term decline in the quantity or quality of a natural resource* -- soil or water. A public good is involved: An intergenerational welfare transfer is involved.

Weight: Fourth, say, up to 20 of 100 points.

### **B. The Priority Areas Where the Application of More Refined Quantitative Analysis Methods Would Be Useful and Advisable**

1. Water Allocation in General (See Table One and Section II.B.1.)

*Priority: Highest.*

Rationale: Present allocative policies, covering both surface and ground water and including both water access and pricing, induce huge distortive effects on one of Jordan's two scarcest agricultural inputs, water. Allocative efficiency has been lost. Income is transferred toward a small, already privileged group (irrigators). Policies provoke daily welfare loss by large numbers of urban residents, many of whom are underprivileged. Policies encourage accelerated depletion and quality decline in water: The present generation is affected, and an increasingly large welfare loss is transferred forward.<sup>2</sup>

2. Output Procurement - Price Floors -- Wheat, Barley, Lentils, Chick Peas, Tomatoes (See Table Two and Section II.B.2.)

*Priority: High.*

Rationale: The procurement of cereals, pulses, and tomatoes at artificially high prices induces allocative inefficiency in the use of land, water, and other agricultural inputs. It distorts the allocative efficiency of the price system. It encourages land degradation and soil loss. It costs the Treasury, but does transfer income to rainfed grain farmers, who are less privileged than irrigators or tree farmers. Tomato farmers are an already privileged group who gain at the expense of other, less well-off Jordanian social sectors.

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<sup>2</sup>. The GTZ is believed to presently sponsor a Ph. D. dissertation on water allocation in Jordan.

### 3. Feed Subsidy (See Section II.B.4.)

*Priority: High*, and linked to removal of output price floors.

**Rationale:** In a well-intentioned effort to benefit rainfed farmers, current policies encourage feed production on marginal areas, with negative effects on marginal soils. Allocative efficiency in input markets suffers, as with price floors. Non-Jordanian livestock producers who graze Eastern rangelands benefit, increasing pressure on the range resource. Without subsidy, livestock feed prices will rise, transferring income to grain and feed producers (many of whom are also livestock producers). This would counter-balance removal of the output price procurement policies. Removal of subsidy will encourage more diversified farming systems, and mitigate range, *badia* destruction.

### 4. Non-Price Trade Barriers (See Table Two and Sections II.B.1 to II.B.4.)

*Priority: High.*

**Rationale:** Import quantity limits, import licenses, export licenses, closed-skies, and other barriers to trade in goods inefficiently produced or transported in Jordan increase costs and lower quantity and often quality of goods across the whole Jordanian society. Such restrictions are often designed to benefit privileged groups who offer competing goods and services that might be available at lower price, in higher quality, or in greater quantity without the barriers. Probably transfers welfare from urban to rural residents. Probably transfers income away from a large social group (not rural producers) to rural producers.

### 5. Market Price Ceilings -- Flour, Fresh Fruits, Vegetables, Milk (See Table Two)

*Priority: Medium*, especially if mitigating measures are adopted.

**Rationale:** Retail price ceilings are a well-intentioned attempt to transfer welfare to consumers, most of them urban. The policies have the allocative drawbacks associated with output product price floors, and in combination create an open-ended exposure of the Treasury. Negative impacts could be mitigated by fixing a ceiling on Treasury exposure. Flour subsidy involves large welfare transfer to less-privileged groups, so, mitigating. Little or no negative natural resource impacts.

117

### III. TRAINING

The needs of GOJ for quantitative analysis to assist in policy decisions and the deficiencies of its institutions and staff in quantitative methods and their application make training an important part of Agricultural Policy Charter implementation. Consequently, training is a significant part of the policy implementation planning frame. Government capabilities in quantitative policy analysis do need to be upgraded via training.

We seek to anticipate some key training aspects and to outline a training plan. These key training aspects are:

- \* General approach to training;
- \* Audience: Who will the trainees be?
- \* Trainee needs;
- \* Nature and kind of training courses;
- \* Who (instructors) might conduct the training?
- \* Where (institution or center) might the training take place?
- \* Costs.

#### A. Key Training Aspects

Any training of a GOJ employee should be linked to daily application of the training by the employee in the normal conduct of her or his duties. The material learned should be used in the daily conduct of a GOJ job and regularly applied when the employee completes the course and returns to her or his job. When Government employees are trained, they should learn methods that are immediately applicable to their daily jobs, and apply the methods regularly once trained. Courses designed for Government employees should require the employee to analyze a practical problem, taken from a situation encountered in the daily conduct of work. Analysis of a practical problem situation should be a major part of in-service training courses for Government employees (say one-half of the course). Application of the course material should form part of the job description of the employee who receives the training. Finally, at her or his desk in the relevant GOJ department, the employee should have a computer, applications software, and training in the applications. This is our recommended general approach to training.

##### 1. Audience

Most trainees will be Government employees. The primary audience is the Ministry of Agriculture and its affiliated para-statals, such as ACC, AMO, AMPCO, and NCARTT. However, the reforms required by the Charter involve ministries and para-statals outside MOA, such as MOS, WOJ, JVA, MOWI, MOP, MOF, and NCARTT. These institutions are very much related to agriculture, and training should also be open to their employees.

118

## 2. Nature and Kind of Training Courses

In-service training is needed. Lectures of one to two hours length, offered over a period of weeks, in the late afternoon or early evening, and repeated yearly or every six months and over a period of years would best fit this audience.

In teaching, a balanced emphasis is to be put on theory (50-60%) and application (40-50%) for all trainees and at all levels of courses. Theory is required because a user must learn to recognize when a given method is appropriate for the analysis of a particular problem, how to formulate the application of the method, and how to interpret results. Because students are in-service, they must learn to apply the course material to the daily conduct of their GOJ duties.

## 3. Trainee Needs and Sample Syllabuses

We have designed seven courses for the in-service training, at basic, intermediate, and advanced levels. Basic courses are recommended in computer applications and basic descriptive statistics. These, plus two intermediate courses and three advanced courses in forecasting, econometrics, mathematical programming, and simulation are described in Appendix I, where sample syllabuses are developed.

The need and audience will be large for the courses in basic computer applications and basic descriptive statistics. The audience in need of intermediate and advanced analysis to inform their ordinary GOJ duties will be much smaller. Care should be taken in the selection of this audience. The eligibility criteria we outline should be observed.

## 4. Who Can Conduct the Training and Where Might It Take Place?

Our interviews reveal that, at present, the University of Jordan (UOJ) as the institution with the fullest capabilities to house and teach these kinds of courses. The Department of Agricultural Economics & Extension, Faculty of Agriculture houses much of the faculty required. Courses paralleling those outlined in Appendix I are already taught there. The Center for Consultation, Technical Services and Studies at UOJ is now equipped with the classrooms, labs, and computer hardware and software that will be needed. That Center now conducts in-service training, and can call on University and non-University instructors as it chooses. The training rates at UOJ are competitive with elsewhere in Jordan.

Other centers or institutions are not excluded, if desired. For example, MOA has a training center and so does NCARTT. These centers, however, are not presently equipped nor staffed to conduct the kind of training described here. It should, however, prove possible to leverage courses by Jordanian computer vendors to build expertise within ministries and especially NCARTT so that it may serve as a technology transfer provider.

Most, if not all, of the faculty expertise required is now available locally in Jordan.

Expatriate faculty or institutions are not an excluded option, but are likely to be more costly and of short duration. The local option is recommended whenever possible.

### 5. An Idea About Costs

Using the UOJ Center and UOJ or other Jordanian faculty, cost estimates range from US\$ 60 per classroom hour for five students to US\$ 66 per classroom hour for six to twenty students. For example, a twenty-hour course for five students would have a total cost of \$1,200 (20 hours times \$60 per hour). A class with fifty classroom hours and 20 students would cost a total of \$3,300 (50 hours times \$66 per hour). At these rates, it would be feasible to repeat the courses every six months or year, if the need were sufficient.

Bringing packaged courses from non-Jordanian institutions or using expatriate faculty would cost much more, and have the additional disadvantage that courses could only be repeated at additional large expense. In general, the length of the course, the number of trainees, the course location, and the facilities required determine the costs of the training course.

### **B. Training Plan Outline**

For the priorities for training in quantitative methods, seven sample syllabuses were prepared (see sample syllabuses, Appendix I).

Each sample syllabus consists of the objectives of the course and the course outline. Timing, length, and frequency of courses are taken into consideration for each sample syllabus.

For effective training, the following steps should be followed:

Step one: Secure funding for the course. It is unlikely that Government employees in-service will be willing to pay to upgrade their skills. They will have to be supported by their institutions, or given free tuition. This, however, offers opportunity to make the course more effective.

Step two: Advertise the course. This may be done in the Arabic language Jordanian newspapers, or within ministries. The advertisement will describe the course and how it can be applied practically during the daily conduct of the Government.

Step three: Require prospective trainees to apply. Each application should consist of the following:

- \* A brief description of any related prior training received by the applicant, eg. in quantitative methods;

- \* A written job description, describing the potential trainee's duties, and clearly implying an on-the-job need for the training to be offered;
- \* A written statement from the trainee about how he or she will use the training upon return to their job;
- \* The outline of a practical problem that the trainee will use the training to analyze, during the conduct of daily duties. The application of the training to this problem should constitute 40-50% of the course grade;
- \* A certification from the employee that he or she has, on her or his desk, a computer with the applications software needed to apply the training;
- \* A signature of approval from the trainee's Department head.

Step four: Design the course to match the applications: length, content, contact hours, structure.

Step five: Conduct a briefing for the department heads of the trainees who will receive the course. Describe the content and its practical applications. Require the department head to sign again, that he agrees to the training and will encourage the trainee to use it in performing normal duties.

Step six: Conduct the course.

121

**APPENDIX I. SAMPLE SYLLABUSES FOR TRAINING COURSES**

**Course # 1. BASIC COMPUTER COURSE**

( KEY BOARD & SPREADSHEET)

**Objectives of the Course**

This will be an introductory computer course to provide participants and trainees computer skills needed for application and for doing the work successfully and efficiently.

**Course Outline**

- I. Introduction to Keyboard
  
- II. Introduction to Lotus 1-2-3.
  1. General ( What is lotus 1-2-3 ? ).
  2. Getting in and out.
  3. Main Parts of Lotus 1-2-3.
    - Spreadsheet
    - Database
    - Graphics
  4. Control Panel
    - Information about the Current Cell
    - Information about the mode or current state of 1-2-3, and
    - Information about the commands
  5. Moving around in the Worksheet
  6. Pointer-Movement Keys
  7. Data Entry and Editing
    - Numbers
    - Labels
    - Formulas
  8. Relative, Absolute, and Mixed Cell Address
  9. Worksheet Commands
    - Format
    - Protection
    - Range
    - Copy and Move
    - File (Retrieve, Save, Erase .....etc)
  10. Use of Simple Statistics with Lotus 1-2-3.

123

## Course # 2. BASIC STATISTICS COURSE

### Objectives of the Course

This course will be an introductory one aiming at familiarizing the trainees with the statistical concepts. Both descriptive and inferential statistical methods will be discussed in a simple way suited to beginners to help them accomplishing their day-by-day work successfully and efficiently.

### Course Outline

#### 1. Introduction

- Definitions, population, sample, variables, observations, qualitative and quantitative variables, continuous and discrete variables, finite population, infinite population.

#### 2. Descriptive Techniques

- (a) Tabular and graphical description, grouped and ungrouped data, frequency distribution, relative frequency histogram.
- (b) Measures of Central Tendency: Mean, weighted mean, median, and mode.
- (c) Measures of Dispersion: Range, variance, standard deviation for (grouped and ungrouped data, sample and population), coefficient of variation, standardized value.

#### 3. Probability and Probability Distributions

- Probability of a Single Event
- Probability of Multiple Events
- Discrete Probability Distributions: The Binomial Distribution.
- Continuous Probability Distributions: The Normal Distribution.

#### 4. Statistical Inference : Estimation

- Sampling
- Sampling Distribution of the Mean
- Estimation using the Normal Distribution
- Confidence Intervals for the mean using the  $t$ -distribution

#### 5. Statistical Inference : Testing Hypotheses

- Testing Hypotheses
- Testing Hypotheses about the population mean and Proportion
- Testing Hypotheses for differences between two means or proportions.
- Chi-Square Test of Goodness of Fit and Independence
- Analysis of Variance

6. Correlation Analysis
- Simple Correlation
  - Spearmans Rank Correlation.

### **Course # 3. INTERMEDIATE COURSE**

#### **Objectives of the Course**

This course is designed to acquaint participants or trainees with budgeting techniques and gross margins analysis, financial and economic analysis, trend analysis and one equation of demand and supply estimation.

#### **Course Outline**

- I. Budgeting and Gross Margins Analysis
  1. Enterprise Budgets.
  2. Partial Budgets.
  3. Whole Farm Budgets.
  4. Cash Flow Budgets.
  5. Importance and Calculation Procedure of Gross Margins.
  6. Derivation of Gross Margins.
  7. Derivation of Gross Margins using Computer (spreadsheets, for Example).
  
- II. Financial and Economic Analysis
  1. Introduction
  2. Technical Feasibility Study
    - Production Methods
    - Project Requirements
    - Project Location
  3. Financial Feasibility Study
    - (a) Undiscounted Measures
      - Payback Period
      - Proceeds Per Unit of Outlay
      - Average Annual Proceeds Per Unit of Outlay
      - Average Income on Book Value of the Investment
    - (b) Time Value of Money
      - The Concept of Interest
      - Discounting, Present Worth
    - (c) Discounted Measures
      - Benefit/Cost Ratio
      - Net Present Value (NPV)
      - Internal Financial Rate of Return (IFRR)
      - Sensitivity Analysis
  4. Economic Feasibility Study
    - Shadow Prices
    - Internal Transactions
    - Import Parity Price

126

- Export Parity Price
- Loans
- Labor Force
- Official Exchange Rate
- Discounted Measures
  - (i) Benefit/Cost Ratio
  - (ii) Net Present Value (NPV)
  - (iii) Internal Economic Rate of Return (IERR)
- Sensitivity Analysis
- 5. Trend Analysis and One Equation Estimation
  - Simple Trend Analysis
  - One Equation of Demand Estimation
  - One Equation of Supply Estimation

## **Course # 4. INTERMEDIATE COURSE**

### **Objectives of the Course**

This course is designed to acquaint trainees with econometric estimation of input demand functions, econometric estimation of commodity demand, product supply functions, simple regression analysis, time-series models (2-variable model only), and forecasting with time series models (2-variable model only).

### **Course Outline**

#### **I. Simple Regression Analysis**

1. The Two-Variable Linear Model
2. The Ordinary Least-Squares Method (OLS)
3. Tests of Significance of Parameter Estimates
4. Test of Goodness of Fit
5. Properties of Ordinary Least-Squares (OLS) Estimators

#### **II. Econometric Methods**

1. Estimation of Input Demand Functions
2. Estimation of Commodity Demand
3. Estimation of Product Supply

#### **III. Time-Series Models**

1. Simple Extrapolation Models
2. Smoothing and Seasonal Adjustment

#### **IV. Forecasting**

128

## **Course # 5. ADVANCED COURSE**

### **Objectives of the Course**

This is an advanced course in multiple regression analysis and is designed to acquaint trainees with more than two-variable linear regression model, namely with multiple regression analysis.

Tests of significance of parameter estimates, coefficient of determination (R-Square), and test of the overall significance of the regression will be discussed. Also, problems in regression analysis and further techniques and application in regression analysis will be discussed.

### **Course Outline**

#### **I. Multiple Regression Analysis**

1. The Three-Variable Linear Regression Model
2. Tests of Significance of Parameter Estimates
3. The Coefficient of Multiple Determination (R-Square)
4. Test of the Overall Significance of the Regression
5. Partial-Correlation Coefficients

#### **II. Problems in Regression Analysis**

1. Multicollinearity
2. Heteroscedasticity
3. Autocorrelation
4. Errors in Variables

#### **III. Further Techniques and Application in Regression Analysis**

1. Functional Form
2. Dummy Variables
3. Distributed Lag Models
4. Forecasting

629

## **Course # 6. Advanced Course in Optimization and Simulation Models**

### **Objectives of the Course**

The first part of this advanced course in Linear Programming (LP) is designed to serve as a tool or a quantitative method for determining optimal decisions and patterns of resource allocation. It is quantitative in the sense that it indicates, for example, the number of units of each commodity to be produced or financial activities to be conducted if a stated goal such as a profit maximization is to be attained.

In a similar quantitative vein, it can indicate the mix of feed ingredients (feed rations) to be used as a feed ration if a stated goal such as a cost minimization is to be attained.

Also, this course aims at developing an ability to use computer programs and linear programming routines and understand the computer printout from these programs.

The second part of this course is simulation.

### **Course Outline**

#### **I. Linear Programming Model (LP)**

1. Introduction
2. The Simplex Procedure
  - (a) The Primal Model
    - The Maximization Model
      - i. Solution Procedure
      - ii. Economic Interpretation of Results
    - The Minimization Model
      - i. Economic Concepts
      - ii. Solution using the Simplex Procedure
  - (b) The Dual Model
    - Setting up the Dual
    - Economic Concepts and Interpretation of Dual Variables
3. Models of Farm Firms
  - Setting up Restrictions
  - Constructing Activities
  - Applications of LP to Farm Management Problems
4. Other Applications for Linear Programming Procedure
  - Writing Restrictions and Activities
  - Examples for Important Issues
  - Application to Ration Problems
5. Using LP
  - Preparation of Input Data
  - Matrix Generation

- Interpretation of Printout

## II. Simulation Models

1. The Simulation Process
2. Evaluating Simulation Models
3. A Simulation Example
4. Model Estimation

## **Course # 7. ADVANCED COURSE in Policy Analysis Matrix (PAM)**

### **Objectives of the Course**

This advanced course in Policy Analysis Matrix (PAM) to agricultural policy analysis is designed to provide trainees, decision-makers and analysts both a helpful conceptual construct for understanding the effects of policy and a useful technique for measuring the magnitudes of policy transfers. PAM results can be communicated easily to policy-makers.

Three related questions can be addressed with the PAM approach, namely competitiveness, efficiency, and policy transfers.

For PAM analysis to be carried out, an accounting matrix is constructed for each representative agricultural commodity system. Each matrix is a combination of two accounting identities, one defining the rows and the other the columns. The first identity is the profits identity: revenues less costs equal profits using actual market, or private prices. The second identity is a definitional statement of efficiency, or social valuations of revenues, costs, or profits.

PAM analysis requires budget building in private and social prices and the difference between them is known as the "effects of divergences".

### **Course Outline**

1. Introduction
  - What is a PAM ?
  - Constructing a PAM.
  - When Might Policy-Makers Use the PAM ?
2. Commodity and Farm Budgets
  - Components of the Budget
  - Profits
3. Estimating Private (Market) Prices
  - Market Prices for Domestic Resources

4. Estimating Social Prices
  - Social Prices for Tradable Goods
  - Determining Import Parity Prices
  - Determining Export Parity Prices
5. Farm Budgets at Market Prices
6. Farm Budgets at Social Prices
7. The Policy Analysis Matrix (PAM)
  - Policy Analysis Matrix (PAM)
  - Creating PAMs for Crops
8. PAM for Measures of Economic Protection
  - Private Cost Ratio (PCR)
  - Comparative Advantage (Domestic Resource Cost Ratio (DRC))
  - Nominal Protection Coefficient (NPC)
  - Effective Protection Coefficient (EPC)
  - Profitability Coefficient (PC)
  - Subsidy Ratio to Producers (SRP)
9. Interpretation of PAM Results

**INSTITUTIONAL DEVELOPMENT SUPPORT FOR  
AGRICULTURAL POLICY IMPLEMENTATION,  
PLANNING AND EVALUATION**

**COMPANION STUDY**

**A REVIEW OF CURRENT  
LEGISLATION PERTAINING TO THE  
AGRICULTURE SECTOR**

***FINAL REPORT***

*by*

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*November 11, 1994*

## TABLE OF CONTENTS

<i>Introduction</i>	2
<i>A. The Legal Framework Governing Agriculture</i>	2
1. <i>The Agriculture Sector in General</i>	2
2. <i>Irrigated Farming</i>	5
3. <i>Rainfed Farming</i>	6
4. <i>The Range and the Badia</i>	6
5. <i>Forestry</i>	7
6. <i>Livestock and Poultry</i>	8
<i>B. Deficiencies in the Present Framework</i>	9
1. <i>Absence of an Overall Land-Use Plan Enforced by Law</i>	9
2. <i>Separation of Water Policy, Legislation and Organizations from     Agriculture Policy, Legislation and Organizations</i>	10
3. <i>Absence of the Ministry of Agriculture's Representation on the     National Municipal Planning Council</i>	11
4. <i>The Current Agriculture Law of 1973</i>	11
5. <i>Land Fragmentation</i>	11
6. <i>Absence of an Environmental Protection Framework</i>	12
7. <i>Absence of Rapid Enforcement Procedures</i>	12
8. <i>Recycled Water from Water Treatment Plants</i>	12
9. <i>Underground Water</i>	12
10. <i>Forestry</i>	13
<i>C. Legal Requirements for Implementing the Agriculture Policy Charter</i>	13
1. <i>Consolidating Land and Avoiding Fragmentation</i>	13
2. <i>Controlling Urban Expansion to Maintain and Protect     Agriculturally Productive Land</i>	14
3. <i>Utilization of Water for Irrigation</i>	14
4. <i>Regulating Range Lands and settling Ownership Claims</i>	15
5. <i>Elimination of Price Controls on Agricultural Products</i>	16

<b>6. Removing Export, Import and Trade Restrictions on Agricultural Products</b>	<b>17</b>
<b>7. Encouraging Private Agribusiness by Eliminating Subsidies and Trade Monopolies</b>	<b>17</b>
<b>8. Encouraging Private Sector Participation in Policy Formulating and Decision Making</b>	<b>18</b>
<b>9. Improving Agricultural Products in Quality and Price to be Internationally Competitive</b>	<b>19</b>
<b>10. Effective Application of the Regulatory Framework by Eliminating Controls and Restrictions</b>	<b>20</b>
<b>11. Encouraging Formation of Various Types of Farmers' Organizations</b>	<b>20</b>
<b>12. Promulgation of New Regulations and Repeal of Outdated Ones</b>	<b>21</b>
<b>13. Exploring and Opening New Markets</b>	<b>21</b>
<b>14. NCARTT to Play a Major Coordinating Role in National Agriculture Research Efforts</b>	<b>22</b>
<b>15. ACC to Function as a Rural Bank</b>	<b>22</b>
<b>16. Pricing Water to Cover Operation and Maintenance Costs</b>	<b>23</b>
<b>17. Encourage the Manufacture of Water-Saving Technologies</b>	<b>23</b>
<b>18. Take Agriculture into Account when Planning Urban Expansion</b>	<b>23</b>
<b>19. Avoid Land Fragmentation and Introduce Land Consolidation Measures</b>	<b>24</b>
<b>20. Land Leasing in Irrigated Zones will be Adjusted to Respond to Actual Social, Economic and Technical Requirements</b>	<b>25</b>
<b>21. Government Acquiring Forest Lands and/or Developing Them</b>	<b>25</b>
<b>22. Improve Management of Existing Forestry Resources</b>	<b>26</b>
<b>23. Establishing Principles Restricting Conversion of Forest Lands</b>	<b>27</b>

<i>24. Establishing Special Agriculture Training Centers</i>	<i>27</i>
<i>D. Next Steps</i>	<i>27</i>
<i>1. Establishing Responsibility</i>	<i>28</i>
<i>2. Establishing an Agricultural Law Library</i>	<i>28</i>
<i>3. Establishing a Policy Working Group</i>	<i>29</i>
<i>4. Reform Implementation Strategy</i>	<i>30</i>
<i>List of Legislation Reviewed</i>	<i>32</i>

# ***A REVIEW OF CURRENT LEGISLATION PERTAINING TO THE AGRICULTURE SECTOR***

## **INTRODUCTION**

This companion study reviews the current legislation pertaining to agriculture and identifies the necessary pieces of legislation which need to be amended or introduced in order to implement the new policy directions contained in the Agricultural Policy Charter. The proposals and recommendations are based on an examination of relevant agricultural legislation as well as on interviews and discussions with personnel of various institutions involved in the agriculture sector. This includes concerned departments of the Ministry of Agriculture and other government institutions. The companion study concludes with a number of "next steps" recommended for implementing the Agriculture Policy Charter. A list of the legislation reviewed is appended at the end of the study.

### **A. The Legal Framework Governing Agriculture**

#### **1. The Agriculture Sector in General**

The general framework under which the agricultural sector and its organizations operate in Jordan is made up of a number of basic enactments which regulate different aspects of agriculture in Jordan. These basic enactments are supplemented by subordinate regulations enacted through Ministerial Orders and Directives issued by public authorities through power delegated to them.

In addition to the above, there are the Council of Ministers' Regulations which have established the administrative organizations of the ministries and establishments involved in this sector and laid down their functions and responsibilities. The basic legislative guidelines within the agricultural sector are the Agriculture Law of 1973, the Jordan Valley Development Law of 1988, the Water Authority Law of 1988, Agriculture Marketing Organization Law of 1987, Agriculture Credit Corporation Law of 1963, and Jordan

## Key Issues and Proposals

- Updating the current Agriculture Law, putting emphasis on development, research, technology transfer, training, management of resources and conservation of the environment rather than putting emphasis on traditional legal principles such as requirements for receiving approvals, permits, licenses, violations, penalties and sanctions.
- Reexamination of all legislation relative to agriculture for defining and clarifying the jurisdictions and authorities of the different organizations serving the agriculture sector and amending such laws to establish and institutionalize coordination mechanism among such organizations.
- Activation of the role of the Agriculture Council to perform a more effective function in formulating the Agriculture Policy and coordinating its implementation among the different organizations involved in the agriculture sector. In this respect it is recommended that certain Articles of the Regulation which established this Council be examined for reassigning clear functions to the Council (Article 2 and 3 of Regulation No. 254 of 1989). In particular the Council should be assigned the function of putting forth a national comprehensive agricultural policy for the country which would include elements of the water policy and preservation of agricultural land within a unified plan for the agricultural sector as a whole.
- Establishing a Legal Department for the Ministry of Agriculture in addition to services currently provided by the present outside counsel. Such a department is needed to develop and pursue legislation relative to the Policy Charter and to update the current Agriculture Law as well as serving the legal interests of the Ministry. The Director of the Legal Department should report to the Secretary General of the Ministry. This recommendation is consistent with the recent Prime Minister's circular about establishing legal departments within government organizations.

Cooperative Organization Law of 1971.

In addition to the above enactments there are other laws which have an impact on agriculture. These include the Law of Supply of 1992; Cities, Villages and Building Planning Law of 1966; the Administration of Government Property Law of 1974 and the Foreign Investment Law of 1987.

The key legal instrument which regulates agriculture and its administration is the Agriculture Law No. 20 of 1973. This law contains comprehensive provisions controlling the two main areas of agriculture: plant and livestock resources. The approach adopted by this law was to establish general rules and principles for the sector and to let specific details be addressed by the Ministry of Agriculture (MOA)(in the name of the Minister) in the form of Ministerial Orders and Directives.

A large number of Ministerial Orders and Directives regulating the different aspects of agriculture have been issued since the enactment of this law in 1973. These include areas such as plant production, plant protection, forestry and livestock. For example, seven Ministerial Orders were issued in 1973 in the area of forestry dealing mainly with licensing requirements and prescribing procedures for exploitation, while six Ministerial Orders were issued in 1990 in the areas of livestock production to regulate establishment of cattle farms and the manufacturing of animal feed. Other Ministerial Orders were also issued to regulate seeds, nurseries, fertilizers, and pesticides.

Agriculture Law No. 20 was not all inclusive. Indeed, it remained virtually silent in one critical area: water. This division is treated below. The basic enactments which control water and water organizations in the kingdom are the Jordan Valley Development Law of 1988, the Water Authority Law of 1988, and the Natural Resources Law of 1986, in particular Regulation No. 26 of 1987, relevant to the control of underground water. The first enactment deals mainly with agricultural development of the Jordan Valley. It regulates the Jordan Valley Authority (JVA) and prescribes its roles and functions in the development of this region. Its basic mission is to develop the water resources of the valley, and the utilization of such resources for irrigated farming. In the meantime, the Water

Authority Law of 1988 has established the Water Authority and has given it responsibilities to manage and develop the water resources in the kingdom. Water in this respect means surface and ground water. The relevance of this law to this study involves the use of underground water for irrigation purposes. Underground water is under the jurisdiction of the Water Authority and is currently regulated under the Water Authority Law and certain provisions of the Natural Resources Law of 1968, specifically Regulation No. 26 of 1977. Under these laws, underground water is extracted through a process of licensing including permits for initiation of work, digging wells and extraction of water.

This bifurcation in legislation and authority is not unique to Jordan. Many nations differentiate between agriculture and water resources. What makes Jordan's situation so noteworthy, as shown below, is the virtual absence of any MOA involvement in framing water legislation issues that bear directly upon the agricultural sector and its minor role in the Jordan Valley, the kingdom's most economically important agricultural area.

## **2. Irrigated farming:**

The main area of irrigated farming in the Kingdom is the Jordan Valley and the Southern Ghor. The Jordan Valley Authority (JVA) and its predecessors have developed the area by providing the irrigation infrastructure. In addition, the JVA has been responsible for the operation and maintenance of all irrigation system components.

According to the JVA Law, the irrigated lands expropriated earlier for purposes of reclamation and development are divided into farm units with minimum sizes. Under no circumstances are farm units to be divided or parceled into smaller units. The JVA, through a committee, selects holders of such units in accordance with certain priorities. Preference is given to farmers residing in the area at the time of expropriation. The holder does not have the right at any time to sell his farm to anyone except to the JVA. However, with the approval of the JVA, the holder is allowed to transfer his holding rights of the farm to his wife and sons. In the meantime, holders may lease to the JVA, if so desired, units which they do not wish to utilize for a period of not more than 33 years. In the case of death of the holder, his rights in the farm are reverted to his heirs, provided that the area

of any unit when parceled shall not thereby be reduced to less than the minimum limit. As to the limit of authority in regard to management of water control in the valley, the JVA maintains the right to fix the upper limit of the amount of water it supplies to the holders in accordance with water availability and the crop plants in the farm units. Also, it has the authority to supervise the water, the supply and distribution and to fix its price (Article 24 j).

### **3. Rainfed Farming:**

In contrast to the irrigated Jordan Valley, which has been the principal producer of horticultural crops, and whose economic importance has generated its own development administration and plans, the rainfed area of the country's productivity, economic importance (with respect to agriculture), and development potential is more modest. The Agricultural Law No. 20 of 1973 is the key legislative document affecting the rainfed farming sector.

The uplands and the heights overlooking the valley receive substantial amounts of rain. Unfortunately, it is this fertile region which is also the locus of uncontrolled urban development. The Law of Cities, Villages and Building Planning of 1966, which is the operative legislation regarding urban development, provides no brakes to slow down this urbanization process.

Cultivation in this area involves mainly wheat and barley, along with horticultural crops. More recently, these highlands have been subject to development schemes such as the Highland Development Project conducted by the Ministry of Agriculture. This project has succeeded in converting a substantial portion of the land into fruit tree plantations. Income received from such farms exceeds that of wheat and barley.

Rainfall decreases gradually to low averages in the semi-desert and desert areas adjacent to the highlands. Such areas have been exploited for range and grazing, as will be discussed.

### **4. The Range and the Badia:**

The ranges and the Badia constitute the major portion of the land of the kingdom.

According to Article 118 of the Agricultural Law, all government lands which receive less than 200 mm of rainfall are considered ranges. Knowing the rainfall averages in this country, the ranges technically include most of the area to the east of the main highway between Aqaba and Amman and Damascus.

The Minister of Agriculture has been granted authority to regulate the use of this area including leasing and allocation for exploitation, provided that such lease or allocation does not involve an area exceeding five-hundred dunums for each family. Also, the Minister is given authority to designate areas where grazing is permitted and those closed for such use. The law sets forth certain penalties for violations of such land use.

#### **5. Forestry:**

Forests in Jordan occupy a very small portion of the country which does not exceed one percent of its surface. These are primarily situated on mountains, chiefly in the northern, eastern and southern slopes of Ajloun, Jerash, Tafela and Shoubak. The main natural forest types include evergreen, oak, juniper, mixed pines and wild olive trees.

There are no separate laws to govern the forests. They are administered under certain provisions contained in the Agriculture Law (Articles 89-116). These provisions are supplemented by several Ministerial Orders specifying mainly requirements for licensing, exploitation, transport, processing and sale of forests materials.

The authority for granting licenses and permits is vested in the Director of Forestry who may delegate his licensing authority. Licenses given are valid for certain periods and holders must observe strict norms and conditions.

According to the law, forests are meant to include trees and shrubs of forest species which may or may not be grafted. Forest material is defined to be any material found on forest land. Forests are divided to either state forests or private forests. State forests are made of lands belonging to the State which are registered as forests in the name of the

Public Treasury and the portions of the roads and streets which are partly or wholly covered by forest trees.

The private forests are, however, forest plantations naturally grown on lands owned by individuals or corporate bodies. Accordingly, man made forests on private lands do not technically fall within the public forests definition, and therefore may not be subject to the same provisions of the Law. This is a deficiency in the forestry law as will be pointed out later.

Conservation and protection of forests, both state and private forests are safeguarded by several measures. These include: prohibition of residence in state forests, prohibition of setting fires in state forests within a radius of five hundred meters outside their limits, prohibition of farming in state forests, unless exceptionally authorized, prohibition of cutting down certain types of trees and prohibition of grazing, except when in accordance with certain authorization.

These protective measures and others are supported by a scheme of penalties against offenders. Cutting a tree or a shrub without a license, for example, is penalized with up to one month imprisonment. Besides ordinary penalties of fines and imprisonment against offenders, the law provides a provision for imposition of collective sanctions to neighboring inhabitants where actual offenders are unknown (Article 107).

## **6. Livestock and Poultry:**

Substantial improvements were made recently in this sub-sector. These include: increasing numbers of farms, enhancement of their quality and operations and doubling their production. The country has reached self sufficiency in the production of chicken, eggs and a good portion of its own needs from dairy products.

The legal system under which this sub-sector is placed relies mainly on the provisions of Agriculture Law No. 20 dealing with livestock sub-sector's resources and its development and protection (Articles 133-86). Provisions contained in the portion of the

code involving livestock are supplemented by a number of Ministerial Orders which were issued pursuant to certain provisions in the code. These Orders have laid down procedures, requirements and conditions which regulate the different areas of this sub-sector. Under the Law, the Minister of Agriculture has broad authority to limit export and import of live animals, if the development of livestock in the country requires such measures. Therefore, the Minister controls the process of establishing and running animal farms through issuance of permits and licensing (Article 133). Also, the Ministry has authority over production, registration, inspection and trading in animal feed (Articles 136-143). Finally, the Law prescribes measures for fighting animal diseases including identification, tests, quarantine, procedures of control and penalties for violating such rules.

As mentioned earlier, there are many supplementary rules issued in Ministerial Orders regulating the different aspects of the livestock sub-sector. Examples are those relating to establishing chicken farms and incubators, cattle, sheep, rabbit and fish farms. Establishment of any of these farms require a license upon meeting certain standards. Farms are limited to certain lot sizes, locations away from the city, town and village limits, certain validity dates, availability of certain sanitary facilities, and the maintaining of records for the Ministry's inspection. Violators are subject to certain penalties including closing down such farms pending restorations of conditions required by law.

## **B. Deficiencies in the Current Legal Framework**

A review of the existing policies governing the agriculture sector discloses a number of striking features. Generally, much of the legal system is out of date and out of touch with the needs of an economically and environmentally sustainable agricultural production and marketing system. Almost every step of the agriculture system, from land acquisition to obtaining inputs, to price policy to export policies, is fraught with complications and a lack of transparency to those in need of information and/or in a position to contribute positively to the kingdom's economic growth. When it comes to government officials interpreting this maze this has led to arbitrary decision-making or paralysis (i.e., no decision-making at all).

At a more specific level, there are a number of deficiencies that require addressing.

These include:

### **1. Absence of an Overall Land-use Plan Enforced by Law.**

During the last thirty years, Jordan has witnessed substantial expansion in building and construction to meet the needs of the significant increase in population and the growth of urban centers. This expansion has mainly been made on cultivable land which is already a very small a portion of the total land area of this country.<sup>1</sup>

The problem is caused by a deficiency in the legal system under which city planning is currently pursued. Although the law requires a topographical study of the area involved prior to initiation of city planning including land use for residential, commercial, industrial and agricultural purposes, there is no provision in the law specifically forbidding or barring authorities from including arable land in city planning, nor are there any provisions for agricultural preservation.

In the absence of such a provision, which would have prohibited cities and towns to expand at the expense of agricultural land during the mentioned period, a good portion of Jordan's cultivable land has been lost. This loss would not have occurred had there been an overall land-use plan, safeguarded by certain provisions in the law, requiring adherence thereto and making it illegal to utilize the land except for purposes designated. This plan would assign agricultural, residential and industrial land, whereby cities and towns may expand only in areas assigned thereunder. The cities and towns could simply have directed their expansion towards areas which are not cultivable.

### **2. Separation of the Water Policy Legislation and Organizations from Agriculture Policy, Legislation and Organizations.**

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<sup>1</sup> The process of urbanization occurring on arable land is hardly unique to Jordan. Virtually every metropolitan area in the world has grown from farm villages and upon farming land. The threat to the agricultural sector is that Jordan has so little arable land outside of the Jordan Valley that every dunum of land lost to agriculture has potential impact upon this sub-economy.

The Agriculture Ministry, which is the main organization responsible for planning, developing, and maintaining agriculture in the Kingdom, does not have jurisdiction over one of the important elements in agriculture; the water resource. Authority over this essential input is allocated to other organizations, especially the Jordan Valley authority. Successful agricultural planning for the country must include water resource considerations whereby water policy is included within overall agricultural policy. The Agricultural Policy Charter recognizes this and calls for close cooperation between the MOA and the JVA and WAJ. To date, cooperation has been infrequent, particularly when planning water use in the agriculture sector.

### **3. Absence of the Ministry of Agriculture Representation in the National Municipal Planning Council.**

Under Article 5 (1) of the Cities, Villages and Building Planning Law of 1966 relative to the composition of the National Municipal Planning Council, the law does not provide for the representation of the Agricultural Ministry on the said Council. The absence of the Ministry has left agricultural concerns almost without consideration in the process of planning and expansion of cities and villages on the nearby agricultural lands.

### **4. The Current Agriculture Law of 1973**

The current Agriculture Law is traditional, restrictive and repressive. It focuses on prohibitions, violations, sanctions, approvals, permits and licenses. It ignores planning, management, development, community participation and involvement as well as training, and preservation of the environment.

### **5. Land Fragmentation**

Due to inheritance laws, agricultural land has been fragmented into small lots. This hinders investment in agricultural projects involving large land plots. The current legal restraint on land fragmentation is contained in the mentioned Municipal Planning Law

Article No. 28 which requires a minimum size for a parcel of land to be ten dunums.

#### **6. Absence of Environmental Protection Framework**

Many provisions in the Agriculture Law involve environmental implications. Yet, there are no standards or specifications for environmental impact assessment. Moreover, the proposed Environmental Law being debated by the National Assembly, calls for the creation of an executive council with representatives from several government agencies. Despite awareness of the importance of the relationship between agriculture and the environment, the MOA is not presently identified as one of the members of this council.

#### **7. Lack of Rapid Enforcement Procedures**

The Ministry of Agriculture is not equipped under the law to deal with situations that sometimes require quick enforcement actions. According to the current procedures, violations are turned over to the courts for trial in accordance with Article 196 of the Agriculture Law. By the time the court issues a legal decision on the matter, the impact of the violation is sometimes irreversible. Even when such a court decision imposes a fine, it is usually of too little value to deter violators.

#### **8. Recycled Water from Water Treatment Plants.**

Currently, effluent in Jordan is being discharged in the nearby water courses, causing pollution to these areas. There are micro-biological standards for the plantation of certain types of crops. For example, plantation in polluted areas should involve only vegetables that are to be cooked, not eaten raw. Where there are violations of growing such types of plants, the law currently doesn't provide for destroying polluted vegetables. Therefore, these vegetables may find their way to human consumption.

#### **9. Underground Water**

With regard to the extraction of underground water and the practice granting permission thereof, consideration should be given to agricultural as well as urban and industrial needs for such water extraction. The authority for making such an allocation determination is currently not with the Ministry of Agriculture.

## **10. Forestry**

As far as forest and soil conservation are concerned, the Agriculture Law has narrowly defined private forests as those which are made up of naturally grown forest occurring on private land. Man made forests are, thus, excluded in this definition of private forests. Technically therefore, planted trees may be dealt with freely without need of licensing as opposed to those growing naturally on private land. On the other hand, the present legal restraints placed on the use and exploitation of "legitimate" private forests (i.e., natural forests existing on private land) are sufficient to deter owners from becoming involved in the development of these lands.

The Law requires the consent of private land owners in order to undertake certain measures aimed at soil conservation and plantation of forest on behalf of the government. This applies to: a) privately owned land with substantial slopes; b) land with slopes affecting water resources; and c) areas identified as tourist land sites where forest plantation is to be undertaken to enhance the beauty of the area (Article 103 of the Agriculture Law). The requirement for the consent of the owner in the situations mentioned above can hinder the government from undertaking development programs and, perhaps more important, negatively effect soil conservation and preservation of forestry in these areas.

### **C. Legal Requirements for Implementing the Agricultural Policy Charter.**

The current Agricultural Policy Charter represents the most recent comprehensive reform program to affect the agriculture sector in Jordan. It contains suggestions for major policy changes and adjustments to the present legal system regarding agriculture. This section will deal with both the implementation procedures and the legal constraints facing such an undertaking. Following are some of the principal proposed policies in the Charter and the constraints that may hinder the process of their implementation:

#### **1. Consolidating Land and Avoiding Fragmentation.**

Implementation of the above policy will be difficult to achieve. First, the ongoing process of fragmentation resulting from the application of Jordan's traditional inheritance laws has been virtually continuous. Altering traditional religious and legal

practice is never easy. Second, such policy reform will require constitutional change (Article 11) as well as amending a number of omnibus laws (Law of Cities, Villages and Building Planning No. 79 of 1976; Land and Water Rights Settlement Law No. 40 of 1952; Jordan Valley Development Law No. 18 of 1988). Coordinating these legislative changes will be difficult and time consuming, involving the efforts of four ministries (MOA, MMRAE, JVA, and MOF). Third, government expropriation or alienation of fragments for purposes of creating viable arable parcels of land would contravene existing law which only permits expropriation of land for purposes of public utility development and in consideration of a fair compensation (Article No. 11 of the Constitution).

## **2. Controlling Urban Expansion to Maintain and Protect Agriculturally Productive Land.**

The Charter advocates a five year freeze on urban expansion to meet the above objective. Jordan's expanding urban areas have grown haphazardly as can be seen by the large areas of vacant land surrounded by buildings in its cities. It has been suggested that inter alia, construction on outlying land should cease until these unused parcels are utilized. Such a determination would almost certainly be greeted negatively by landowners of surrounding suburban property.<sup>2</sup> Another constraint will revolve around determining the criteria for which land is eligible for urban development. A large portion of the agricultural land is already included within existing city growth plans and this will be difficult to reverse. Finally, there is the problem of defining urban boundaries. Considerable building is occurring outside of city limits, without any controls or permits. These "outposts" in time come to define a new boundary which existing urban areas expand out to.

## **3. Utilization of Water for Irrigation**

The Policy Charter advocates a number of policies regarding effective and efficient

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<sup>2</sup> Those owning presently unused parcels within the city, however, might see this as an excellent strategy, insofar as it would almost certainly drive up the value of their holdings.

150

utilization of water for irrigation. These include: development and implementation of a National Water Policy; replacing furrow with drip irrigation systems; regulating seasonal demands; equitable sharing of irrigation water; monitoring of aquifers; and promotion of crops that provide the highest economic return per cubic meter of water. Implementation of such policies, however desirable, will be complicated by several factors. In the near term, the existence of several organizations, laws, jurisdictions and authorities with responsibilities for managing water resources will have to be addressed through careful coordination. The MOA has advocated assuming a leadership role in this (and all other sectoral reform) area(s). Yet to date, the Ministry has played only an indirect role or no role at all in irrigation matters, at least in the Ghors.

In the long term, the most critical issue will likely be increased competition with the urban areas for shares of water. The MOA and the AEPD in particular, working closely with the JVA, will have to justify the continued utilization of large amounts of an increasingly valuable resource on the basis of economic return to the kingdom, in the face of growing urban pressure to obtain more water.

#### **4. Regulating Range Lands and Settling Ownership Claims.**

The Agricultural Policy Charter recognizes the fragility of the Badia and the need to conserve it. Once capable of sustained forage production for Jordan's livestock, the Badia is increasingly threatened by overgrazing and squatter farming. Both threats are largely the result of past government policies subsidizing livestock fodder. The recent decision to terminate these input subsidies will help lessen the attraction of larger herds and risky dryland cereals farming.

The government has declared that the Badia is public land and that individual squatters have no claim to it. Difficulties remain in realizing this declaration. These stem from two sources. First, legal precedent exists whereby squatter ownership of land may be recognized by their having utilized such land for a certain period of time.

This doctrine is incorporated in Article 1181 and 1182 of the Civil Code of Jordan. The Civil Code is the main law which will be used to decide these claims. Settlement of these matters, which involve private rights and the settlement of these claims to such lands, will take a long time since each individual case will have to be reviewed and decided upon separately on its own merits. Second, there are traditional claims regarding ownership of large tracts of Badia land which have generally been accepted as binding.

Government plans to control Badia use, replenish forage areas, and avoid further deterioration caused by dryland farms are also constrained by very limited human and financial resources with which to oversee and regulate the Badia. Replanting schemes are very expensive and only marginally successful, with respect to forage. Moreover, responsibilities for the area are split between the MOA and MMRAE's Department of Environment and no national land use plan or environmental law exist.

##### **5. Elimination of Price Controls on Agricultural Products.**

Elimination of price controls on agricultural products is seen as one of the key reforms required to increase food self reliance, and has been agreed to by the government. Its implementation requires issuance of a resolution by the Council of Ministers taking the agricultural products off the "Basic Food Materials List" as well as the "Supplies Materials List." The Council of Ministers was given authority to identify the materials to be listed. Prices are fixed for all materials contained in both lists. The relevant provisions of the law are Article No. 2 and No. 7 of the Law of Supply No. 17 of 1992.

The effective date for such an action will be contained in the Council of Ministers' Resolution issued on this item and communicated to the Minister of Supplies.

## **6. Removing Export/Import and Trade Restrictions on Agricultural Products.**

Liberalization of agribusiness opportunities in Jordan will require removing sectoral import and export trade restrictions. The relevant provisions of the law controlling the above issues are mainly contained in the Agriculture Law No. 20 of 1973, the Supply Law No. 17 of 1992 and the Agricultural Marketing Organization Law No. 15 of 1987. Under Articles 188-189, Article No. 4 and Article No. 6 of the above laws, respectively certain controls are placed on export, import and trade of agricultural products. These restraints are expressed in subjecting export and import to monopoly and the necessity of receiving permits from certain authorities. Under the Agriculture Charter, the policy is directed toward reducing or eliminating such restraints and freeing trade. The legal mechanism for achieving this change lies in modifying certain portions of the above laws by removing the restrictions or amending them to the extent necessary. The procedures for undertaking this change involve introduction of specific legislation to this effect, to be reviewed and approved by both Houses of Parliament and then issued in the Official Gazette after receiving the endorsement of His Majesty the King. The new legislation will come into force after thirty days of the date of its publication unless indicated otherwise (Article 93 [2] of the Constitution). Further, a Resolution of the Council of Ministers will be necessary to remove agricultural products from the two lists mentioned above in Policy No. 1.

## **7. Encouraging Private Agribusiness by Eliminating Subsidies and Trade Monopolies.**

One of the keys to increasing food self reliance and stimulating agricultural growth is changing government's role within the sector from one of control and competitor to that of facilitator. Implied in this position is the elimination of subsidies and trade monopolies. The relevant provisions of the laws controlling the above issues are mainly contained in the Supply Law No. 17 of 1992. Under Articles No. 6 (a) and (b) of the Supply Law the Ministry of Supply has been given monopoly over importing certain Basic Food Materials. In addition the importation of

certain 'Supply Materials' require approval of the same ministry. Under the Agriculture Charter the policy is directed toward encouraging business by eliminating monopolies and subsidies to make such activities accessible and profitable for the private sector. The legal mechanism for achieving this objective, if this policy is to be implemented, lies in issuance of a Resolution by the Council of Ministers removing agricultural products from the list of the "Basic Food Materials" and the "List of Supply Materials" of which the Ministry has been granted monopoly and approval authority of export and import. The same requirement will be necessary for removing subsidies on such products. The Resolution will contain the effective date for such removal.

#### **8. Encouraging Private Sector Participation in Policy Formulating and Decision Making.**

At present, representatives from the private sectors in the composition of the Boards of Directors of several organizations involved in Agriculture are outnumbered by those from the public sector. The policy is directed under the Charter toward balancing or increasing the influence of the private sector in decisions affecting their economic activities. The private sector should have stronger voice and involvement. Examples of organizations involved in agriculture where representatives of the private sector on the Board of Directors should be increased are the Agriculture Council, the Water Authority, the Jordan Valley Authority, the Agricultural Marketing Organization. The legal mechanism for achieving this change, if this policy is to be implemented, lies in modifying certain provisions of the laws of these organizations, in particular those relative to the composition of these organizations. The modification should be made to the Council of Ministers Regulation No. 24 of 1989, relative to the Agriculture Council, to the Jordan Valley Development Law No. 19 of 1988 Article 8 (6), the Water Authority Law No. 18 of 1988 Article (8), and the Agricultural Marketing Organization Law No. 15 of 1987 Article (5). The procedures for undertaking this change in regard to the above laws mentioned of the last three organizations involve the introduction of specific

1524

legislation to this effect, review and approval of such legislation by both Houses of Parliament and the issuance of such legislation in the Official Gazette after receiving endorsement of His Majesty the King. The new legislation will become effective after one month unless another date is specified otherwise. As to the first Regulation relative to the Agriculture Council, a new Regulation amending it will be needed from the Council of Ministers and should be published in the Official Gazette.

#### **9. Improving Agricultural Products in Quality and Price to be Internationally Competitive.**

Raising the quality and quantity of Jordan's agricultural products to internationally competitive levels will require revision of a wide array of policies and practices. These include issues as diverse as: ending wholesale unit pricing in favor of paying higher prices for quality merchandise; ending Royal Jordanian's virtual monopoly; freeing up ground transportation regulations; bringing Jordan's packing standards up to EU levels; enforcing quality control and phytosanitary regulations; improving marketing communications with producers thereby making them more aware of sales and marketing opportunities; and encouraging private foreign investment in agriculture to bring technology as well as know-how and provide means for penetrating foreign markets. Accomplishing these reforms will entail revisions of: the Royal Jordanian Airlines Law No. 10, of 1969 as amended; the Civil Aviation Law No. 50, of 1985; Law of Transport on Roads No. 49, of 1958; AMO's Law No. 15, of 1987, and Ministerial Order No. 1, of 1988 (packing Restrictions); Ministry of Industry and Trade Law No. 16, of 1989 for quality control, health standards and specifications; and the Encouragement of Investment Law No. 11 of 1987. The legal procedures for achieving these reforms involve the introduction of special legislation to this effect, to be reviewed and approved by both Houses of Parliament and then issued in the Official Gazette after receiving the signature of His Majesty the King. The new legislation will be effective after one month of its publication unless another date is specified.

## **10. Effective Application of the Regulatory Framework by Eliminating Controls and Restrictions.**

Currently, there are many provisions in the Agriculture Law No. 20, and in the Ministerial Orders which were issued pursuant to it, that require approvals, permits and licenses. Other ministries such as MIT, and MOS, and organizations such as AMO also require approvals, issue permits and licenses. Examples of such provisions include: importing and exporting licenses for agrichemicals, feed, seeds, plants, fertilizer, livestock, capital equipment; inspection and quarantine; quality control of chemicals; testing for pesticide residues; and standards for grading. The new policy calls for a shift away from such requirements. To implement this policy, these provisions of the laws and the Ministerial Orders should be examined to identify the areas in need of adjustment. The legal mechanism for implementing this adjustment policy in regard to the Agriculture Law itself will require introduction of legislation to this effect. Such legislation should be processed through the stages mentioned earlier, while amending Ministerial Orders will require the issuance of new orders. Such new orders will become effective upon their publication in the Official Gazette.

## **11. Encouraging Formation of Various Types of Farmers' Organizations.**

Establishing farmers' organizations is currently possible only under the legal framework of the provisions of the Jordan Cooperative Organization Law No. 20, of 1971. The establishment and the operations of such organizations will be governed by the provisions of the existing law. However, if such farmers' organizations are to be established under the umbrella of the Ministry of Agriculture, new legislation will be necessary. Such new legislation could be in the form of an amendment to the current Agriculture Law, or a separate law specifically for such farmers' organizations. In both situations, the new legislation will have to go through the legislative process of the two Houses of Parliament, endorsed by His Majesty the King and published in the official gazette.

## **12. Promulgation of New Regulations and Repeal of Outdated Regulations.**

A substantial number of Ministerial Orders and Directives have been issued by the Minister to regulate the different aspects of the agriculture sector. These regulations and directives have been issued pursuant to authority vested in the Minister by the Agriculture Law No. 20 of 1973. The Policy Charter requires re-examination of these existing regulations with a view to eliminating outdated ones and improving the effectiveness of remaining ones. The legal mechanism which the Minister uses to implement this change is for the Minister to rescind outdated regulations by issuing new Ministerial Orders to this effect. The Minister also has authority to amend and update the remaining ones. The new Ministerial Orders introducing such change will become effective upon publication in the Official Gazette.

## **13. Exploring and Opening New Markets.**

AMO has been engaged in efforts to undertake exploratory trips to Eastern Europe and provide producers with marketing information support. One agricultural export marketing group has recently formed, as have cut flower growers to explore export opportunities. Jordan has some large agricultural producers such as Abu Ghazali, and Shabab, valley grape growers who already have international ties and access to markets in western Europe, South America and even the U.S.

Several reforms related to opening new markets by lifting restrictions and encouraging the development of quality produce, were treated above. These reforms, if enacted, will establish a foundation upon which aggressive and successful exports to existing and new markets can build. An additional approach suggested to implement the above policy is to encourage international trading Houses to open offices in Jordan. Establishing a presence for a foreign company in the kingdom can take many forms. The simplest is establishing and registering a regional office, which it may do by establishing a regional office in Jordan under Articles 280-286 of Jordan Companies Law No. 1 of 1989. This law permits foreign companies to register regional offices with the Ministry of Industry and Trade. Such registration will entitle

a regional office to obtain several advantages, including exemption from registration and licensing fees, exemption from custom duties on furniture and equipment for offices, exemption of non-Jordanian staff from Income Tax on their remuneration and the option of bringing a car into the country for each non-Jordanian employee without having to pay custom duties.

#### **14. NCARTT to Play a Major Coordinating Role in National Agriculture Research Efforts.**

Under the Policy Charter NCARTT is to play a major role in coordinating national agriculture research efforts. Institutional reform will be required for NCARTT to perform this leading role in the national agriculture research strategy. The legal mechanism for this institutional reform of NCARTT, if it is to remain part of the Ministry of Agriculture, requires issuance of a new regulation by the Council of Ministers (based on Article 120 of the Constitution) amending Regulations No. 19 of 1990 as amended by Regulation No. 43 of 1993, and Regulation No. 42 of 1993 to accommodate required institutional reforms on NCARTT. The new regulations have to be approved by His Majesty the King and published in the official Gazette. The new law usually comes into force from the date it is published in the Official Gazette. If however, NCARTT is to become a separate entity, a new law will be required.

#### **15. ACC to Function as a Rural Bank.**

The Agriculture Credit Corporation Law No. 12 of 1963 under which the ACC currently operates, does not allow this organization to function as Rural Savings and Credit Bank. The Policy Charter proposes that this organization be reformed to function as a rural bank accepting deposits and charge higher rates of interest on its loans. The legal mechanism for undertaking the above change in the ACC function lies in amending its current laws, specifically the ACC law No. 12 of 1963, the ACC Regulation No. 1 of 1963 and the financial regulation of the ACC No. 5 of 1963 to the extent necessary to accommodate the new required functions. This may be achieved through enactment of new legislation to this effect and having it processed through the legislative process mentioned earlier.

## **16. Pricing Water to Cover Operation and Maintenance Costs.**

The current price of water<sup>3</sup> is too low compared to expenses involved in maintenance operations. The Policy Charter advocates O&M prices to approximate their economic value. Several options have been developed to reflect the value of O&M. The legal mechanism for adopting any new procedures for determining the price of water lies in amending the Jordan Valley Development Law No. 19 of 1988 Article 24 (J) and the Water Authority Law No. 18 of 1988 Article 10 (F) to incorporate the basis on which O&M prices will be established. Also, Article No. 28 of the JVA Law of 1988 should be studied for finding out if this Article may provide the legal mechanism for implementing this policy. The procedures for undertaking this effort involve introduction of legislation through the Parliament and processing it through the steps mentioned earlier. These procedures will be different if implementation in regard to the JVA is pursued under Article 28 of the JVA Law of 1988.

## **17. Encourage Manufacturing of Water Saving Technology.**

The Policy Charter calls for irrigation techniques and technologies for water saving. Several options for implementation are suggested, including a rebate program based on sales of irrigation equipment and reducing taxes on imports for manufacturing technologies and exemption of such industries from income tax. The legal mechanism for introducing tax incentives to companies manufacturing such equipment involves amending the Income Tax Law No. 57 of 1985 Article 7 if such incentives would involve total exemption. Reduction in tax rates would involve amending Article 17 of the Tax Law. This would be done through a special legislation enacted by the legislative process and published in the Official Gazette.

## **18. Take Agriculture into Account When Planning Urban Expansion.**

Developing a rational and economic strategy for urban expansion that does not consume even more agricultural land will call for a mix of policies that includes both

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<sup>3</sup> Water, according to religious precedent, cannot be priced. Instead, Jordan opts to charge users of public water for operation and maintenance (O&M) costs.

new and modification of existing legislation. New legislation would include development and adoption of a national land use plan. Conceivably, this could be done as part of the pending National Environmental Law now before parliament, but more likely will have to be developed by a joint ministerial committee led by MMRAE, and with MOA, MIT, JVA, MPW (Public Works), MOH, MOF, Land and Survey Department and private sector representation. Other potential legislation could include introduction of a five year moratorium on expansion of urban areas whilst existing undeveloped land already included within urban boundaries is used. With respect to existing legislation, the Policy Charter urges that agricultural concerns be taken into account by the National Municipal Planning Council prior to its deciding upon the future expansion of urban limits. Currently, expansion is usually readily approved by this body. To implement this change, the legal framework of the National Municipal Planning Council should be amended to include a representative from the Ministry of Agriculture in order to voice such concerns. The legal mechanism to bring about this change lies in amending the law governing the composition of the said Council. Under Article 5 (1), the Council is composed of the Minister of Municipal and Rural Affairs as chairman, the Mayor of Amman, the Secretary General of the Ministry of Public Works, Secretary General of the Jordan Building Council, the Director General of the Housing Organization, Manager of the Department of City and Village Planning, the Prosecutor General, the President of the Engineers Association and the Secretary General of the Ministry of Health. Specifically, implementation requires introduction of a special law to this effect, which implies completing the lengthy process of being reviewed and approved by the two Houses of Parliament and then published in the Official Gazette after receiving endorsement by His Majesty the King. The new legislation would come into effect after one month of its publication unless another date was indicated.

#### **19. Avoid Land Fragmentation and Introduce Land Consolidation Measures.**

Present laws do not allow compulsory consolidation. According to Article 11 of the Constitution, no property of any person may be expropriated except for

purposes of public interest and in consideration of a just compensation. The only means for implementing this policy is therefore through indirect measures, such as increasing the minimum allowable lot size that existing farms can be subdivided into. Currently, this minimum is ten dunums (Article 28 (1) of the Cities, Villages and Building Planning Law 79 of 1966). Also, an incentive program to encourage the transfer of ownership of land fragments within a family could be created in the form of eliminating taxes upon transferal and consolidation of such property.

## **20. Land Leasing in Irrigated Zones will be Adjusted to Respond to Actual Social, Economic and Technical Requirements.**

The relevant provisions of land leasing in irrigated zones are contained in Article 22 (H-K) of the Jordan Valley Development Law No. 19 of 1988. What is in need of adjustment is the length of leases, such that lessees have the incentive to invest in lands because they have sufficiently long leases to make such investments worthwhile. As a condition of securing the Agricultural Sector Adjustment Loan, the government has agreed to propose legislation which legalizes private, freely transferrable long-term leases up to 30 years.<sup>4</sup> Adjustment should be made to existing legislation to the extent necessary to accommodate this new policy. This will require new legislation and publication to go through the legislative process and publication in the Official Gazette.

## **21. Government Acquiring Forest Land and/or Developing It.**

a) Private Forest Land: Implementation of this policy may be pursued within the current legal framework of trading government land for private forest land. This legal mechanism is available under provisions of the Administration of Government Property Law No. 17 of 1974. According to Article 10 of this law, private forest land may be traded for government land located in the same area for purposes of consolidating forest land provided, however, that approval is granted by the Minister

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<sup>4</sup> World Bank: Proposed Agricultural Sector Adjustment Loan. 1994: p. 17.

of Agriculture, and the Supreme Committee and the Council of Ministers. The Supreme Committee referred to consists of the Minister of Finance as Chairman, the Director General of the Land and Survey Department, the Director General of the Agriculture Credit Corporation, Secretary General of Ministry of Interior, Secretary General of the Ministry of Municipal and Rural Affairs and the Environment, along with the Director of the Forestry Department.

In order for the trading of government land for private forest land to be more effective, an amendment to this law is necessary. This amendment involves removing the condition which requires that the two lots of land to be traded be in the same location. The amendment should accommodate trading government land for private forest land, even though the two lots are in different locations. The legal mechanism to achieve this change requires a special law to be enacted by the legislative process, endorsed by His Majesty the King and published in the Official Gazette. b.

**Development and Reclamation of Private Forest Land:** The Agriculture Law contains a mechanism for achieving this objective. Article 103 enables the government to develop certain forest land (such development being paid for by the government) provided, however, that the owner of such land agrees to such measures. This hinders implementation of such land development. To implement this policy, amendment of the law will be necessary to remove the approval of the owner for such measures.

## **22. Improve Management of Existing Forestry Resources.**

Several measures are suggested including revising legislation to provide forest officers with enforcement authority. The legal mechanism for achieving the above lies in amending the Agriculture Law No. 20 of 1973, Articles 97, 98 and 99. The amendment would be in the form of new legislation to be enacted through the legislative process of the two Houses of Parliament and endorsed by His Majesty the King. Such new amendments would come into force after thirty days of the date of its publication in the Official Gazette unless another effective date is indicated.

### **23. Establishing Principles Restricting Conversion of Forest Lands.**

The relevant provisions for conversion of private owned forests are contained in Articles 100 and 101 of the Agriculture Law No. 20 of 1973. The new policy principles are to be included in an amendment to the said Articles. Such an amendment will be in the form of a legislation to be processed through the legislative process through stages mentioned earlier.

### **24. Establishing Special Agricultural Training Centers.**

It is presently proposed that such centers be developed within existing RASC (now RCARTTs) structures as part of the proposed NCARTT/Extension reorganization. If these centers are to remain part of the administrative organization of the Ministry of Agriculture, the legal mechanism is to issue a regulation from the Council of Ministers pursuant to Article 120 of the Constitution amending Regulation No. 19 of 1990 as amended by Regulation No. 43 of 1993 relative to the organization and administration of the Ministry of Agriculture. If, however, such centers are ultimately designed as stand alone institutions with the legal status of a fully autonomous body, such as the Agriculture Marketing Organization or the Agricultural Credit Corporation, then the legal mechanism for implementation will require issuing a special law creating a separate and independent entity, and involve the participation of the Ministry of Higher Education.

## **D. Next Steps**

The previous section of this study outlined the main objectives of the Agriculture Policy Charter and the legal changes necessary to achieve their realization. The numerous constraints to implementation of the Charter that were identified were not meant to establish roadblocks to the process. Rather, they were meant to provide a realistic picture of the degree of complexity that the implementation process will entail. A number of steps need to be taken in order to ensure that, from a legal perspective, the key elements of the Charter are achieved. These steps are meant to be sequential, although some can be initiated concurrently.

## **1. Establishing Responsibility**

The Agriculture Policy Charter identifies the MOA as the institution which will be responsible for overseeing development and reform of the kingdom's agriculture sector. Within the Ministry, the Secretary General should formally identify a department as having responsibility for legal matters. Henceforth, this department would be the repository for all legal documentation concerning the agriculture sector. Thus, at any time any government personnel or private citizen concerned with legal issues would be able to obtain answers in one place.

The Ministry already has a relationship with an attorney for legal guidance. We recommend that this position be formally defined (by means of a succinct job description), and that the incumbent be a professional with a strong background in agricultural law. The attorney need not be full-time, but should establish a regular schedule regarding his/her presence at the MOA.

We recommend that the Agricultural Economics and Policy Department (AEPD) be that department. This recommendation is predicated on the assumption that the policy function which the AEPD presently has is inextricably bound with the legal means necessary to achieve the Ministry's policy objectives.

The AEPD Director should appoint an individual with overall responsibility for legal matters, and provide for his/her training so that s/he is capable of managing the archives and providing information quickly and correctly. This individual would work directly with the attorney, and would coordinate the attorney's schedule within the MOA regarding legislation-related matters. At the outset of this process (i.e., for the first year), this will be a full-time position. After archives are established and operating procedures determined, it should be possible for this to be a half-time position.

## **2. Establishing an Agricultural Law Library**

At present, there is no single place within the MOA (or anywhere else, for that matter) where a comprehensive set of all legislation, regulations and ministerial determinations regarding legal matters within the sector is present. Before embarking on a new policy, it is essential to know what policies already exist. The Charter has advocated that inter alia, laws and regulations regarding economic and health concerns be transparent

(i.e., clear, available, and understandable to all those operating and wishing to operate within the sector).

In order for these things to happen, it is necessary to establish a single locale where such information exists and is formally known to exist. The individual within the AEPD responsible for legal matters will be charged with responsibility for developing an archive/library containing all legal documentation pertaining to the agricultural sector. This means that data must include laws and regulations whose oversight may not be the responsibility of the MOA (e.g., water regulations overseen by the Ministry of Water and Irrigation; price control legislation from the Ministry of Supply; etc.). This data set should be available in hard copy and upon computer, and organized so that it is easily accessible to potential users<sup>5</sup>.

### **3. Establishing a Policy Working Group**

The Minister of the MOA, working with the Secretary General and the AEPD Director, should establish an inter-agency Policy Working Group. The objective of this Group should be to develop an agricultural policy reform agenda. Using the Charter as its point of departure, the Group should focus on: a) identifying, b) prioritizing, and c) developing implementation strategies for agricultural policy reforms. The Group should report to the Agricultural Council (assuming that it meets) on a regular (quarterly) basis, providing progress reports and citing constraints that need addressing. Copies of the Group's proceedings should also be shared with each of the ministries involved (through reports submitted to the respective ministers and secretaries general).

The Group, to be chaired by the Director, AEPD, should include counterparts in those ministries that directly affect agriculture (i.e., MWI, Ministry of Supply, Ministry of Municipalities, Rural Affairs and the Environment, Ministry of Industry and Trade, Ministry of Finance, Ministry of Health, and the Ministry of Planning). Participants should be senior

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<sup>5</sup> When the MOA installs an electronic mail system, this data set should be accessible to network users. It should be extended to all government and private sector agencies as they become network members.

(i.e., Director-level) and involved in those ministerial units directly dealing with agricultural issues.

#### **4. Reform Implementation Strategy**

Developing and implementing legal reforms in the agricultural sector should proceed beginning with the easiest reforms and culminating with the more complex ones. Easiest, in this sense, refers to those reforms or regulations which:

- can be created and/or amended without legislation
- require minimal inter-institutional cooperation
- are popular (i.e., possess broad public/sectoral support)
- the ministry in question has the capacity to implement without external assistance

An example of this is the Charter's objective of improving public and private sector animal health. This includes privatizing much of the existing public sector animal health program or devising means of cost recovery that would in effect end subsidies, while ensuring that essential government services are in place. A survey of those in the veterinary service disclosed that they were supportive of such moves. Veterinarians in the private sector were equally supportive insofar as obtaining the objective would at a minimum result in eliminating subsidies for services thereby making their own (i.e., private) competitive. There is at present no widespread livestock owner opposition, and none is organized.

It should be possible to implement such a program within the MOA, relying on the veterinary officers to work with the AEPD to establish a privatization process, determine the most appropriate roles for the public sector, and design and implement necessary research and training programs connected with this objective.

Other examples of "easier" reforms would include: increasing market information to producers and consumers; replacing furrow with drip irrigation systems; and promotion of an integrated barley/livestock production system. Each is largely self contained within a single ministry which can develop necessary regulations and processes, and each reform can be implemented with technical support provided by Jordanian experts.

"Complex" reforms refer to those that:

106

- require amendment of several existing laws
- involve three or more ministries or government institutions
- require substantial inputs such as financial and technical assistance resources
- challenge traditional beliefs or practices
- the ministries involved lack the implementation capacities to achieve the reforms

An example of a complex policy is the proposed legislated National Land Use Plan. From a jurisdictional perspective, such a plan would require the involvement of at least four ministries (MMRAE, MOA, MWI, and MOP), non-governmental organizations (e.g., RSCN), entities such as the Higher Council for Science and Technology, and Jordan's universities. Issues to be included in such a plan would include: defining urban boundaries, determining land ownership in the badia, including the possibility of ending dryland farming there, defining water rights on private and public lands, zoning areas for grazing, forested areas, conserving what remains of Azraq, and settling the development of the southern Jordan Rift Valley. These issues touch on virtually every existing and traditional practice in the agricultural and non-agricultural sectors. Many decisions have substantial resource implications (i.e., compensating owners, squatters and jurisdictions to change their behavior) at a time when the government is attempting to curb public spending. Environmental impact analyses and socio-economic research will have to be done to determine the best course of action for many of the above issues. At present, the implementation capacity to achieve all or even most of this is lacking.

By focusing on easier issues at the outset, the reform implementation process can build upon successes and thereby create some momentum. This will also give the MOA and other involved institutions time to strengthen their capacity to design and undertake policy reforms.

107

### **List of Legislation Reviewed**

- A. The Constitution of the Hashemite Kingdom of Jordan of 1952
- B. Law of Agriculture No. 20 of 1973
- C. Water Authority Law No. 18 of 1988
- D. Jordan Valley Development Law No. 19 of 1988
- E. Supply Law No. 17 of 1992
- F. Jordan Cooperative Organization Law of 1971
- G. Agriculture Marketing Organization Law No. 15 of 1987
- H. Agriculture Credit Corporation Law No. 12 of 1963
- I. Law of Administration of Government Property Law No. 17 of 1974
- J. Law of Land and Water Rights Settlement No. 40 of 1952
- K. Natural Resources Law No. 12 of 1968
- L. Law of Cities, Villages and Building Planning No. 79 of 1966
- M. Encouragement of Investment Law No. 11 of 1987
- N. Income Tax Law No. 57 of 1985
- O. Ministerial Orders of the Ministry of Agriculture issued pursuant to the Agricultural Law No. 20 of 1973 partially compiled
- P. The Civil Code of Jordan of 1976
- Q. The Patent and Designs Law No. 22 of 1953
- R. The Trade Marks Law No. 33 of 1952
- S. The Companies Law No. 1 of 1989
- T. Proposed Law for the Protection of the Environment of 1994
- U. Council of Ministers Regulation 19 of 1990 for Administrative Organization of the Ministry of Agriculture
- V. Council of Ministers Regulation No. 42 of 1993 for Administration and Organization of the National Center of Agricultural Research and Technology Transfer
- W. Council of Ministers Regulation No. 54 of 1992 for the Administrative Organization of the Ministry of Water and Irrigation
- X. Council of Ministers Regulation No. 57 of 1976 for the Organization and

**Administration of the Ministry of Municipal Affairs and Environment**

- Y. Council of Ministers Regulation No. 26 of 1977 for the Supervision of Underground Water**
- Z. Royal Jordanian Airlines Law No. 10 of 1969, as amended**
- AA. Civil Aviation Law No. 50, of 1985**
- BB. Law of Transport on Roads No. 49 of 1958, as amended**
- CC. Ministry of Industry and Trade Law No. 16 of 1989**
- DD. Draft National Environmental Law n.d.**
- EE. Administration of Government Property Law No. 17 of 1974**

165