

PNAAS 113

A Socio Economic Study of the
Jordan River Valley

Near East Bureau
Agency for International Development

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NE/TECH/AD
December 2, 1980

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PREFACE

This study is intended to brief consultants, experts and laymen on the socio-economic development aspects in the Jordan River Valley with special emphasis on agricultural development. The valley has become significant to donors and to the Jordan economy due to the ongoing plans to construct the Maqarin dam on the Yarmouk River (a tributary of the Jordan River). The cost of the dam and conduits to transport water to principal population centers has been estimated at more than one billion dollars.

The United States Agency for International Development (AID) and its predecessor agencies had pioneered in the development of the Jordan River Valley since the Eisenhower Administration. The first U.S. studies of the region were made by the Johnston Commission Report in October 1955. AID had since participated in the construction of the East Ghor Canal, a network of irrigation canals and in building schools, clinics, housing, and roads. Also it provided grants, loans and technical assistance to improve agricultural development and other related infrastural elements in the valley.

In its effort to establish peace and prosperity in the region, the United States Government is one of the principal donors participating in harnessing the waters of the Yarmouk River to increase crop production with modern irrigation technology and to improve the availability of food nutrients for a growing population with equity and growth.

FOREWORD

Jordan was created by Great Britain after World War I and named the Emirate of Trans-Jordan. In 1948 it became the Hashemite Kingdom of Jordan.

It has an area of 37,100 square miles (or 96,088 square kilometers) of which 18 percent is cultivated (11 percent dry-farmed and 7 percent irrigated) and a population of 2.2 million in early 1980 increasing at an annual rate of 3.2 to 3.4 percent.

It has a climate that is generally hot with dry summers and mild winters, characterized by low and extremely variable annual rainfall which result in recurrent drought conditions lasting from one to several years. Average annual rainfall varies from less than an inch in the desert to 20 inches in the more fertile areas of the Northern region (Table I). It has a topography that ranges from 1,292 feet below sea level in the Jordan Rift Valley to Jebel Ram, the highest mountain in Jordan at Rassen-Naqab with an elevation of 5,755 feet (Table II).

The country is poor in natural resources except for phosphates and potash minerals. It has been considered a traditionally developing country with a pastoral economy dependent on livestock and cereal crop production until the fifties. It progressed since then to a relatively modern, service oriented economy, especially in the last decade whereby only about ten percent of the rural population is engaged in agriculture.

Infrastructural elements were established or strengthened in all socio-economic pursuits in the country. Over 250,000 skilled and unskilled workers have migrated to work in the nearby oil-producing countries sending remittances to their families in excess of \$1.5 billion in 1979. Jordan has turned into a labor-short country and foreign cheap labor has been

brought in especially for irrigated agriculture and construction work.

Amman, the capital and the largest city, grew from a population of 5,000 people in 1928 to 750,000 people in 1979 (mostly due to the flux of refugees). Its geographic area was extended from one hill to twelve hills in 1980. Water shortage and hygenic facilities seem to be the principal limiting factors to its continued expansion. Marginal farm land has been neglected and changed character from farming to development and speculation. Dryland agricultural production decreased during the last years of drought. Only land with dependable water supplies for irrigation such as that in the Jordan River Valley continue to be developed and expanded.

According to IBRD, Jordan catapulted to a middle-income level country during the last few years and had a 1978 per capita income reported at \$1,050 and a population growth of 3.4 percent per annum.

The lack of reliable socio-economic statistical data pose a problem in establishing trends and patterns for development; nevertheless factual improvement and growth are in evidence. Primary and secondary schools, clinics, roads, etc. are universally established throughout the country. The University of Jordan was established in 1972 and includes faculties of Art , Science and Agriculture granting BS and MS degrees. A new university is scheduled to be established in 1982 at Irbid and will be named the University of Yarmouk.

Unemployment is almost nil. Construction work is widespread and unskilled agriculture labor have unlimited opportunities for employment

to supplement their income. A laborer may earn 5 JD^{1/} in one day which is more than he can hope to earn from one dunum of land^{2/} planted in wheat or barley under dry-farmed conditions in a whole year. Statistics seldom reflect a farmer's income from other employment and remittances from abroad. Pastoralists, on the other hand, have the opportunity to obtain job security by joining the armed forces of Jordan.

Several donors are giving economic and technical assistance to Jordan. Among them are AID with technical and economical assistance that was started in the early fifties. Others such as the Netherlands which recently completed the financing and construction of a marketing center in the Jordan Valley and will be followed with the construction of a wooden box factory to provide containers for fruits and vegetables.

The United Kingdom is financing a produce marketing center in the northern end of the Jordan Valley which is scheduled to be operational in 1981. The Federal German Republic gave \$20 million to finance feasibility studies and \$5 million for the construction of a dam at Wadi Arab. The European Economic Community (EEC) is providing \$2 million to the Jordan Valley Farmers Association to develop greenhouses and vegetables nurseries. The Arab Organization for Agricultural Development (AOAD) has performed lengthy studies on dryland farming in Jordan. The

1/ 1 JD equivalent to \$3.30

2/ 1 dunum is one-tenth of a hectare or one-fourth of an acre.

World Food Program (WFP) contributed \$12 million to promote development of the rainfed lands by distributing fruit trees seedlings to farmers. The UNDP prepared a range development program for the country. The British Overseas Development Ministry and Federal German Republic are strengthening the Jordanian Veterinary Services and the United Kingdom is performing an assessment of the livestock industry. The IBRD is preparing a feasibility study for the implementation of an integrated plan of development for the dryland farming subsector of Jordan and an economic analysis of the Maqarin Dam as well as a Jordan Valley socio-economic agricultural development study. Iraq and the United Kingdom provided \$10 million loans to the Jordan Cooperative Organization (JCO). Also FAO and ICARDA have ongoing dryland farming programs in the country.

A total of 16 donors have pledged financial support for the construction of the Maqarin Dam and the extension of its water facilities to Amman and Irbid at an estimated cost of over one billion dollars. However, agreement among these donors to proceed with the construction of the dam has not been finalized due to various economic and political factors.

Background:

The topography of Jordan consists of three main regions: 1) a plateau rising over 3,000 feet, 2) a rift valley descending gradually to 1,292 feet below sea level and which is the subject of this paper (see map) and, 3) wasteland, semi-desert and desert.

Rainfall is capricious and highly variable resulting in severe drought and semi-drought conditions which often wreak havoc with dryland agricultural farming rendering the country highly dependent on the import of its food necessities to meet its basic needs. In normal years an average of less than 16 inches of rainfall can be expected in the highlands; 8 inches in the valley and little or no precipitation in the desert. As shown in the agricultural production indices (Table III), extreme year-to-year rainfall variation tends to mask increases in crop productivity. On a per capita basis, present Jordan agricultural production has been below what it was ten years ago. This has been due in a large measure to recurrent drought conditions and the influx of displaced persons from regional conflicts.

In its Five-Year Plan (1976-80), the Government of Jordan gave high priority to water sources for the irrigation and development of the Jordan River Valley which is considered to be its most potentially productive agricultural region. The Valley area is about 104 kilometers long and between 4 to 16 kilometers wide and has the potential of producing agricultural crops year round when dependent supplies of water and modern scientific technology are made available. And because of its topographic depression, it has the unique advantage of producing crops out of season for the local and export markets at great advantages to growers with a minimum outlay in the cost of crop protection from cold weather and from frost damage.



EAST GHOR DEVELOPMENT

250

240

230

220

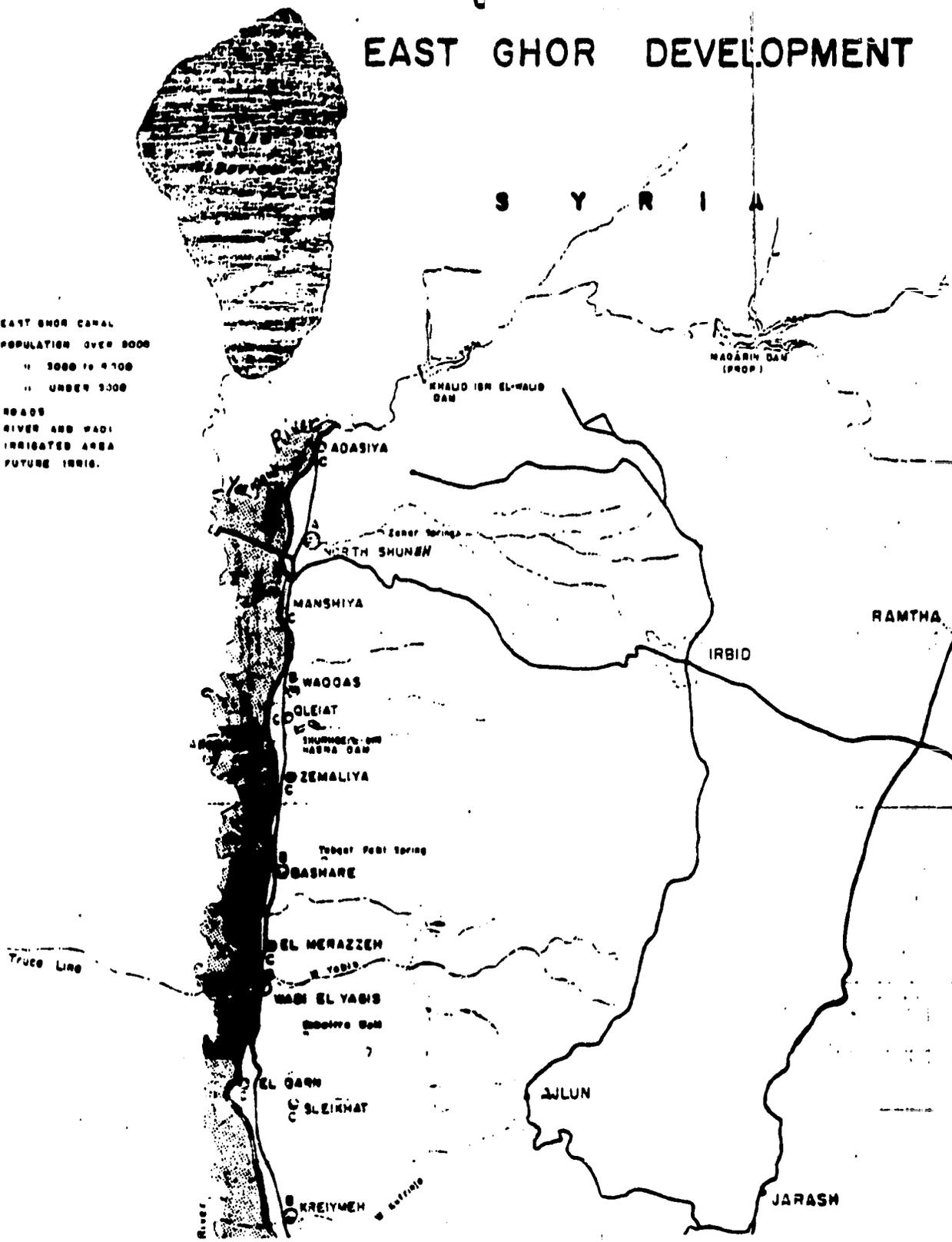
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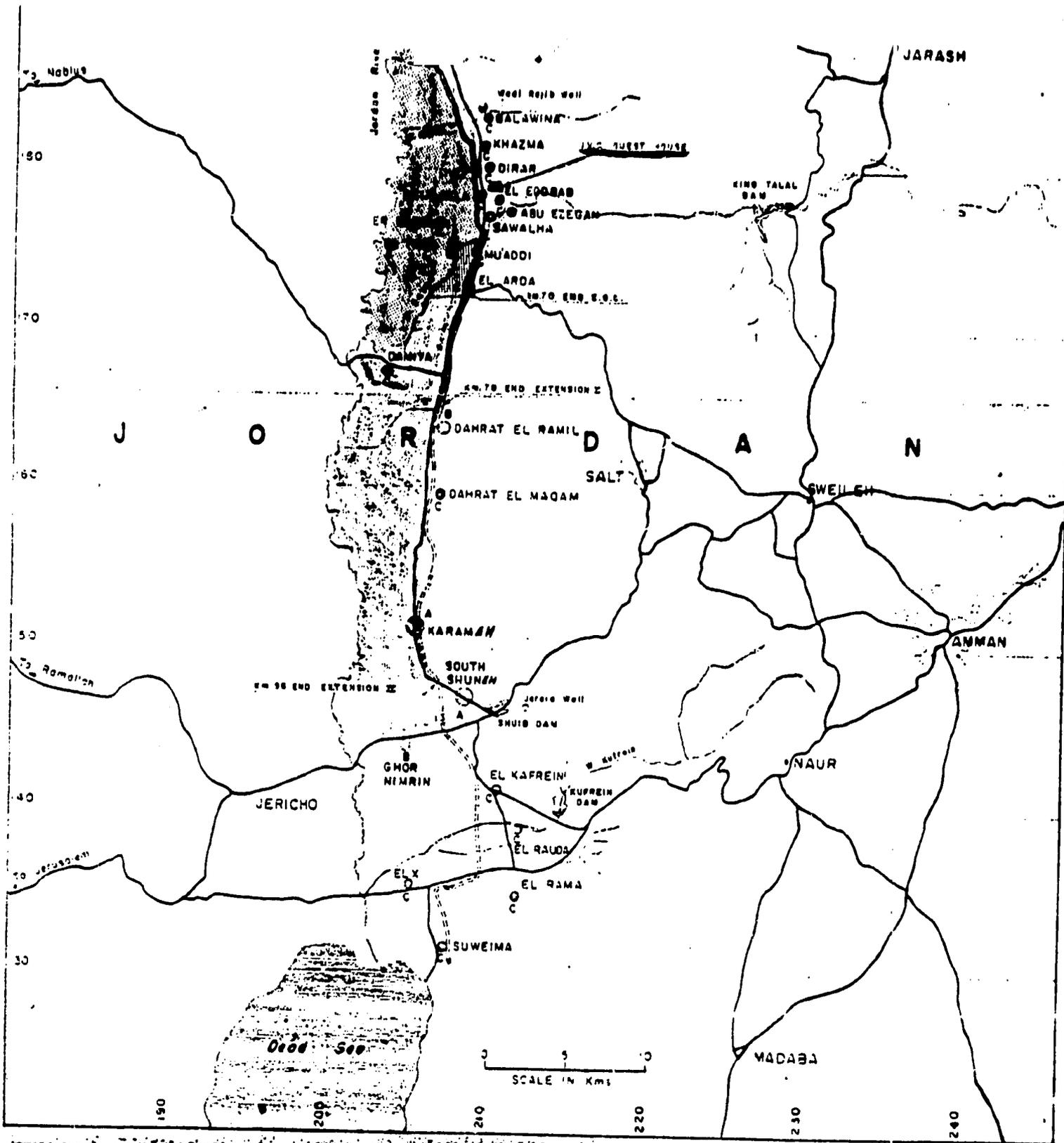
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190

LEGEND

CONSTR	PROP	EAST GHOR CANAL
(Symbol A)	(Symbol A)	POPULATION OVER 8000
(Symbol B)	(Symbol B)	" 3000 TO 4700
(Symbol C)	(Symbol C)	" UNDER 3000
(Symbol D)		ROADS
(Symbol E)		RIVER AND WADI
(Symbol F)		IRRIGATED AREA
(Symbol G)		FUTURE IRRIG.





SCALE IN Kms

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T A B L E III

Indices of Jordanian Agricultural Production

Total and Per Capita (1961-65=100)

Agricultural Production	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u> ^{1/}
Total	107	134	66	165	73	109	79	98	62	100
Per Capita	82	98	47	113	49	70	50	59	37	75

^{1/} Estimate

Source: USDA/Economic Research Service
Washington, DC

It is estimated that the Jordan Valley produces over 65 percent of the gross value of current agricultural crop production and over 80 percent of the value of agricultural exports with fruits and vegetables forming 25 percent of all commodities exported by Jordan. Under the Government Five-Year Plan, the expansion of the irrigation system, application of new technology and increased investment in materials and equipment in the valley are projected to increase the agricultural net crop value by sixfold by 1992 from the base value of 30 million dollars in 1976.

The Jordan Valley area consists of 600,000 dunums of which 360,000 dunums were classified in 1962 as irrigable. Of this irrigable area, about 240,000 dunums are presently under full or partial irrigation with water provided from the East Ghor Canal (extended to 60 miles of canals at present) and all other water sources including the Zarqa River, the Haben Kafrein Wadi, side wadis, springs and underground water sources.

Plans are underway to extend irrigation to all the irrigable land area when the irrigation system has been entirely pressurized in order to provide irrigation water on a year round basis with modern technology. The proposed multipurpose Maqarin Dam will provide water to supplement the present irrigation water supplies and extend the irrigated area to the remaining irrigable area.

In its plans to provide support for an orderly development of the Valley, the Government established the autonomous Jordan Valley Commission (JVC) in 1973 to oversee and coordinate programs, eliminate jurisdictional

rivalries among government agencies involved in the Jordan Valley and to implement plans and programs for its integrated development. The Jordan Valley Commission was renamed the Jordan Valley Authority (JVA) in 1976 and had a staff of nearly 1300 employees and 600 daily workers in October 1979. Also the Jordan Valley Farmers Association (JVFA) was created in 1974 to provide farmers with the organization, supplies, credit, marketing and other services required to increase agricultural production in the valley.

The dearth of baseline socio-economic data for the Maqarin Dam project and related infrastructure have been limited in quantity and scope for the development of in depth impact analyses and evaluation plans. This has hampered the development of adequate indicators for project performance and evaluation of the quality of life of the rural population except for occasional random surveys made by government agencies. There is need to strengthen the project planning with research institutions and project implementation to overcome this deficiency. In 1977, the Jordan Valley Authority established an information system to collect and evaluate a socio-economic baseline data by contracting the services of the University of Jordan and other government agencies such as the Department of Statistics and the Royal Scientific Society. Similarly, the Jordan Valley Farmers Association sent out periodic subject-specific questionnaires to its membership to collect specific information to evaluate some of their agricultural management practices. Also Department of Statistics performed socio-economic surveys in March 1965 and June 1973 respectively. The latter survey showed a population of 64,012 people living in 11,213

households (33,159 male and 30,853 female) with an average household size of 5.7 persons which is slightly below that for the country as a whole. The ratio of residents 15 years old or younger were found to constitute 53.2 percent of the valley population. They would now be 21 years old. Also the survey indicated that the Valley had a relatively high ratio of workers among the population and a greater involvement of women in the labor force than elsewhere in the country. About 33 percent of the population (19,495 people) were workers compared to 20 percent for the rest of Jordan. Also 28.1 percent of women were found to be field workers (96.1 percent of them in agricultural pursuits) as compared to 10 percent elsewhere in Jordan. The survey revealed that 76 percent of all houses were constructed of mud bricks, 12 percent were tents, 11 percent were built of cement bricks or concrete and 1 percent were constructed of mud and stone. The average number of bedrooms was 1.33 per household with an average of 4.3 people to each bedroom. Bathroom facilities were not built in 90 percent of the homes and kitchens were incorporated in the bedroom in most houses.

Illiteracy was found to be high among the older age group. It was 90 percent among those who were 50 years and older, 84 percent among people 40 to 49 years old, 61.6 percent among people 25 to 39 years old and 40.8 among those 15 to 24 years old.

Life expectancy was estimated at 58 years. However, conditions have improved since the 1973 survey and a manpower survey published in 1976 indicated that 82 percent of the males and 63 percent of the females

between the ages 15 and 19 were literate.^{1/} The completion and operation of 25 schools in the valley will further ameliorate illiteracy. Also ten new health clinics, nine government buildings, potable water facilities and a high tension line and an electrical distribution network for 28 villages and five water pumping stations were connected to the national power grid since that time. In addition three hundred houses were constructed and made available to government workers and 2,100 new housing units were built for sale to valley residents.

According to the Jordan Department of Statistics there were about 5,700 holdings in the Jordan Valley in 1978 which constituted 10 percent of land holdings in the whole country. Average land holdings for the valley were about 40 dunums yet individual holdings may greatly vary due to fragmentation and Moslem inheritance laws (Table IV). A total of 34 percent of all agricultural holdings in the Jordan Valley were privately owned and operated; 59.3 percent sharecropped or rented and 6.7 percent were of mixed tenure, i.e. part of the land is cultivated by the owner and part is sharecropped or rented (Table V).

There is some variation in the average size of owner-operated holdings in the three sub-districts of the Valley. Their land holdings in the north and south have tended to be larger than in the middle of the Valley. They constitute 50 percent in the north, 30 percent in the south and 20 percent in the center which is a reflection of the land

^{1/}

A. Scott and W. Kelly Manpower Development in the Hashemite Kingdom of Jordan with Special Reference to the Jordan Valley. Amman, June 1976.

9A

T A B L E IV

Agricultural Holdings and Average Farm
Size in the Jordan River Valley, 1973

<u>Sub Area</u>	<u>Area (Dunums)</u>	<u>No. of Holdings</u>	<u>Mean Size (Dunums)</u>	<u>Median Size (Dunums)</u>
North (all irrigated)	78,574	1,713	45.9	27
Middle (part irrigated)	78,449	2,221	35.3	25
South (part irrigated)	24,510	541	45.3	45
Total	181,533	4,475	40.6	27

Source: Department of Statistics, Social and Economic Survey of the East Jordan Valley 1973.

(Table V)

History of Type of Land Tenure
in the Jordan Valley
by Percentage

<u>Type of Tenure</u>	<u>1961 Survey *1</u>	<u>1973 Survey *2</u>	<u>1978 Survey *3</u>
Owner-Operator	32.5	35.9	34.0
Sharecropped	39.0	47.2	59.3
Cash-Rent	1.8	2.7	N.A.
Mixed	26.7	14.2	6.7

Source:

*1 Department of Statistics, The East Jordan Valley, A Soil and Economic Survey, 1961 (pp. 159).

*2 Department of Statistics, Social and Economic Survey of the East Jordan Valley, 1973.

*3 Department of Statistics, Social and Economic Survey of the East Jordan Valley, 1978.

reform started at the inception of the Jordan Valley Development Program. There are 48 villages and settlements in the Valley. Scattered homesteads are included with the nearest population centers. Four principal villages are included with the nearest population centers. Four principal villages have a population of over 3,000 people; seven villages have a population between 2 to 3,000 people; ten have a population between 1 to 2,000 people; nine have a population of 500 to 1,000 people; 11 have a population between 200 to 500 people and seven villages have less than 200 residents each. The largest two towns in the valley with established municipalities are North Shuneh (pop. 7662) and Kareimah, (pop. 6678). Mashari, South Shuneh, Karamah and Deir Alla have a slightly less population. According to the Government of Jordan, a municipal status allows a village to benefit from the collection of property taxes within its jurisdiction. Also the community is entitled to receive income from issuing permits and licenses and can share in receiving income from gasoline taxes, custom duties, vehicle registration, fines, etc. Under Jordanian law any village which has had a village council for a minimum of five years and has a population of 2,500 people or over may petition the Ministry of Municipal and Rural Affairs (MOMRA) to change its status to that of a Municipality. Some of the smaller villages are incorporated, which means that they have complied with the law that requires them to have a minimum 1,000 residents; 100 houses and a minimum total of 180 taxpayers. Therefore, they become entitled to establish a village council and obtain an incorporated status. This status automatically grants them taxing power and permits them to collect head, livestock and agricultural production taxes. Also they may acquire the ability to obtain loans

from the Municipal and Village Loan Fund (MVLFF) and acquire authority to independently disburse collected taxes.

Most villages have water supply systems or reasonable access to drinking water. Average water consumption has been estimated at 20 liters per capita per day as compared to 40 to 80 liters for the larger cities in Jordan.

Village clinics are operated primarily by health workers who live or commute from other villages. A doctor may visit a clinic twice a week for a few hours per visit but due to his short visit, may not be able to provide adequate services. The problems appears to be that of staffing the clinics with adequately qualified personnel rather than the availability of physical facilities because of the concentration of physicians in the capital city and in larger towns. Midwives and paramedics are few and health workers from other communities often find it difficult to find available abodes to reside in the village. Similarly, education problems do not lie in the unavailability of school facilities but rather in an inadequate number of qualified educators. There are primary schools in most villages and some secondary level schools in the larger villages which appear to meet the needs of the inhabitants. The problem has been debated as to whether the educational curriculum really meets the rural needs of the villagers or creates expectations among rural students which result in their migration to cities. Furthermore the schools are not normally utilized as community development centers for vocational training or other communal village activities.

Except for seasonally underemployed small cultivators with economically unviable plot sizes or tenants unable to make a satisfactory living in the valley, migration trends have been toward the Valley as evidenced by the increasing population in the valley. Further development of valley potential would require the improvement of amenities available to residents and the introduction of income generating activities to enhance further migration to the valley. Unlike other areas in Jordan where villages have an economic base consisting of a diminishing agricultural and pastoral sectors and increased out-of-village employment; valley trends appear to draw migrants to share in the new land ownership opportunities, sharecropping and in spinoff activities. Already the population is thought to have passed the 90,000 mark in 1980 with an annual increase projected at 10 percent until all the irrigable land has been developed.

HISTORY AND DONOR SUPPORT

The Jordan Valley was selected for development because of its high potential for production growth through irrigation and is contemplated to form a viable agricultural base and a stable economy. Also it has potential to produce a dependable source of food supplies to meet the needs of Jordan and to conserve Jordan's precarious balance of payments. However, the hostilities of 1967 and subsequent internal strife which lasted until 1971 had an adverse effect on the rate of its development and is estimated to have set this back by several years. During these conflicts irrigation installations were destroyed or fell in disuse as the pre-war population estimated at 90,000 people abandoned their homes. An estimated 7,000 out of 14,500 homes were reported destroyed and the Khalid Ben Walid Dam, the predecessor of the Maqarin Dam scheme, which was designed to hold 200 million cubic meters of Yarmouk River water, and whose construction was started in 1966 was suspended.

The U.S. AID and its predecessor agencies have been the principal donors in the development of the Jordan River Valley. Their effort started with the construction of the East Ghor Canal begun in 1958 and culminated with some 17 ongoing projects in 1980 dealing with institutional infrastructural development and technical assistance activities. Many of these impact directly on Jordan Valley development.

Since the end of hostilities in 1971, the Government of Jordan developed a 1973-75 plan for the rehabilitation and development of the Jordan Valley and with assistance from donors, the irrigation system

was reactivated. The fields began to produce again as observed in the increased value of agricultural exports which were reported to have progressed from \$117 million in 1974 to \$180 million in 1978. Also the number of landowners increased to 4,475 in 1973 (the last social and economic survey) and hundreds of dwelling were constructed and most of the farmer residents returned to their land.

The first impetus to valley development was begun by the AID funded East Ghor Irrigation Canal. The project included a major diversion tunnel, 43 miles of main canals, 247 miles of lateral canals and storage and drainage facilities and provided an irrigation system for 120,000 dunums. The net income per dunum increased from \$6 in 1959-50 to \$40 in 1965-66 and to \$80 in 1976-77 under surface irrigation methods. Total income in the project area arose from \$1.2 million in 1959-60 to \$9.5 million in 1965-66 and reached about \$30 million in 1976. Equally the land tenure component of the project had an impact on equitable land distribution and on the welfare of farm owner operators and tenants.

Several other projects followed the East Ghor Canal. Among them was the East Ghor Rural Development project which funded the infrastructure required for the valley agricultural development. This project is reported to have provided 186 miles of farm to market roads, three multi-purpose farm cooperative centers as well as agricultural credit and health facilities. Other projects provided training, agricultural extension and technical assistance to the cooperative societies.

Following the restoration of peace in 1971, AID resumed its assistance effort to Jordan Valley Development. Some of the projects undertaken dealt with the improvement of irrigation and water management techniques, horticultural crop production, provision of credit to small farmers, upgrading of roads and agricultural marketing, building schools and construction of clinics and housing for government officials assigned to the Valley. It also provided supported to the Jordan Valley Authority, Jordan Valley Farmers Association, the University of Jordan and the Ministry of Agriculture and provided consultant services, participant training for advanced degrees in agriculture in the United States and other technical assistance activities required to develop the infrastructural capacities of these institutions.

A Yarmouk to the Dead Sea Road (62 miles) was widened and resurfaced in 1976 and resulted in a vehicle traffic increase from 923 vehicles before improvement to about twice that number in 1980. Within the East Ghor Canal Extension project, a dam was constructed on the Zarqa River, a canal was built to deliver water to the East Ghor Canal and lateral canals were added. Under the Zarqa Triangle project sprinklers and a Sprinkler Irrigation Equipment project was initiated.

Different phases of Village Development Projects have been providing ongoing basic social and economic infrastructure. The first phase funded 25 schools, 10 health clinics, 8 local and government administration buildings and 300 houses for government workers, home mortgages, improvement of village streets and water systems. The second and third phases will fund additional construction of schools, clinics, community

and municipal buildings, and provide mortgage funds for improved housing.

Under the Village Development projects infrastructure will be provided and will have considerable impact on the target group as evidenced by the great demand for these services and the population movement to the Valley.

An AID Malaria Eradication Project begun in 1958 and phased out in 1970 helped in eliminating malaria from Jordan. Prior to this project, this debilitating disease lowered worker productivity and sharply hindered Valley development. Its effective control in reducing human misery and increasing worker productivity has been a key factor to rapid expansion of the agricultural development in the Valley. Prior to this advent the Valley was a dreaded place for residents and a source of health hazard to settlers. AID supported geographical reconnaissance activities and was able to locate and eliminate the anopheline mosquito breeding areas completely by anti-larvae, residual spraying and swamp drainage activities throughout the valley. In 1970, the government Malaria Eradication Services took over this activity and has been successfully able to monitor and continue the implementation of this program.

WATER AVAILABILITY

Water is the prime limiting factor to agricultural development in the Jordan Valley. It determines the cropping pattern to be followed by farmers and the number of crops to be grown and rotations to be practiced.

Several studies have been made so far to assess the total available water resources for Jordan, i.e. surface, replenishable surface and groundwater. However, because of the paucity of data and the variable rainfall, estimates have varied from a total replenishable resource of 625 million cubic meters (MCM) of which 77 MCM originate from underground water resources to a total of 1,100 MCM of which 220 MCM are from subterranean sources.

Irrespective of the total available water resources, the concensus is that 450 MCM of water are presently used annually in Jordan of which 400 MCM or 89 percent are for irrigation use (mainly in the Jordan River Valley); 40 MCM or nine percent for domestic use (urban and rural) and 10 MCM or two percent for industrial use. With an estimated population of 2.2 million people, at present, the availability of 40 MCM provides an average 40 liters (10.5 gals.) per capita per day which is probably half the quantity required in most developed countries to maintain minimum hygienic standards. It is estimated that the population would have doubled in the year 2000 A.D. and an expanded consumption rate of 80 liters per capita per day would require 160 MCM for municipal use in addition to another 25 MCM for an expected growing industry which would leave 440 MCM for agricultural use; an amount close to that used today. All from a total replenishable resource of 625 MCM.

Domestic water demand in Jordan is currently more than double the available supplies. Consequently water is rationed in cities and distributed to each area on an intermittent basis which is often once a week. This has been due largely to the rapidly growing urban population which has changed Jordan from a predominantly rural to an urban society with 1.8 million people or 82 percent urban dwellers and only a 0.4 million rural population of whom about 10 percent are entirely engaged in agriculture. The water situation is exacerbated further by the fact that over 50 percent of the urban population is concentrated in the Amman-Zarqa area where only an estimated six percent of the usable water resources are found. Consequently water is an expensive item for which consumers pay 1.25 JD (\$3.83) per cubic meter (264.17 gallons) of potable water delivered by water tank to their homes from private sources and half that amount when delivered from municipal sources.

To meet the increasing needs of the urban population for domestic water; irrigation of agricultural crops would have to take a second priority. This has resulted in pressure to increase efficiency in farm irrigation practices through better crop management technology, improved water conservation techniques and utilization of crops with high water efficiency. Farmers are now charged three fils (1 U.S. dollar=300 fils) per cubic meter of water for irrigation purposes from the East Ghor Canal and which constitute about half of its actual cost to the JVA.

The Maqarin multi-purpose dam, Jordan's last substantial available water resource development, on the Yarmouk River, is intended to regulate

the flow of the Yarmouk River and provide the following tentative supplies of water:

1. Provide 120 MCM of water for municipal and industrial use (principally for Irbid and Amman).
2. Supply sufficient water to supplement the currently irrigated area of 240,000 dunums in the valley in addition to the possibility of irrigating another 120,000 dunums.
3. Provide 25 MCM for industrial use.
4. Generate hydroelectrical energy as a by-product of water release for municipal, industrial and irrigation use.

This water will increase the value of agricultural crop production by encouraging production of high value off-season fruits and vegetables.

The project as tentatively proposed by the Jordan Valley Authority will include the following:

1. An earth rockfill dam at Maqarin with a reservoir elevation of 170 meters (crest elevation 178 meters) and a storage capacity of about 300 MCM.
2. A diversion of Wadi Raqqad in Syria into the reservoir.
3. A concrete diversion weir on the Yarmouk River at Adasiya and diversion weirs on three sides.
4. Power plants at Maqarin and the King Talal dam.
5. Rehabilitation of the East Ghor Main Canal, its automation and extension.

6. A piped water distribution system for the irrigation of new lands in the valley.
7. Conversion of the present surface irrigated area to a piped pressure distribution system to use modern irrigation systems.

The IBRD tentative cost estimate at October 1979 prices for the dam, at a crest elevation of 178 meters, was \$817 million in addition to a water supply component that would require an additional \$350 million for water conveyance to Irbid and Amman.

The waters of the Jordan River emerge from Lake Tiberias and flow into the Dead Sea are too saline for irrigation because of water diversion from the lake and diversion of salt springs into the river. The flow of the streams of its tributaries in the river vary with the seasonal rainfall and salt content is reduced during the winter flow. The Yarmouk River is its largest tributary joining it at about seven kilometers below Lake Tiberias at the village of Adasiya (Table VI).

(Table VI)

Jordan River Tributaries With Drainage
Area and Water Flow

<u>Tributary</u>	<u>Drainage Area (Km²)</u>	<u>Maximum Mm³</u>	<u>Maximum Mm³</u>	<u>Average Mm³</u>
Yarmouk River	6.805	870	240	438
Zarka River	3.440	148	29	85
Wadi Arab	254	42	14	35
Wadi Ziglab	107	16	7	13
Jurum Wadi	27	15	9	13
Wadi Yabis	131	11	1	6
Kufrinja Wadi	119	25	2	12
Water Rajib	80	8	1	4
Wadi Shuaib	187	20	4	11
Wadi Kufrein	161	26	3	12
Hisbar Wadi	90	9	2	2

Source: Jordan Valley Development Plan (1975-1982)

SOCIAL ANALYSIS

The Jordan Valley is a socio-economically differentiated region with a population growth attributed mostly to in-migration. Many of the older villages in the valley are of tribal origin and claim title to their land from the period when the British had the mandate over the country. Prior to that period the Jordan Valley was Masha' (state-owned land) grazed by livestock herded from Palestine, TransJordan, Syria and even Saudi Arabia during the warm winter months. The bulk of new settlers moved in the valley after the regional conflicts in 1948 and 1967 and foreign labor was brought in only in recent years when Jordan became a labor short country.

The population is predominantly moslem. The older villages are of tribal origin, homogeneous and have their own separate tribes. A tribe (Asheera) is subdivided into clans (hamulas) and a hamula is subdivided into several families (Iyal). The individual family (ayla) consists of the parents with their married and unmarried children and sisters and brothers. A village may have one or several Asheeras with each subdivided into several clans and families. Each clan and its sub groups is represented by a Mukhtar (chosen leader) who is selected by senior Council members of the clan and who holds tenure of office for life. However, he may be recalled by a majority vote of the clan and its subgroups. This occurs should he disgrace his clan or manifest poor judgment not compatible with the sensitivities and values of his tribe, or if he manifests senility.

There is more than one Mukhtar in a village with the largest clan naming their leader as Mukhtar Awal (1st leader) and the less numerous tribes having a representative who is a Mukhtar Thani (2nd leader or representative). There are seldom more than two such elected leaders in a village although there may be more than two ethnic tribes.

An elected leader must be officially approved by the government and is issued a seal with his name engraved on it. He uses it to stamp official deeds and affidavits dealing with village affairs that may be of concern to the village, the national government and the courts. He can be an opinion molder in the village and have sway and influence over village affairs and can effectively relate micro service allocations to the social structure which is significant in the adaptation of new technology and development. However, an illiterate leader, although selected by the tribe, can be denied approval by the government as he must be capable to comprehend the documents upon which he affixes his seal.

A paternalistic approach is engrained in the young. They normally hold their elders in esteem. Member clans have an unwritten comprehensive code of social ethics to conduct the most minute details of behavior in village affairs. This code constitutes a veritable village constitution and a social protocol. It is a carryover from tribal customs of previous generations passed on by word of mouth to the new generations and is implemented ^{especially} in times of celebration of the three important events in the lifetime of a villager, i.e. his birth, wedding and death. This code sets out detailed procedures between families, clans and tribes and includes comprehensive measures taken in the celebration and commemoration of events and condolence or assistance to be rendered in the event of bereavement and catastrophe.

Deviation from the strictures breeds enmity and discord in inter-village affairs and in their interrelations, therefore; the code is jealously guarded by village elders who consider themselves guardians of the village image.

The code of ethics which regulates proper behavior among men and women adjudges women in high esteem. Any deviation in behavior toward women calls for serious inner council meetings of the family or the clan. Serious infractions of the code can be reason for inter-tribal council meetings and may result in grave consequences to the village. Deviation by a woman from the accepted norms of ethics, especially in regard to chastity, can bring dishonor to her family and clan and may engender, in case of involvement by another tribal member, endless bloodshed and feuds. The closely knit paternalistic relationship of both sexes is maintained by necessity among members of the clan with men looking over women out of self interest, more than piety, to preserve the code of honor (sharaf) of the village which is jealously guarded by village residents.

Born out of this paternalistic society is a moral responsibility incurred by the young toward their elders for their upbringing. They reciprocate by taking care of their elders in their old age and infirmity. Subsequently, there is little or no external welfare for the elderly as each family accepts responsibility for the support of its aged members.

Relations between the different tribes are structured formally on a protocol basis in matters of marriage, sale or transfer of property, land tenure arrangements and other transactions where certain priorities

are given by right to close relatives and members of the clan over strangers and non clan members. Social, economic and civil disputes are usually resolved in tribal councils at the village level and only those beyond their scope of authority are referred to the Sharia and Civil courts in Amman. Villagers pride themselves in resolving their own disputes without resorting to outside village authority and in making their own solutions with collective decisions. Similarly, they are anxious to adopt new technology and innovations that would improve their individual and collective socio economic status in competition with other villages in the area.

The newer villagers are of heterogeneous origin and do not consider the Jordan Valley as native land since they became settlers only as a consequence to the regional conflicts of 1948 and 1967. Hence, they do not necessarily subscribe to the code of the older villages. They include a mix of commercially active individuals, farmers, tenants and landowners in comparison to the older villagers who are the progeny of former nomadic tribes who used the valley for centuries as grazing grounds for their livestock.

Unemployment is low in the valley although there is underemployment due to fluctuations in the labor force because of the seasonality of agricultural operations. These operations peak in the southern end of the valley in November; in the central part of the valley in January and in the northern end of the valley in April and decline sharply in late Spring and in Summer. The reason for these fluctuations is due to the limited availability of irrigation water for further cropping and the temperature

variation at different times of the year in different parts of the valley. Subsequently farm laborers have extended employment opportunities over a longer period of time and can move from one end of the valley to the other in pursuit of farm work.

With the advent of irrigation development and the scarcity of labor, Egyptian and Pakistani laborers have been brought into the valley. There were about 3,000 unskilled Egyptian laborers in the Valley and about 300,000 in the whole country in 1979. They usually migrate to Jordan without their families and accept lower wages. Many earn an average monthly payment of JD 45 (\$150) for six day work weeks and are thought by landowners as hard workers.

Employers esteem their labor and often provide them, in addition to their pay, with food and lodging. Even some Egyptian university students are known to migrate to Jordan and work several months in the valley during the winter months. On the other hand, Jordanian laborers may work by the hour and may receive 1 JD per hour although most work for JD 3.5 to 5.0 per day. The reason given for their higher pay is due to the alternative employment opportunities available to them in Saudi Arabia and the Gulf States where their labor is in demand. Also there is an estimated 7,000 Pakistanis who usually bring their families to Jordan, and like the Jordanians, demand hourly wages and opt for shorter work days.

The per capita income of sharecropper tenants in the valley was estimated at \$400 in 1979 and is lower than the national per capita income of \$1,050 (Table VII). However, this can be substantially higher because of other employment opportunities in the valley and in the housing

T A B L E VII

Annual Per Capita Income Distribution
for 1974-1979 JD

	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Total Population	122	134	174	190	220	320
Agriculture Sector	70	60	90	90	110	N/A

Source: Jordan Department of Statistics

construction industry in the cities.

A high social status in the village is usually conferred upon those whose wisdom have been tested in the inner councils of the village and who have been adjudged to be prudent and wise. Next on the ladder of social esteem are teachers and clerics of distinction and the elderly who command respect commensurate with their age and demonstrated wisdom. Curiously, the economically wealthy may carry little deference among their compatriots unless they possess weightier qualities than wealth alone. However, the forces of modernization that are taking place due to the expansion of irrigated agriculture are slowly making inroads on long embedded social stratification values and accelerating social change. Village development projects, availability of education, land reform and land distribution are forming new socio-economic identities and are helping in making serious inroads on the age old traditional values. By way of example, the enormous prowess previously flouted by large landholders among their villagers have been reduced to a reasonable proportion. However, the social structure in the tribal village remains intact except for cracks in the old armor of traditional values which are beginning to take place. Many of these changes are loathed by the conservative old but welcomed by the young.

Pertinent to the physical development taking place in the valley, the government is making a serious effort to settle farmers, laborers and other workers in the valley on a permanent basis. The construction of road networks, clinics, schools, rural electrification, water supply sources, houses and mortgage availability for home construction and credit

for the procurement of inputs and equipment are tangible evidence toward that end. The creation of this infrastructure and accompanying institutions are hoped to encourage settlers to devote their full energies to valley development on a permanent basis. The government expects the population increase to level at 150,000 people when all irrigable land is fully irrigated.

The five population centers (see map) which form the hub of trade and commercial activities in the valley, i.e., North Shuneh, Wadi El Yabis, El Arda, Karameh and South Shuneh are likely to reach 10,000 to 15,000 residents each as planned by the Jordan National Planning Council. They will eventually become the centers of supply commerce and marketing for their immediate vicinities. Already the population in these towns have made significant growth in recent years, especially in North and South Shuneh. Both of whom have served as historical landmarks for tribal encampment and to travellers from adjacent countries who herded their livestock to graze in the valley. The residents of South Shuneh who take pride in their ancestry to the Adwani tribe in the southern part of the valley and those of North Shuneh who attribute their ancestry to the Ghazawi tribe at the northern end of the valley may well form the two principal centers of commercial activities for the entire valley.

BEDOUINS:

Nomads are not included in the statistical surveys of the Jordan Valley and are not considered by census takers as bona fide residents of the Valley because of their mobility. They live in woven tents spun from goat hair along the roads and foothills of the escarpments and constitute an estimated 2 to 5 percent of the valley population. The higher percentage of their population is during the winter months when the valley is relatively warm in comparison to the plateau and there is more vegetation available to graze their livestock. The lower numbers are during the hot summer months when much of the vegetation in the valley is exhausted and dried out. The free bedouin way of life supplements the economic ancillary mode of land cultivators. Bedouins own most of the sheep, goats, and camels in the valley and make maximum use of wild vegetation sprouting along the canals, wasteland and crop remnants left after the crop harvests. Because of their mobility they are in a position to literally follow the clouds in quest of moisture and grass that may sprout shortly after rain showers in the area.

Bedouins render a useful service to valley residents. They provide the ancillary population with their meat requirements from the sale of their sheep, goats and camels and supply surplus milk and butter. An average sale price of goats, sheep and camels was, at 1979 prices, \$80, \$120 and \$320 respectively. Sheep meat is in greatest demand by villagers and commands the highest price, followed by goat meat. Camel meat is consumed by the poorest of the population who could not afford to purchase mutton or goat meat. Goats produce an average of 45 liters of milk, sheep 75

liters and camels 120 liters annually. Unmarketable surplus milk is transformed into shortening (saman) after hours of shaking the milk in a goatskin hitched on a tripod; a chore which is usually performed by women. The leftover skimmed milk is hardened into solid dried balls of kushik or jamid and is therefore easy to store, sell or transport. The kushik is easily recycled into skimmed milk upon being soaked in water in a vessel and agitation by hand. The hair and wool are sold and sheep skin serves as mats and goatskins as containers to transport water or other liquids or used for leather for shoes.

Settlers of both tribal (homogeneous) and new migrant (heterogeneous) groups interact compatibly together and a new feeling of interdependence has developed between them over the years. This has replaced the initial resentment held by the older residents against new comers when they first came to settle in the valley. The new settlers who work as farmers, sharecroppers, land renters, traders, marketing agents, mechanics and perform a wide variety of chores have slowly gained the confidence and respect of the older settlers who still retain their nomadic love for freedom and dislike being tethered to the land.

Most of the new settlers were experienced cultivators before they came to the valley although not necessarily in crop irrigation. Many chose to settle in the valley from necessity rather than choice and have since conscientiously begun to adapt their Arabic accent to the indigenous bedouin dialect to harmonize with the older inhabitants of the land. Government policy in the distribution of new lands does not appear to differentiate between them and a healthy mix of old and new villagers find themselves

working in harmony. This interaction is manifested more among the younger generation who faces the same technical problems and challenges in crop production under irrigated conditions. The complexity of their situation heavily entails risk taking, business acumen and need for decision making in dealing with farm mechanization, chemicals, fertilizers, credit, equipment and marketing operations in a new technological package with which they have had no previous experience.

(Table IX)

AMOUNT OF CREDIT BY SOURCE ON TENANT'S FARMS
IN THE JORDAN RIVER VALLEY

Area	No. of Tenants	No. of Tenants Involved in Credit	Source					Total
			Cooperative	ACC	Landowners	Commission Agents	Relatives, Friends	
hern Ghor	73	25	160	150	208	1080	2630	4
le Ghor	83	58	550	55	990	7063	2300	10
hern Ghor	54	34	30	0	1615	2463	1195	53
1 .	210	117	740	205	2813	10606	6125	20

Source: Economic Research Department Survey (1974)
Royal Scientific Society

BENEFICIARIES

All residents of the Jordan River Valley will stand to benefit from the projected Maqarin Dam during and after construction and from subsequent development projects. The first priority of the waters of the dam are earmarked for allocation for municipal use to alleviate the acute water shortage in Amman and Irbid, the largest two cities in Jordan in order to enable them to meet the requirements of a booming urban population. The second priority will be given to support crop production on a year-round basis. The hydro-electric use of the dam will provide electricity for the valley and will be fed into the national grid system as well as help the budding industrial development in Jordan.

Benefits will accrue to residents from direct employment in dam construction, increased crop production due to stable irrigation water supplies and the expansion of the irrigated area. Also commercial and trade activities related to the domestic and export markets and the processing and preservation of agricultural crops will be increased. All of this will contribute to an improved standard of living and an increased foreign exchange earning from export.

Projects executed by the Jordan Valley Authority so far have laid down the needed basic infrastructure focused on general and comprehensive development. For instance, the road network constructed in the valley will promote the welfare of all residents in addition to developing economic and social contact within the valley and with the rest of the country. The roads will facilitate bringing in services and commodities to residents at reasonable cost which would otherwise be beyond their reach. Road traffic increased considerably since the roads were built and

a daily vehicular circulation count of some 900 vehicles per day before the road construction had more than doubled in 1979. Clinics, so essential to the well being of residents, now bring health services directly to residents including some having hospital beds. Schools at both primary and secondary levels for boys and girls provide the education needs for the children of valley residents at no cost to their parents. Rural electrification has transformed the valley from an isolated area to an integrated part of the country, providing light, refrigeration, television from Jordan's two channels, power to support backyard industries and garment manufacture by women using sewing machines to design and produce local apparel. Potable water now provides residents with wholesome water supplies in lieu of previously scarce and contaminated supplies.

Subsequent to these activities, trade centers, supply and repair services for agricultural equipment and machinery, light industries, furniture manufacture and other allied industries have sprouted to meet the needs of residents.

Farmers have rapidly become entrepreneurs with considerable capital investment (owned or borrowed) to procure irrigation equipment, machinery, seeds, fertilizers, pesticides and packing boxes for marketing. Their outlook has been transformed from that of subsistence farming to agribusiness enterprises and can compare favorably with farmers in many developed countries. In some instances, farmers have manifested impatience with the bureaucracy of their government to move forward. For instance, they plunged into drip irrigation from second to none in 1974 and currently have several thousand dunums under this type of irrigation system.

Government agencies were slow then to realize the importance of this water saving irrigation system in the water short Jordan, and for years refused to grant credit for the purchase of drip irrigation equipment until farmers and suppliers had proved its effectiveness. The government had to relent and change its loan policies belatedly and now provides considerable loans for this type of irrigation equipment.

Some investment capital is now being made in the valley by business entrepreneurs out of the valley who provide commodities, supplies and services to the growing population. Also organizations such as the Jordan Valley Authority and the Jordan Valley Farmers Association were formed as proof of the government commitment to continue valley development.

It is difficult at this stage, without available detailed statistics, to attach money value or perform a realistic cost/benefit analysis on the comprehensive development of the project. No measure of life span improvement, better food diets, increased individual production through better health services, educational attainment, welfare and amenity development have been made. However, it has been estimated that 80 percent of the reported 4,045 tractors in the country in 1977 were used in the Jordan Valley. Also most of the 16,708 tons of fertilizers and 1,451 tons of pesticides imported by Jordan in that year were earmarked for Jordan Valley village use (Table VIII).

The following can be listed as some of the benefits received, directly or indirectly, by the target group from the irrigation component in the valley:

T A B L E VIII

Reported Tractors in Jordan (1973-1977)

	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
a. Tractors sold:	284	203	201	166	160
(tracked)	11	-	13	2	-
(wheeled)	273	203	188	164	160
b. Operating tractors including (a)	3,344	3,547	3,748	3,914	4,047

Source: Jordan Department of Statistics (Table 91 pp. 132) 1977.

Fertilizers and Pesticides Imported in
Jordan in Metric Tons (1973-1977)

<u>Year</u>	<u>Pesticides</u>	<u>Potash</u>	<u>Phosphates</u>	<u>Nitrogenous</u>	<u>Other Other Fertilizers</u>
1973	737	742	3,504	6,125	5,456
1974	738	310	2,712	8,185	2,743
1975	621	961	4,384	1,107	5,855
1976	664	4,425	3,375	15,168	987
1977	1,451	7	2,723	13,205	773

Source: Jordan Department of Statistics (1977).
(Table 101 pp. 141)

1. The number of landowners expanded at a great rate. There were 4,475 landowners reported by the Jordan Department of Statistics in 1965 with an average of 40.5 dunums. More recent information reported by IBRD indicates that there are 4,970 owners of the current irrigated area with an average size holding of 24 dunums. About 60 percent of these holdings have sharecroppers under various tenancy agreements which indicate that 7,000 farm families or 39,900 individuals (at 5.7 people per family) would benefit from the project.
2. The new land distribution under the Jordan Valley Development Law will limit land ownership up to 40 dunums per landholder as applied in the case of the original East Ghor Main Canal which will benefit another 4,000 families or 22,800 individuals.
3. Will obtain irrigation water at less than cost from the JVA.
4. The Jordan Valley Farm Association was established in 1974 with "objectives to develop agriculture in the valley, enable farmers to participate in formulating and implementing government agricultural policy, to increase their participation in the development of the national economy, to ensure equitable earnings for them and to increase food production through optimum utilization at minimum cost of arable land and water resources in the valley."^{1/}
To attain these objectives, the JVFA was authorized to "provide loans and agricultural inputs needed by its members for agricultural

^{1/}

Bylaws of JVFA

production; undertake agricultural operations common to its members, such as pest and insect control, harvesting and transportation of crops to marketing centers including their sorting, packaging and preparation for marketing according to the conditions and specifications laid down by competent government authorities and to sell and market the agricultural crops of its members.^{1/}

There are about 4,000 members in the JVFA. Membership to farmers is automatic, provided they exploit a farm unit in the irrigated part of the Valley on the basis of ownership, sharecropping and/or rent farming. Sharecroppers can join the JVFA provided they make decisions dealing with the production and marketing of crops. Absentee landlords and day or seasonal laborers are not allowed to join the association.

The JVFA became fully operational in 1979, rendering credit, supplies and services to members at cost. Some materials such as wettable sulfur are offered to members at a considerable reduction in price as compared to commercial sources in Jordan. Tractors are rented out with their operators to members on an hourly or daily basis at cost. JVFA is expected to operate the El-Arda Marketing Center by 1982 since that center is currently operated by the JVA.

The transition of agriculture from traditional to modern agricultur and the need for timely inputs has accelerated the need for capital and credit. Subsequently JVFA gave 1,203 short-term loans to its members by the end of August 1980 in the amount of JD 675,069 at seven percent interest thus sparing them a 30 percent rate charged by non-institutional

^{1/}
Ibid

sources.^{1/} It is noteworthy that 47.6 percent of loans from this AID-provided loan fund (during the period March-May, 1980) were rendered to sharecroppers who are members of JVFA.

According to a random survey made by the Royal Scientific Society, Economic Research Department in 1974, the source of tenant credit was shown to be mostly from relatives, commissioners and landowners (Table IX).

5. Under the Jordan cooperative organization law, designed to encourage the cooperative movement, 27 cooperatives with 2,400 members were established in the Valley by 1979.

6. According to IBRD, an economic rate of return of 12 percent on irrigation works and 14.5 percent from municipal and industrial water use will be realized from the water resource development in the Valley. However, JVA consultants estimate the overall economic rate of return at 14 percent.

Economic analysis indicates the rate of return on the new lands component will depend on the implementation rate. The rate of return in the land conversion to irrigated land will hinge on production costs and will depend on the rate of returns from the new lands. Also project modification will probably be required in the process of planning and implementation as components are further reviewed and analyzed.

^{1/} 336 loans were made for JD 155,312 in 1978; 431 loans for JD 236,257 in 1979 and 436 loans for JD 281,500 by the end of August 1980. The average loans given were JD 462 in 1978, JD 548 in 1979 and JD 646 by August 1980, respectively. (Amman 5919)

Cost Benefit Appraisal

A cost benefit analysis of the East Ghor Canal Project and the forthcoming Maqarin Dam are beyond the scope of this paper. However, broad comparative advantages and the general methodology of cost benefit analysis are briefly discussed here. Data for project cost would have to include the following: (1) opportunity costs of money (2) public and donor investment in the project (3) JVA/GOJ operating costs and (4) value of production with the existence of the project and without the project. The rapidly escalating inflationary prices on project analysis would make it necessary to translate all price data into constant Jordanian Dinars by computing a GNP deflector using, say 1978 prices as a base.

Undoubtedly, the East Ghor Canal project brought marked changes in the cropping patterns of the Jordan River Valley and considerable increase in output per cultivated unit. A comparison of production before the advent of irrigation and the current situation leaves little doubt that the project has made a profound impact on the valley and its people. The construction of the Maqarin Dam, will furthermore, attempt to complete the cultivation of the irrigable land in the valley. To examine the financial costs and benefits of the project that are quantifiable and to determine the justification of the project in economic terms, one will need to consider the social and economic factors that can be identified but not readily quantified. Therefore, an analysis will be needed to provide information for making the basic comments relevant to project implications in an extended cost benefit analysis.

To undertake a financial cost benefit analysis of the project, in the absence of available data, certain pragmatic assumptions will need to be made. Among them is the expected life of the project which is set for fifty years from the completion of dam construction after undertaking engineering studies to evaluate the sedimentation rate in the reservoirs behind the dam in order to provide data to be used for the assumed project life and an assumption of the date at which the analysis is to begin.

Since construction has been added in increments from the initial completed construction date in 1966; prior increment costs would have to be treated as sunk costs and additional increments will be added to the cost data of 1966, discarding project benefits and operating costs prior to that period.

Net returns per irrigated unit for each project year from 1966 to 2016 will be required along with the number of dunums for each crop; the gross income, production costs of labor, water, rent, seeds, fertilizers, pesticides, equipment, marketing charges, taxes, credit, interest, inputs per dunum and total net return. Banana plants and citrus trees will not yield commercial crops for the first 14 months and four years respectively and should therefore be noted.

The price data will be used in constant 1978 Jordanian Dinars for the period 1966-2016 and the gross revenue will be computed using the price data for each crop grown each year under the fixed irrigation methods prevalent in the Jordan Valley, i.e. by drip, sprinkler, plastic tunnels and gravity irrigation methods.

The value of the animals raised and their products of milk, meat, hides, manure; poultry and eggs used by the consumers and marketed will also need to be treated as a project benefit from livestock. From 1984, when the Maqarin Dam, let's say, is completed, to 2034 the valley will come almost under full irrigation and there will be some increase in irrigated area and improvement in production due to improved extension and research services in crop and irrigation operations that would have developed by that time.

The labor cost will be computed at the local wage rates and water cost will be computed on the basis of optimum water requirements for each crop grown (in cubic meters of water multiplied by the ongoing water cost).

The primary beneficiaries from the project will be the residents of the valley and will include farmowner/operators, sharecroppers, renters, farm laborers, JVA/GOJ and consumers. The secondary beneficiaries are the suppliers of agricultural inputs, transport, credit and agricultural traders of farm products and agricultural industries. Benefits to JVA are the receipts from water sales which are treated as a cost of production element and GOJ receives tariffs on imported capital equipment as well as export charges, foreign exchange and improvement of the balance of payments. The benefits to consumers will include producers and rural and urban consumers.

A major outcome of the project is the increase in the availability of food crops that are consumed in the country and the improvement of the national diet at affordable prices by consumers.

The population would not have been there nor

would it have had this food resource and alternative sources of food supply without the project. Also a relatively higher proportion of the population's disposable income would have been spent on food without the project. However a direct measure of consumer gains is complex. This complexity would necessitate an alternative indirect measure of gains which would probably underestimate the real consumer utility culminating from the project. Knowledge of market demand functions for each of the major food commodities produced for each year during the viable life of the project, their market price and disposable income without the project will have to be estimated. Would the immigration to the valley have occurred if there was no project? What would be the income and price levels that would have prevailed without the project? and what would be the number of the population under varying assumptions? A strategy will need to be developed to derive an estimate of reasonable gain in consumer welfare because of the project and an estimate of savings that consumers would make from not having to import these crops and the nutritional loss they would have suffered during each of the years of the life of the project without the existence of this project will be calculated.

The direct cost of equipment and infrastructure of the irrigated valley area, electricity and industry generated from the dam and benefits derived therefrom will be taken into account. Also since the electricity generated is fed directly into the national grid it will produce receipts and benefits for all the participating population in the country and will need to be prorated.

Agriculture

The primary objective of agricultural development in the Jordan River Valley is to maximize farm productivity and profits with new farm technology. It is said that crop production thrived in the Jordan Valley in ancient times and subsequently was neglected as the valley drifted into a pastoral economy before its recent rejuvenation with the advent of irrigation from the East Ghor Canal. This canal utilizes water diverted from the Yarmouk River, Ziglab and King Talal (completed in 1978) reservoirs as well as side wadis along its course. Construction of the canal was begun in the late fifties and several extensions have been made since then, bringing its total present length to 96 kilometers. With the contemplated construction of the Maqarin Dam this will enable the extension of the East Ghor Canal by another 14.5 kilometers to the Dead Sea thus permitting irrigation of land in the southern extremity of the valley in addition to providing municipality water to Irbid and Amman.

The valley is endowed with high agricultural potential. It lends itself for growing winter vegetable crops out of season and has adequate fertile soils to grow high value crops. Farmers appear to be inclined to direct their energies and investment capital to modern agricultural technology when provided with technical advice. They currently grow citrus, bananas, tomatoes, cucumbers, eggplants, peppers, muskmelons, watermelons, beans, okra, and squash throughout the valley.

Irrigation water is provided by both surface water flow and underground sources. The former stems from the East Ghor Canal and side wadis in the North and Middle Regions of the valley under the control of the Jordan Valley Authority while the latter are from privately owned wells in the southern region of the valley. The following irrigation systems, with a list of their advantages and limitations are practiced throughout the valley:

1. Surface irrigation is the traditional gravity flow method in which water is regulated to flow in furrows where the crops are planted and has the following advantages:

- a. It is the most familiar of irrigation systems to farm labor.
- b. It has low capital investment and low cost for water distribution.
- c. It causes limited leaching of nutrients when managed properly.
- d. It can be used when windy weather prevails.

The limitations of this system are the following:

- a. It requires intensive labor.
- b. It cannot be used efficiently on highly porous and imperious soil types.
- c. The land needs to be levelled or nearly levelled for irrigation effectiveness.
- d. It causes seepage, salinity problems and water loss if not properly managed.
- e. It requires special soil preparation and construction of furrows for water application.
- f. It can damage seeds and small plants sensitive to heavy water application.

2. Drip irrigation consists of pump, engine, screen, sand filters, filter mixers and main and lateral pipes. The lateral pipes have nozzles or perforations for water to drip on the seeds or seedlings on which mulch is often placed.

The advantages of the drip system are the following:

- a. It saves 30 to 40 percent water from loss by evaporation, erosion and drainage.
- b. It controls irrigation water application rates.
- c. It delivers fertilizers directly to the roots of the plants where they are utilized in solvent form.
- d. It discourages growth of weeds.
- e. It delivers water and liquid plant nutrients in small slow doses for optimum plant consumption and can be used in greenhouses and under plastic cover for growing crops out of season.
- f. It makes efficient use of water soluble material to the plant.
- g. It can be used on slopey land without costly levelling.
- h. It requires less labor and water than all other irrigation systems.

The limitations of this system are the following:

- a. It requires a high initial cost for material and equipment.
- b. It needs a pressure system and annual change of tubes and mulch especially under the hot climate in the valley.
- c. The nozzles clog frequently with the dissolved nutrients and chemicals and need regular change and maintenance of the filtration system.
- d. It requires close supervision for malfunctioning and defects.
- e. The system has a short life span of two to five years and is vulnerable to damage and vandalism.

3. Plastic houses can be 20 to 25 feet long and 8 to 9 feet wide but may vary in length according to their source of manufacture. The plastic walls may have window flaps for ventilation purposes or plastic sheets with open spaces between them. The crops are planted in rows and held by nets to accommodate a maximum number of plants.

The advantages of this system are the following:

- a. A maximum number of plants can be grown within the available space.
- b. Plants can be protected from hot winds, frost and climate vagrancies.
- c. Cropping time is unlimited with the possibility of early planting to produce out of season crops.
- d. Pesticides can be used more efficiently without hazards of spray drift.

Its limitations are the following:

- a. The high initial investment cost is estimated at 1800 JD per dunum.
- b. It requires a pressure system.
- c. It increases chances of plant disease due to humidity concentration inside the house.
- d. It poses a greater hazard of contamination to farm operators from re-entry in the plastic houses.
- e. It has cramped space inside of houses and lacks labor maneuverability for good cultivation and management practices.

4. Plastic tunnels are arranged in small plastic houses which are about 2 to 3 feet wide and 2 feet high extended for some distance in the field. They have the following advantages:

- a. They are cheaper than plastic houses.
- b. Crops can be grown out of season.
- c. Crops can be protected from climatic vagrancies.
- d. Early planting and late crop harvesting can be manipulated in accordance with market demand.

The limitations of this system are as follows:

- a. The plastic usually needs to be changed annually.
- b. There is need for more labor to place and remove the plastic sheets on the wires for management operations such as irrigation, weeding, spraying, ventilation and harvesting.

Crop cultivation under plastic covers has registered the greatest increase in the number, size, variety and quality of irrigation systems in the valley over the past few years. Plastic houses may have a capacity of 360 to 1800 square yards each and may include drip or surface irrigation although drip irrigation is more popular. Efficiency in the deployment of this system appears to be improving as valley farmers master its technology and increase their future capability to grow more than one crop a year.

5. Sprinkler Irrigation: This system has had limited application in the valley so far but will probably increase in use in the future.

The following are its principal advantages:

- a. The equipment has a comparatively long life.

- b. The system is portable.
- c. The system can be used on upgraded, sloping, shallow and/or unlevelled land.
- d. The system can cool plants against extreme high temperatures in the valley as well as protect plants from frost.
- e. The rate of water application can be controlled.
- f. It can be used on many types of soils except those with steep infiltration.

The following are its principal limitations:

- a. It operates on a pressure system.
- b. It is expensive to install in the field and set up.
- c. It requires skill to operate efficiently.
- d. The sprinklers require periodic replacement and are subject to clogging when irrigation water is not clean.
- e. It has a high water loss due to evaporation in hot weather.
- f. Sprinkling can cause increased foliar diseases and damage to crops sensitive to salt water at low application rates.
- g. Improper management can cause the leaching of plant nutrients from the plant root zone.
- h. The pipes are vulnerable to damage and breakage.
- i. The system must be stored when not in use.

Overall water use efficiency has been estimated at 40 percent for surface irrigation, 70 percent for sprinkler irrigation and 80 percent for

drip irrigation although the cropping intensity on land presently irrigated by the main canal is lower. The selection of any one system over another on a purely economic basis could be harmful to land and crops and each method would need to be scientifically weighed and evaluated for its suitability to the individual situation. An estimated cost and returns of each method as shown by Professor Steitah of the Faculty of Agriculture in his "Preliminary Economic Analysis and Returns from Producing Cucumbers and Tomatoes Under Plastic Covers and Drip Irrigation System in 1978" and surface irrigation by Harza show the following:

<u>Irrigation Method</u>	<u>Cost JD</u>	<u>Net Income JD</u>	<u>Crop</u>
Plastic irrigation	87	163	cucumbers
Drip irrigation	180	209	tomatoes
Drip/Plastic combined	1900	995	cucumbers
Surface	--	45	tomatoes

Most farmers have been quick to adopt the new technology when shown its superior economic returns and the private commercial sector has taken the lead in introducing this technology in the valley. For instance, plastic houses and tunnels were started in 1972 and drip irrigation was begun from nothing in 1974 and now covers a considerable area planted in tomato and cucumber crops throughout the valley. However the commercially minded farmers are beset with problems of insects and diseases, lack of high yielding and disease resistant crop varieties, marketing and application of insufficient quantities of the correct fertilizers and pesticides.

The Agricultural Census of 1975 reported that an average of 87 kilograms of fertilizers per dunum were applied on irrigated crops in the valley while rates proposed by the Ministry of Agriculture were 50 kilograms of ammonium sulphate and 180 kilograms of superphosphates per dunum. Even the amount recommended is only about half what American farmers apply to similar irrigated vegetable crops in the U.S. Southwest.

With the exception of recent improved yields from the out of season winter vegetables, the reported Jordan Valley crop yields are low (Table X). Adaptive research and improved extension services along with other inputs, are needed, if the yields are to be improved in the second phase of the Jordan Valley Project which entails a pressurized system of irrigation by 1992.

Soils

Jordan soils are generally underlain by calcareous rock of several types. Sandstone and granite parent soils predominate in the Jordan Valley with soils ranging between clay, clay loam, and sandy loam at the southern end. The soils are mostly deficient in organic matter and low in nitrogen, phosphates and trace elements especially in zinc. Soil texture tends to become heavier north of the Zarqa River and lighter southward. The soils of the valley floor were classified by the Baker and Harza Engineering Company in 1953-1954; the Institute of Pedology and Technology of Zagreb in 1964 and by Messrs Nedeco Dar El Handassah in 1966. The Baker and Harza Engineering Company who made a systematic appraisal of soil types, profile, texture, topography and soil characteristics and suitability for irrigation and drainage on 605,840 dunums indicated that 364,080 dunums were classified as arable (Table XI).

Soil nutrient deficiencies are apparent in citrus, bananas and tomato leaves which are sensitive to zinc deficiency and subsequent yellowing of the leaves due to zinc fixation with calcium in the soil. Also phosphate deficiency is apparent with the burning of the tips of leaves due to phosphate unavailability to plants.

The water holding capacity and permeability of the soils of a considerable area of the valley are adequate for irrigation. A topographic tilt of 25 feet per kilometer along the rift valley from East to West lends itself

(TABLE X)

Selected Crop Yields in the Northern Jordan Valley (1960-1977)*1
(metric tons)

<u>Crop</u>	<u>1960</u>	<u>Average 1965/66</u>	<u>Average 1971/72</u>	<u>Average 1973/74</u>	<u>Average 1975</u>	<u>Average 1976/77</u>
Tomatoes	0.56	1.47	1.49	0.87	1.73	0.92
Cucumbers	0.35	0.64	0.77	0.65	1.21	0.87
Eggplants	0.98	1.55	1.41	0.91	1.74	1.39
Watermelons	0.40	1.37	0.85	1.46	1.13	1.05
Peppers	0.42	0.82	0.90	0.51	1.09	0.66

*1

These vegetables represent over 80 percent of all crops grown in the valley.

Source: Department of Statistics, the Agriculture Sample Survey in the Ghors, 1977.

(Table XI)

Soil Classification in the Jordan River Valley

Class 1 Soils	Contain features of topography and drainage favorable to the production of adapted cashcrops. They are mostly alluvial soils in the perennial stream floor of the valley, on Ghor terraces and small areas throughout the Zor (116,380 dunums).
Class 2 Soils	Land that may bring about slightly reduced crop adaptability and reduced yields. Most of these lands are on the upper fringes of recent floor plains and have moderate heavy profiles (114,600 dunums).
Class 3 Soils	Land with restricted suitability for irrigated crops because of features that reduce crop adaptability and yields. They are mostly located near the upper reaches of the Ghor and stream channels (48,630 dunums).
Class 4 Soils	Soils temporarily unsuited for agriculture due to soil salinity but can be reclaimed to produce crops equal to Class 3 land. Most of this land is at the southern end of the valley (84,470 dunums).
Class 6 Soils	Land not suited for irrigated agriculture due to rough, shallow or stony soils, excessive elevation or isolation from other arable land (241,760 dunums).

Source: Baker and Harza Engineering Company (USA)

to some soil drainage and a PH of 7.0 to 8.5 is reported throughout the area.

The problem of salinity can pose a real hazard to crop production expansion. The Yarmouk River waters above the Al-Mukheibeh village are of medium salinity with an electric conductivity of 420 to 720 micromhos and the waters at Zarqa reach 850 micromhos while most of the water from side wadis have an electric conductivity of 400 to 500 micromhos. Random water samples from the East Ghor Canal have shown an electric conductivity of 790 micromhos per centimeter which is considered medium to high salinity.*1 This will require monitoring of irrigation practices especially on medium and heavy textured soils with emphasis on judicious soil management.

Saline areas are already in evidence in the valley and unless a comprehensive drainage system coupled with an adaptive approach to the complex interactions of irrigated agriculture are instituted, a comparable situation to the serious saline problems which occurred in the AID supported Helmand Arghandab Valley Project in Afghanistan in the fifties may be encountered.

*1 One millimo is equivalent to 1000 micromhos and 660 parts of salt per million are equal to one millimo.

Cropping Patterns

The interest of farmers to focus on growing selected cash crops without crop rotation has been due mainly to the considerable market demand which has precluded them from instituting proper scientific crop rotation schedules. Greed for immediate returns have distracted their better judgment for judicious crop rotations which may subsequently be of greater benefit to themselves and their land in the long run. Their desire to take advantage of the immediate market demand for vegetable crops is sowing the seeds for future problems associated with saline land, plant disease, plant pests, nematodes and reduced soil fertility.

Several crop rotation recommendations by agricultural scientists have been made over the years but none implemented due to the following:

1. Lack of availability of water in different parts of the valley when required.
2. Supplies of seeds, fertilizers, pesticides, nematicides etc. not readily available when required.
3. Little or no applied research results disseminated among cultivators.
4. Lack of extension services to bring needed information to farmers.
5. Lack of availability of credit facilities at reasonable rates from credit institutions to procure the needed inputs when needed.
6. Lack of adequate marketing, modern packing, grading and shipping facilities.

Nevertheless substantial crop production increases started to materialize as vegetable crop production rose significantly from 260,000 metric tons in 1977 to 479,000 metric tons in 1980 with a share of valley production of 65 percent in 1977 to 85 percent in 1980 respectively.

The most recent crop production trends for Jordan are the following:

(000 Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
Tomatoes	86	209	191	230
Onions	14	14	12	15
Potatoes	13	17	12	14
Other Vegetables and Small Fruit (eggplants, okra, squash, melons)	147	241	126	220
Wheat	63	52	15	150
Barley	12	16	5	35
Lentils	6	8	4	10
Vetch	11	3	3	3
Chickpeas	.60	.40	.20	.50
Bananas	3	21	10	15
Grapes	22	31	25	30
Olive Fruit	8	37	12	25
Olive Oil	1.80	7	2	5

Source: USDA Economics, Statistics and Cooperative Service
Washington, D.C.

Farmers have been persistent in continuing to grow tomatoes and other vegetable cash crops without rotation in their greed for high prices. When confronted with disease and nematode problems many of them consider this to be a risk to be taken and express interest in fumigating the soil more frequently rather than have crop rotation and risk receiving less monetary returns.

A two-year crop rotation proposed by the National Planning Council, but never seriously implemented, called for the following:

<u>1st Year</u>	Sept. - Dec.	Tomatoes
	Jan. - Mar.	Eggplants
	Apr. - June	Corn and Chickpeas
	July - Sept.	Berseem
<u>2nd Year</u>	Oct. - June	Wheat
	June - Aug.	Chickpeas or peanuts
<u>3rd Year</u>	Oct. - Dec.	Tomatoes
	Jan. - Mar.	Cucumbers
	Apr. - Aug.	Lentils or Chickpeas
	Sept. - Dec.	Tomatoes

Bananas were to be planted for a maximum of ten years in the same plots to avoid or reduce root disease and nematode problems but are allowed to grow on the same land for much longer periods of time.

Tomatoes

In spite of the various crop patterns and crop rotations proposed, the commercially oriented farmers have geared their interest to the local and export market demand for both tomatoes and cucumbers grown out of season and have therefore concentrated on the production of both crops. Tomatoes are planted in August and transplanted in September in the southern end of the valley; in December/January in the middle of the valley and in February/March at the northern end of the valley.^{5/} The tomato varieties planted include Claudia Raf, Primer, Marville, Heurst, Special and Mira Flora. The total acreage devoted to this crop under drip irrigation was estimated at 60,000 dunums in 1977. However, some of this area was interplanted with cucumbers, squash, beans and eggplants. Yields have been low with less than two tons of tomatoes per dunum but is reported to have increased substantially with improvement in handling the plastic cover housing, the drip irrigation system and the staking of tomato plants. These systems were initially started by farmers at the southern end of the valley but now have expanded throughout the valley.

One of the principal economic problems facing tomato production is their infestation by the White Fly (*Bemisia tabaci*) and the virus that it transmits which causes tomato leaf curl. The White Fly has become resistant to several pesticides and according to some entomologists is uncontrolled.

Root-knot nematodes (*Meloidogyne Javanica* and *Meloidogyne Incognita* species) constitute another serious economic problem to the production of tomatoes and other vegetables, bananas and citrus. Few farmers are familiar with nematicides for control of nematodes or follow a healthy

^{5/} The North region of the valley is between Wadi Kufranja and Adassiyah. The Middle area is delineated between Wadi Kufranja and Arda and the south area extends between Arda and the Dead Sea.

cropping system! And no Meloidogyne resistant crops are utilized, notwithstanding the development of such cultivars elsewhere in the world; especially by the International Meloidogyne Project where resistant cultivars have been found which inhibit root-knot reproduction and effectively reduce their population density. Under that project, nematode resistant crops have been screened and selected following intensive testing which indicated their rating for susceptibility, tolerance and resistance. The resistant cultivars were further subdivided for their high, moderate and low resistance to root-knot.

Among the tomato varieties found to resist nematodes in various degrees were Beefeater, Calmart, Atkinson, Anahu, Big Boy and Healani. Other crops are being identified for their resistance to root-knot nematodes which can be of considerable value to vegetable and banana crop production in the valley.

There is a definite need for a pest control research program and a better system of dissemination of information to farmers to assist them with the many pest problems they face in growing the tomato crops.

Landlord/tenant arrangements in growing the crop have evolved over the years from the use of the new technology in relation to sharing investment, operating costs and receiving benefits in growing a crop.

The financial relationship between the landowners and sharecroppers when plastic tunnels and drip irrigation are used as observed in a random sample of 30 sharecroppers interviewed in 1977 by Professor Steitch of the University of Jordan indicated the following:

1. Land and water resources were provided by the landowner.
2. Labor was provided by the sharecropper, except in few instances where harvesting costs were shared equally between the landowner and sharecropper.

3. In drip irrigation, the owner provided the drip system and the plastic mulch, while the sharecropper paid a fixed amount per dunum as his share for the use of the system.

4. The cost of the plastic tunnels were shared equally or at different rates with the landowner. However, the returns were shared in proportion to their investment in tunnel cost.

5. The sharecroppers' share in the cost of plastic houses ranged from 30 to 70 percent. The returns were divided in accordance with the investment of the landowner and tenant investment in the cost of material.

Generally, financing of all investments and operating costs is the responsibility of the landowner. This appears to have the effect of strengthening his position in deciding what crops to grow and where and how to market these crops.

Special arrangements are invariably made in the division of capital and labor between the landowner and tenant. For instance, the landowner may provide the land, pumps and the filtering system while the tenant may take responsibility for annual recurring costs for plastic tubes, plastic mulch and emitters which cost about \$120 per dunum at 1979 prices. Also the landowner may provide the entire elements of the drip system and the tenant may pay \$66 as a fixed fee for the use of the system.

An estimated production cost per dunum of tomatoes grown under drip irrigation may vary considerably, however, the following was submitted by a JVA official as an example:

Pumps and filtering system	\$130
Plastic tubes, plastic mulch and emitters	\$120
Seeds and fertilizers (nitrogenous and superphosphates)	\$ 40
Chemicals and pesticides	\$ 60
Manure	\$ 60
Labor (transplanting, weeding, monitoring the irrigation system and harvesting)	\$200

These estimates may have increased by 30% in 1980 due to inflationary costs and do not include the cost of water which was estimated at 6 fils per cubic meter in 1979.

The price of tomatoes vary with season, reaching a peak of about JD200 per metric ton in December/January at the market place and decrease gradually to less than half that price in the summer months.

A four-ton yield may bring JD800 (\$2,664), if the crop is of high quality, of which \$2,064 (minus expenses) are net profit for the farmer or about \$1,032 when sharecropped. An estimated 10 percent of the out of season crop is usually marketed in Amman and the remainder is mostly for export to neighboring countries such as Syria, Kuwait, Saudi Arabia, the Gulf States and Lebanon.

Cucumber production is grown in the middle of the valley starting at the southern extremity of the canal extension. This crop is predominantly grown in plastic tunnels with average yields of two tons per dunum at an

average market price of 200 JD per ton. Tomatoes are produced past the middle of the valley northward starting about February/March.

Also an indeterminate area is intercropped with eggplants, squash and cucumbers under both drip and surface irrigation. These crops mature in 60 days while the tomato crop requires 90 to 120 days to maturity.

The costs and net returns for different vegetable crops vary with farmers in accordance with the irrigation system followed, the locality, soils, planting season, technology, and available facilities, inputs and services. In its 1975-1982 plan, the Jordan Valley Development Authority made estimated cost and net returns for selected crops under surface irrigation (Table XII) and under sprinkler irrigation (Table XIII) respectively.

TABLE XII

Per hectare costs and returns of producing selected crops under irrigation (existing system) with high yield assumption in Jordan Valley (JD)

	Machi- nery	Fertili- zer & Manure	Plant Protec- tion	Seeds & Plants	Hired Labour	(JD)		Total Cost (2)	Tot. Cost North	Tot. Cost South	Gross Returns	Net Returns		
						Water North	Water South					Case I (3)	Case II (4)	
													North	South
Tomatoes	7.97	73.90	19.69	24.60	96.12	22.41	27.91	126.16	244.69	250.19	854.91	728.75	610.22	604.72
Eggplant	7.46	73.62	14.10	26.38	99.78	47.25	55.12	111.56	258.59	266.46	814.04	702.48	555.45	547.58
Pepper	8.44	52.02	13.68	8.38	102.44	47.25	55.12	82.52	232.21	240.08	623.04	540.52	390.93	382.96
Cabbage & Cauliflower	9.12	71.49	10.57	20.13	97.42	17.19	21.12	111.31	225.92	229.85	304.44	193.13	78.52	74.59
Squash & Cucumber	11.73	60.70	13.54	12.47	72.72	23.21	26.43	98.44	194.37	197.59	741.4	542.96	547.03	543.81
Beans	9.51	56.48	15.38	12.70	88.50	16.87	20.68	94.07	199.44	203.25	726.0	631.93	526.56	522.75
Onions	7.38	19.17	6.57	9.16	15.06	37.74	40.47	42.28	95.08	97.81	245.44	203.16	150.36	147.63
Other Vegetables	8.60	51.61	13.68	8.61	68.62	26.45	31.01	82.50	177.57	182.13	352.88	270.38	175.31	170.75
Leat	4.29	-	-	6.51	5.88	23.78	30.76	10.80	40.46	47.44	104.5	93.70	64.04	57.10
ize	6.57	-	-	3.16	20.05	34.44	36.56	9.73	64.22	66.34	144.00	134.27	79.78	77.60
itrus	9.53	119.00	7.66	31.00	133.55	55.56	62.85	167.19	356.30	363.59	1225.55	1058.36	869.25	861.96
ananas	-	140.66	-	149.00	248.02	106.93	115.75	289.66	644.61	653.43	1947.18	1657.52	1302.57	1293.75

SOURCE: unpublished data compiled by the J.V.C.

- 1) Establishment costs have been annualized over 40 years for citrus and 8 years for bananas.
- 2) Total costs excludes hired labour and irrigation costs.
- 3) Represents returns to land, capital, water, labour (including family labour), and management.
- 4) Represents returns to land, capital, family labour and management.

TABLE XIII

Per hectare anticipated costs and returns of producing selected crops under
Sprinkler irrigation (proposed system) at full development in Jordan Valley (JD)

(JD)

Crops	Machi- nery	Fertili- zer & Manure	Plant Protec- tion	Seeds & Plants	Hired Labour	Water North Ghor	Water South Ghor	Total Cost**	Tot. Cost North Ghor	Tot. Cost South Ghor	Gross Returns	Net Returns		
												Case I+++	Case II+++ North South	
Tomatoes	27.50	85.00	53.04	26.00	87.15	26.50	33.00	191.54	305.19	311.69	1207.5	1015.96	902.31	895.61
Eggplant	27.50	85.00	47.60	32.50	82.49	55.88	65.18	192.60	330.97	340.27	1082.5	889.9	751.53	742.2
Pepper	27.50	98.00	47.60	32.50	85.99	55.88	65.18	205.60	347.47	356.77	1062.	856.4	714.53	705.
Potatoes	42.50	85.00	46.16	110.00	24.01	23.40	28.20	283.66	331.10	335.90	1110.90	827.24	779.80	775.
Cabbage & Cauliflower	27.00	78.00	43.00	7.00	45.83	20.33	24.98	155.00	221.21	225.86	344.0	189.0	122.29	118.
Beans	25.00	68.00	43.20	32.60	60.19	19.95	24.45	168.80	248.94	253.44	1237.5	1068.70	988.56	984.
Onions	30.00	48.00	45.00	10.00	40.00	25.80	33.98	133.00	198.80	206.98	482.8	349.8	284.00	275.6
Squash & Cucumber	31.00	68.00	49.80	18.50	34.24	27.45	31.25	167.30	228.99	232.79	943.6	776.30	714.61	710.8
Wheat	16.00	13.00	1.78	4.32	2.86	28.16	36.38	35.10	66.09	74.34	192.50	157.40	126.41	116.1
Maize	18.00	22.50	21.03	2.00	7.52	40.73	43.24	63.53	111.78	114.24	300.0	236.47	188.22	185.7
Alfalfa	22.50	45.00	26.00	15.00	22.00	04.33	114.30	102.50	234.83	244.80	640.02	531.5	405.17	395.2
Berseem	22.50	45.00	26.00	14.00	18.75	37.20	46.05	107.50	163.45	172.30	640.0	532.5	476.55	467.
Fodder maize	37.50	45.00	14.00	16.00	22.26	35.18	37.20	112.50	173.94	175.96	250.00	137.50	76.06	74.
Citrus	21.00	90.30	57.30	105.00+	100.44	65.70	74.33	273.60	439.74	448.37	1587.5	1313.90	1147.76	1139.
Bananas	-	246.00	17.50	150.00+	204.26	126.45	136.88	423.50	744.21	754.64	2346.0	1932.52	1602.79	1592.

SOURCE: unpublished data compiled by the J.V.C.

- * Establishment costs have been annualised over 40 years for citrus and 8 years for bananas.
- ** Total costs excludes hired labour and irrigation costs.
- +++ Represents returns to land, capital, water, labour (including family labour) and management.
- ++++ Represents returns to land, capital, family labour and management.

Marketing of Vegetables and Fruits

Several studies have been made on the marketing and distribution of Jordan Valley crops. In 1969, a study was prepared by FAO in which it proposed that the Agricultural Marketing Organization (AMO) be given a monopoly in processing, grading, marketing and promotion of vegetable crops. In 1977, a Harza study proposed that markets be developed for the expected volume increase in vegetable crops during the nineties as projected after the completion of the construction of the Maqarin Dam. Another survey was made in 1977 by the Tropical Products Institute in which proposed marketing programs were reviewed and the El Arda Marketing Center and its functions and staff in the Jordan Valley were analyzed. In 1979, a study was prepared by Donald Wolf in which plans concerning the functions and policy for the El Arda Marketing Center were made in order for it to become a viable entity. He proposed that the Center be operated in conjunction with middlemen or commission agents rather than replacing their marketing functions altogether.

All studies made so far have indicated that the principal shortcomings to the marketing of fresh vegetables and fruits are due mainly to the lack of market information available to producers, lack of promotion programs, lack of quality standards of vegetables, vacillating government policies, regulation of prices by the government and the dominant role of middlemen. Also, the picking of crops, grading, packing, transportation, storage, bulk, and consumer packaging, financing, certification and inspection of produce have been pointed out to be the basic limitation to marketing. In spite of the voluminous advice given by experts, no measures have been taken to correct the situation save for the duplication of existing public and private agencies involved in the marketing process. No provisions have been taken relative to crop and price information to farmers to assist them with their production and marketing decisions, or the establishment of a

system for the certification of grades, specifications for standard containers or a program for the expansion of foreign markets. Also farmer attitudes toward the El Arda marketing center have not been evaluated.

Obviously, encouragement of the existing competitive forces in the marketplace, removal of retail price controls, and export embargoes as well as removal of restrictions on marketing channels can provide the incentive for innovations in the marketing system and assist in the distribution and marketing development processes.

Among the often repeated deficiencies of the marketing system as stated by foreign consultants are the lack of grading of the produce, quality selection of fruits and vegetables and lack of procedures for their certification, specification of standard containers and availability of cooling and refrigeration of facilities at the wholesale and retail levels. For example tomatoes of all sizes, colors and maturity are mixed together and placed in boxes of about 20-22 kilogram capacity each which tend to damage the ripe tomatoes in the bottom of the containers. Also topping containers with attractive fruit over poor quality fruit is widely practiced and "better quality vegetables are set aside, frequently in back rooms of sales outlets where customers ask for them and pay more for them than the established rates."^{1/} "There is undoubtedly need for the government of Jordan to adopt long-term policy guidelines on agriculture that will provide a consistent, stable environment for future planning by the private sector and by government agencies. Priority

^{1/} Marketing Policy for Fresh Vegetables and Fruits in Jordan, Chemonics International Consulting Division, May 1980

should be given to the expansion of total production of vegetables and fruits in the Jordan Valley and improvement of quality and reduction of post harvest losses. Such a policy would permit expansion of export sales and sales to domestic consumers at the same time. Also would increase farmers' total revenue, increase foreign exchange earnings and assure domestic consumers greater supplies of vegetables and fruit at more reasonable prices." ^{1/}

The JVA plans to operate the El Arda Marketing Center for the first two years starting in 1980. However, it will need to develop the cooperative role of farmers to compete with the commission agents who now dominate the marketplace. In addition JVA needs to develop information regarding crop production trends, demand for the domestic and export markets and seasonal variations in demand. Also JVA will need to abolish the monthly plan for exports and imports established by the Ministry of Agriculture and abolish embargoes on fruits and vegetables. Unless these measures are undertaken it will remain difficult for farmers, exporters and creditors to develop a viable marketing system that will encourage producers and traders to expand their activities and plan for the future.

The El-Arda Marketing Center will be counted on to fulfill a major pilot role in its functions in order for the two other planned marketing centers at Wadi El-Yabis and South Shumeh to be established and properly developed to serve their perspective objectives.

^{1/}
Ibid - pp.13

Chemicals and Pesticides

As observed, there has been an increase in the intensity of development of modern agriculture in the Jordan Valley and subsequent application of relatively large quantities of chemicals and pesticides without the needed adaptive research. This would appear to be needed to determine the effectiveness of these chemicals and their safety to users and consumers alike. The farmers now rely on the commercial sector for advice on the use and application of pesticides with considerable hazard potential due to their high rate of illiteracy, lack of labeling, of containers and unfamiliarity with the chemicals.

The relatively large quantity of pesticides used constitute a serious threat to food crop contamination. Some of them are hazardous to farm operators and consumers and can contaminate underground water; especially water soluble pesticides such as the DBCP nematicide. However, water contamination seems minimal at the present time because the wells for village water supplies draw water from aquifers that are above the areas brought under irrigation. The heavy metallic pesticides such as arsenic, mercury and chlorinated hydrocarbons such as DDT, Dieldrin and endrin are the most hazardous of these pesticides and can cause soil contamination that persist for several years. On the other hand, herbicides can generally cause crop damage with limited long-term detrimental soil effects.

Some 946 metric tons of pesticides were reported as imported by Jordan in 1979. These included the following fungicides: 583 metric tons of sulfur, 87 tons of dithiocarbamates, 13 tons of copper compounds, 11 tons of propineb, 7 tons of benomyl and 7 tons of pyrazophos. In addition, highly toxic

pesticides were imported and include 57 tons of phosphorous compounds which include 8 tons of parathion (known locally as Folidol) and is a potent insecticide highly hazardous to warm-blooded animals; 14 tons of methomyl, a carbamate insecticide locally known as Lannate, 10 tons of monocrotophos, 6 tons of methyl bromide and 1/4 ton of mevinphos.

The indiscriminate use of these chemicals has resulted in some grave health problems and illness although no exact statistics relating to injuries from pesticides are available. A study made by the Department of Community Medicine, Faculty of Medicine, University of Jordan indicated that 51 recorded cases of pesticide related casualties occurred in 1979. Probably many more occur but go unreported because the hospitals and clinics do not maintain accurate records of pesticide related illness. The GOJ is planning to ameliorate this situation by requesting expert assistance from the U.S. Environmental Agency, Agency for International Development and the U.S. Center for Disease Control. A team representing these agencies is due to make an assessment of this situation in late 1980 and will assist the GOJ in establishing a monitoring system with remedial measures to better identify and assist pesticide poisoning victims.

An integrated pesticide program is contemplated that will include pest surveillance and the establishment of an information system on pest occurrence and the issuance of warning for control operations. Pest identification, trapping with sex pheromones, protection of natural predators with selective chemical compounds, crop spray, crop rotation and plant breeding for resistance to pests and diseases will eventually be integrated in such a system.

Many of the pesticide hazards stem from inadequate storage, re-packing of chemicals from bulk, improper labeling of chemicals although the government has statutes and regulations to safeguard their distribution and sale. Lack of protective cover worn by farm operators in spraying, exposure from spray drift and contamination from sprayed foliage present a serious health hazard. It is apparent that with increased vegetable production in plastic houses and tunnels, re-entry exposure becomes more hazardous due to the slower breakdown of pesticides due to the reduced ultraviolet light and greater exposure to the inhalation of fumes in these enclosures.

The Government of Jordan appears to have adequate laws and regulations to control the use of pesticides but seems to have less ability to enforce the rules. GQJ laws require that all chemicals must be registered before import. Also for a product to be considered for registration, a pesticide must be registered for use by the parent company in its country of origin.

It is to be noted that the Ministry of Agriculture is designated as having the sole authority to approve pesticides to be brought into Jordan legally. Also a pesticide laboratory is planned to be established by the Government in order to determine the toxicity of chemicals imported and to perform an analysis of their toxic residues on crops.

Research

Agriculture research is conducted at the Dier Alla Experiment Station in the valley which is managed by the Ministry of Agriculture. Also research work is conducted by the University of Jordan, College of Agriculture at that station and at the University Farm in the valley. The Dier Alla Station had a staff of 16 technicians and maintained six tractors in 1979. The tractors were rented out for custom work to valley farmers. Another experiment station at Al Yabis is reported to be used for applied research work. However, there is a shortage of qualified research staff in both the College of Agriculture and the Ministry of Agriculture. The College of Agriculture appears to have more latitude in their work and has good facilities although they consider instruction and not research as their primary concern. Their land and building facilities are adequate but supporting facilities are deficient.

Some of the research activities carried out deal with valley agriculture problems such as crop rotation, so fundamental to crop production success. Cereals (wheat and barley) with residue alfalfa and broadbeans and vegetables are among the crops included in these rotations to develop a system to reduce soil borne diseases and to improve soil tilth.

New crops are reported to be researched for low water requirement when off season irrigation water supplies are low. However, more crop research is required to develop package practices that would increase crop production and augment soil conservation practices.

Publications by the University of Jordan indicate that some 50 agricultural research projects were underway in 1978, many of which were

related to Jordan Valley problems. Some of them dealt with cultural crop management such as land preparation, irrigation efficiency, plant population, adapted crops, weed control, insect and disease identification and control, disease resistant crop varieties, optimum crop harvest and storage and marketing of crops. The research program for improved tomato crop production was supported with consultant services of foreign scientists working in Jordan. In addition, Jordanian participants have been receiving advanced training overseas.

Nematodes which are ubiquitous in all valley soils and are strongly affected by the intensity of single crop production are yet to be fully studied. A cropping system of rotations and development of resistant crop varieties to reduce their numbers will be needed. Control by cultural methods dealing with the timing of planting, harvesting and fallow practices as well as chemical control using nematicides not harmful to warm-blooded animals and drinking water supplies will need to be added to the research program.

Also research work on the advantages and disadvantages of each of the principal irrigation systems in the valley will be needed to recommend to farmers the most appropriate irrigation system suitable for their soils and crops. Such research will have to be accompanied by studies dealing with land topography, soil profile and texture, water quality, type of crops to be grown, rotation, crop management and availability of labor and technical training and instruction.

Extension

In the concept of American land grant colleges the role of a strong outreach program is a critical link between research and farmers. However in the Jordan Valley the extension capability has been, thus far weak between researchers and cultivators and needs to be strengthened and upgraded to serve farmer needs and economic development.

In 1979, 27 extension agents were reported to be assigned to the valley but were rather ineffective in their relationship with farmers. They are employed by the Ministry of Agriculture but work for JVA which has overall responsibility for coordinating development activities in the valley. A few of them live at the Dier Alla Experiment Station in the valley. All lack adequate logistic support, equipment, transportation and supplies to conduct field visits, attend village meetings, perform field demonstrations and formulate a viable link between the Faculty of Agriculture (which is delegated authority to perform research work) and farmers. The extension agents are involved in JVFA organizational activities such as submitting recommendations for loan approval to farmers and other administrative work which does not enhance their extension activities with farmers and limits their contribution to farmer welfare.

The shortage of extension workers is coupled with a deficiency in their quality of training. A team approach to problem solving is lacking and the extension agents are in need of intensive training in irrigation of horticultural crops to focus on priority problems faced by farmers and to channel feedback information to research workers.

The Faculty of Agriculture feels that it should be involved in agricultural extension in order to focus on the needs of farmers.

The weak link in the extension capability appears to lie in the extension service, its organization, shortage of personnel and scope of work of the role of extension agents. A need exists for a coordinating committee to link all parties attempting to work with valley farmers. These include the University of Jordan, Faculty of Agriculture, Ministry of Agriculture, JVA, JVFA and other agencies. This could probably be performed by the Agricultural Council established in late 1979. At the present time the Ministry of Agriculture is responsible for extension and the Faculty of Agriculture seems to have taken responsibility for research. In 1963, the Extension Service was formed as an independent entity within the Ministry of Agriculture to complement the Research Department which was established earlier in 1959. Both were joined together in 1969 but have been losing effectiveness due to loss of personnel and support. In a 1974 survey by the Economic Research Department of the Royal Scientific Society it was shown that 85 percent of farm tenants in the Southern part of the valley and 54 percent in the Northern part had not received any advice on improved farming practices from extension workers. It has been reported that the low salaries, inadequate support, transportation, equipment and supplies are reasons for this situation. According to various reports the Faculty of Agriculture, established in 1973, appears to have a more motivated staff and accepted by farmers in the valley than those of the Ministry of Agriculture.

Land Tenure and Tenant Credit

Land tenure surveys conducted by the Economic Research Department of the Royal Scientific Society in the Jordan River Valley indicate that trends of land cultivated under sharecropping arrangements increased from 39 percent in 1961 to 47.3 percent in 1973 and to 59.3 percent in 1978 (Table V). The trend of sharecropping land will probably continue to be on the increase. Surprisingly, "The average yield per cultivated unit under gravity irrigation has shown no indication that owners-operators are more efficient than sharecroppers and results of costs and returns did not substantiate the hypothesis that sharecropping is inherently inefficient."*1 Also in another government survey at Wadi Dhuleil, outside the valley, it was shown that owner-operators on the average were less efficient farmers than either renters or sharecroppers. Landowners/operators obtained an average of 1,265 kilograms of tomatoes/dunum in comparison to 2,895 by the sharecroppers at Wadi Dhuleil. A similar tomato crop yield survey in the Jordan River Valley showed a tomato yield of 1,507 kilogram/dunum by owner operators as compared to 2,160 kilograms by sharecroppers.*2 "This would appear to be contrary to Adam Smith and Alfred Marshall economic theory that (1) sharecropping is inefficient when compared to either owner-operation or cash tenancy; and (2) sharecropping provides the farmer with insufficient land and technological innovation."*3 However most landowner operators growing tomato crops out of season appear to be slightly more efficient than sharecroppers because of their greater inputs.

*1 Agro Economic Aspects of Tenancy
in the East Jordan Valley (1975) pp. 24

*2 Ibid - pp11

*3 Ibid - pp4

In 1974 a random survey of 209 tenants and their 166 corresponding landlords (some landlords had more than one tenant) indicated that landowners leased their land because they had more land than they could cultivate efficiently, considered labor too expensive, were women owners who inherited the land, owners who suffered from infirmity or old age or are absentee owners such as shown in Table XIV.

The majority of lease agreements between owners and tenants are usually conducted orally with only a few executed in writing. Arrangements are generally made for a single crop season or for a one full year period as follows:

1. Equal sharing of crop yields between the sharecropper and landowner is most prevalent. The sharecropper usually provides labor including most of the hired labor and other inputs while the landowner provides land and half the other inputs (seeds, fertilizers and pesticides). The landowner provides the hired labor in the central and southern parts of the valley and to a lesser extent in the North. Water cost is borne by most landlords in the southern part of the valley where water originates from underground sources while water cost is shared by both landowner and sharecropper in the central and northern parts of the valley where the source of water is from the East Ghor Canal.

2. The two-thirds and one-third system with sharecroppers receiving two-thirds and landowners one-third of the output. The sharecropper provides all variable inputs. This system is more prevalent at the northern end of the valley.

(TABLE XIV)

Absentee Ownership and Land Holdings in the
Jordan River Valley (1974)

Area	Number of Landowners surveyed	Absentee Landowners							
		Total		Less than 30 dunums		30-50 dunums		over 30 dunums	
		No.	Percent	No.	Percent	No.	Percent	No.	Percent
North	68	23	48.5	2	6	13	39	18	55
Middle	71	23	32.5	4	17	5	22	14	61
South	27	6	22.2	0	0	0	0	6	100
Total	166	62	37.2	6	10	18	29	38	61

Source: Agro Economic Aspects of Tenancy in the East Jordan
Valley, 1975 (Table II-1)
Economic Research Department
Royal Scientific Society

3. The three-fifth and two-fifths system whereby three-fifths of the produce are for the sharecropper and two-fifths for the landowner. The sharecropper equally provides three-fifths of the variable costs and the labor, including hired labor while the landowner provides two-fifths of the cost of variables, the land and shares the cost of water.

4. A system in which the sharecropper provides one-third of the cost of all variables and receives one-third of the outputs. This system is used in a few places in the northern end of the valley.

5. A system in which the sharecropper receives one-fourth of the produce and provides the cost of one-fourth of all inputs. This system is used in a few places in the central valley.

The decision as to what crops to grow, date of planting, date of land preparation, fertilizers and pesticides to be applied, dates of harvesting and marketing as well as sales of produce are determined by mutual agreement between landlord and sharecropper (Table XV).

Plowing is mostly performed by sharecroppers using tractors owned by landowners and results in making mutual decisions between ^{the} landowner and sharecropper in farming operations.

Most sharecroppers need short term or seasonal loans to provide them with working capital for their farming operations and often borrow from the landowners. However in the survey made the commission agents were found to be the most important source of credit, particularly in the Middle and Southern valley. The Commission agents supplied credit to 47 percent of the tenants surveyed and provided credit to 60 percent in the Middle, 41 percent in the South and 24 percent in the Northern part of the valley. The second most important source of credit on farms operated by tenants was their relatives and friends. About 28.2% of the tenants surveyed, obtained credit from this source. The highest percentage obtaining credit from relatives and friends was in the Northern part of the valley (60%) while the lowest was 14.7% in the Southern end. The third source of credit to tenants was from the landlords (28%) and was higher in the Southern part of the valley and lower in the North. Government lending agencies such as the Jordan Cooperative Organization and Agricultural Credit Corporation were a minor source of credit to tenants".*1

*1 Ibid pp47-49

(TABLE XV)

Decision Making on the Sharecropped Farms
in the Jordan Valley (1974)

Decisions Regarding	Area	Percent of Farms in Which the Decision is Made by		
		Sharecroppers	Landlords	Mutual Agreement
Choice of Crops	Northern Valley	27.9	4.4	67.7
	Middle Valley	33.8	6.8	59.4
	Southern Valley	9.8	5.9	84.3
Land Preparation	Northern Valley	51.5	1.4	47.1
	Middle Valley	59.5	4.0	36.5
	Southern Valley	13.7	13.7	72.6
Date of Planting	Northern Valley	57.4	0.0	42.6
	Middle Valley	59.5	5.4	35.1
	Southern Valley	54.9	2.0	43.1
Quantity and Kind of Fertilizer	Northern Valley	47.0	0.0	53.0
	Middle Valley	54.0	1.4	44.6
	Southern Valley	7.8	2.0	90.2
Date of Harvesting	Northern Valley	63.2	0.0	36.8
	Middle Valley	67.6	0.0	32.4
	Southern Valley	47.0	7.9	45.1
Harvesting Methods	Northern Valley	63.2	0.0	36.8
	Middle Valley	64.9	0.0	35.1
	Southern Valley	47.0	7.9	45.1
Sale of the Produce	Northern Valley	38.2	17.7	44.1
	Middle Valley	21.6	18.9	59.5
	Southern Valley	2.0	49.0	49.0

Source: Agro Economic Aspects of Tenancy in the East Jordan Valley, 1975
Economic Research Department
Royal Scientific Society

"Credit from the government agencies is generally not available to tenants because most of them do not have real estate or written leases to offer collateral for mortgage." However loans have been given to sharecroppers by the Jordan Valley Farmers Association since 1979 based on their membership in that organization. Under the referenced sample survey in the valley, an estimated 56 percent of sharecroppers were found to have obtained credit with the highest ratio of 69.9% in the middle of the valley and the lowest in the northern region at 34.2 percent. These loans were needed when surface irrigation was predominant and now the needs have increased with the accelerated diversification to other pressurized systems of irrigation.

*2

Ibid pp54

Coordination and Administration

The Government of Jordan has been attempting to improve agricultural production and development in the valley since the early fifties. Donors, especially the United States shared this effort due to the pivotal location of Jordan in a volatile part of the Near East and the need for the maintenance of peace in that region. Many teams of scientists, consultants, and engineering firms have visited the valley and made studies, prepared programs and plans over the years but most have been shelved or interrupted by configurations, political unrest, lack of fiscal resources or inability of the government to proceed with proposed technical plans.

The government initiated development of the valley by establishing a labyrinth of administrative and technical institutions to plan, program and organize its efforts. Some of these have been fairly effective and some faded away with the passage of time or were replaced by new organizations. A case in view was the Jordan Research Council established in 1964 and abolished in 1976. The Council had at that time a mandate to supervise the planning, organization and coordination of research activities to improve the scientific, economic, social and health standards of Jordan with emphasis on the valley and to encourage and support all private and government research activities.

At present the following twelve entities are involved in various agricultural development activities in the valley:

(1) The Ministry of Agriculture is responsible for regulatory matters dealing with inputs and outputs of agriculture including import and export of fruits and vegetables, extension services, livestock

production, veterinary and range management, forestry, crop production, cereals and forage crops, soil conservation and water resource management. It also has research centers and an extension program in the valley.

(2) The Jordan Valley Authority (JVA) is the primary organization responsible for the development of water and land resources in the Jordan Valley. It has responsibility for social and economic plans with a mandate to implement agricultural services required in the valley and has reached a modus vivendi with the University of Jordan whereby that institution will perform research work on a contractual basis. Also JVA was given responsibility for the management and operation of the El Arda marketing center.

JVA has been attempting to maximize its efficiency in valley administration by acquiring the services of foreign consultants to advise it on ways and means of improvement. Among its recent efforts was the building of an econometric model of economic activities for the Jordan Valley to determine their impact on the economy of Jordan. The ultimate purpose of the model is to strengthen the decision-making process of the organization and pinpoint the deficiencies in its system to make the necessary improvement and adjustment.

(3) The Jordan Valley Farmers Association (JVFA) was founded by government decree in 1977 to assist members to procure farm inputs at competitive prices and to market their produce. It was envisaged to become farmer-operated and owned. "It includes a short-term credit service element which provides loans to members including sharecropper members if they can provide two JVFA members as guarantors. Almost none

of its funds, except membership dues, and limited support comes from valley farmers. It has been plagued by squabbles between its management and board of directors. And when the construction of the El Arda Marketing Center was completed it had no funds to operate the center. This resulted in JVA taking over its operation. One senior team of marketing consultants observed that an inherent weakness in the JVFA stems from the fact that eligibility for membership in the association has not been well delineated. Commission agents, for example, who own and farm land in the Valley are eligible for membership, despite an obvious potential conflict of interest between their roles as commission agents and farmers. Similarly, share-croppers and other small-grower members of JVFA frequently become obligated to commission agents who provide them with credit and production supplies that they cannot function as free agents when exercising their rights as members of the organization. This weakens the ability of farmers to act as a group in their own enlightened self-interest in formulating JVFA policy. The result is that farmer influence within the total market structure is weakened, a condition which, if continued, will reduce farmer incentive to produce the volume and quality of fruits and vegetables needed." ^{1/}

(4) The College of Agriculture (University of Jordan) was established in 1972 with U.S. Land Grant College System objectives of teaching, extension and research. It grants Bachelor and Master Degrees of Science in plant production, plant protection, soil science, irrigation, animal production and animal health. It has an extensive research program which included 54 studies in 1978 of which 35 were implemented in the valley. Plans are underway to expand the faculty to include agricultural economics leading

^{1/} Ibid pp 10.

to a Bachelor of Science degree and to increase its research activities. At present, the faculty has a staff of 40 members with Ph.D. degrees, 30 holding Master of Science degrees and 40 technicians. About two-thirds of the budget is allotted to research and one third for training.

(5) The Jordan Cooperative Organization (JCO) was established to provide its members with farm inputs at competitive prices. These include fertilizers, chemicals, equipment, machinery and seeds. It has organized vegetable marketing cooperatives in the southern end of the valley and received JD 10 million in 1978 from the United Kingdom and Iraq to strengthen its cooperative effort and provide loans to its members. In 1978, it had 142 cooperatives with over 10,000 members and gave out almost 3,000 loans. However, it started in March 1980 a venture in "parallel markets" which consists of retailing produce in direct competition with the private sector and now has one retail market and four vans for direct selling to the public with plans to expand this activity to show marketing operations by way of improving grading and packaging of produce.

(6) The Agricultural Marketing Organization (AMO) was originally set up to organize the marketing of produce, domestic and foreign. It has imported watermelons and potatoes at government request and attempted to ensure domestic supplies of potatoes through grower contracts. Also it operates as its own commission agent in the major wholesale markets. It owns, but has little influence on, the operation of Jordan's only tomato paste processing plant. This plant buys 5-6,000 tons of domestic tomatoes per year at a specified intervention level in order to support farm prices. Its main product is tomato paste in consumer cans. When domestic supplies are not available, it imports highly concentrated tomato paste in barrels and repacks them at a lower concentration in consumer cans. While the

Ministry of Defense may import tomato paste in consumer packs, the processing plant has a monopoly over all other sales of tomato paste in Jordan.

Although the plant is operated year-round, it is usually underutilized and needs additional volume of low-priced products. Experimental packs of pickles, olives, apricot jam, and turnips have been tried, but sufficient raw materials for volume production are not available. Also the processing plant operates the only can-manufacturing facility in Jordan. ^{1/}

(7) The Agricultural Credit Corporation is considered as the principal entity for providing short- and long-term credit to farmers in Jordan. It is financed by external loans and governments loans. It disbursed JD 13 million in 7,500 loans to 5,000 farmers during 1974-79.

(8) The Natural Resources Authority has responsibility, among other things, over the regulation and development of underground water resources in the upland and the Water and Sewage Authority. Originally, it had responsibility for developing agricultural irrigation plans but this has been slowly relinquished to the JVA relative to Jordan Valley water resources development.

(9) The Agricultural Council was established in April, 1979 to address policy issues relative to the development of the agricultural sector. The Council consists of 16 members. It is chaired by the prime minister with the Minister of Agriculture serving as vice president. The other members include the president of the Jordan Valley Authority, Minister of Supply, Minister of Economy and Industry, President of the National Planning Council, Director of the Jordan Cooperative Organization, President of the Jordan Valley Farmers Association, Director of the Agricultural Marketing Corporation, President of the Natural Resources

^{1/} Ibid - pp. 11.

Authority, President of the Agricultural Engineering Syndicate, two officials from the Ministry of Agriculture, two farmers and the Dean of the Faculty of Agriculture.

The Council has authority to determine agricultural policy within the scope and concepts of national development plans in matters dealing with plant and animal production, agricultural inputs, marketing, agricultural resources, manpower, tax matters including imports and exemption of taxation on agricultural production inputs. It has authority to review projects within the framework of development objectives for the country and laws relating to the development of the agricultural sector. Among its functions is the coordination of activities of institutions involved in the agricultural development sector to avoid duplication of effort and waste. Some of its notable achievements, so far, have been to strengthen the coordination of the agencies involved in the export and import of agricultural commodities; support of the Jordan Valley Authority to improve agricultural inputs at competitive prices and promoting wheat production by setting a minimum price to farmers and encouraging a program for improved seed production. However, in reality the Council yields more authority at the cabinet level with minimum influence in coordinating the government agencies level.

(10) The Ministry of Supply is concerned with the import of Consumer Commodities. It is primarily oriented to consumer needs, regulation of food imports and fixation of retail food prices.

(11) The Ministry of Economy and Industry is concerned with the economic and industrial development of Jordan relative to development

programs dealing with economic and industrial growth within the framework of objectives of the national plans.

(12) The private sector consists of agricultural trade organizations, middlemen and tradesmen who provide needed agricultural inputs and purchase produce from farmers.

In addition, donor organizations involved in Jordan Valley development include the UNDP dealing with forestry and range management programs; the World Food Program which provides subsidies to farmers who engage in soil and water conservation activities; AID which assists in infrastructural activities and training in water management, health, education, credit and construction of schools and clinics; the British Overseas Development and the German Federal Government assisting in veterinary services; the Dutch government assisting in the construction of improved marketing facilities for produce; the British and Iraqi governments providing loans for farmers, FAO dealing in agricultural research programs and the World Bank dealing in socio-economic analytical studies.

The proliferation of these poorly coordinated programs and agencies with overlapping responsibilities has not lent to efficiency in administration. There is need to reassess the activities of each organization and the coordination of these responsibilities to stimulate agriculture production. Foremost is the need to strengthen the cooperation effort of farmers to increase their clout in increased production and better marketing of their crops giving them stronger hand in the management of the El-Arda Marketing Center and the two future centers to be constructed at South Shuneh and Wadi El Yabis.

SUMMARY

Jordan is undergoing a period of transition from an agrarian to a predominantly urban society struggling from a known and comfortable experience to an uncertain future. It is buffeted by regional events of war and peace that are often not of its own making but directly influence its economy and the economic welfare of the Jordan Valley. It has had an aggregate annual economic growth that averaged seven percent in real terms over the last few years but continues to have a weak socio economic base with some 60 percent of the GDP income provided from the service sector alone. It has a trade imbalance between budgetary expenditures and domestic revenue bridged only by external aid without which the country could not hope to maintain its current economic levels.

It is rather difficult to perceive accurate future predictions for Jordan's economy partly due to a weak socio economic infrastructure, migration of skilled labor in search of higher economic remuneration, mostly in the neighboring oil states, and other factors not within Jordan's control.

The share of agriculture in the GDP has been decreasing steadily with employment in agriculture dropping from 32.9 percent in 1970 to about 10 percent in 1980. However development of the Jordan River Valley with the construction of the Maqarin Dam is projected to produce over 800,000 tons of vegetables, 200,000 tons of fruits and other new field crops which will diversify and broaden the economic base.

The increased food produce resulting from irrigation under pressure irrigation systems will provide food nutrients at affordable prices to the citizens and improve their diets, export earnings, foreign exchange and balance of payments in addition to relieving the water shortage at Amman and Irbid, increasing electricity and providing power for a

The ideal planned objectives of the Maqarin Dam and the second phase of Jordan Valley agricultural development will be to formulate an integrated socio-economic entity for valley residents in particular and the national economy in general with provisions for domestic water supplies for the Irbid and Amman metropolitan areas and power for electricity and development of a growing industry. Viable links exist between the valley, the region and the national economy with no targeting of specific benefits to any one single group.

The harnessing of the Yarmouk River waters by constructing the Maqarin Dam, the last large scale available source of water that drains an area of 6,800 square kilometers will have a stabilizing influence on the economy with an estimated preliminary rate of "overall internal rate of 17.4 percent based on direct benefits alone and preliminary benefit-cost ratio at a 10 percent discount rate estimated at 1.9."^{1/}

Increasing the national economic growth by increased production through the Maqarin Project will assume growth with equity in all parts of the Jordan Valley and produce a better concept of redistribution of lands among beneficiaries as seen in Table XVI.

A disaggregate analysis of interrelations between transition growth and equity would save serious errors of judgment at the outset of project plans, thus questions of land tenure and land distribution (to prevent privileged landowners from acquiring a disproportionate share of project benefits), cost of water, land rent, credit availability, income distribution, etc. need to be analyzed in the planning stages of the project. Also an

^{1/} AID Development Loan Committee, August 8, 1977, pp. 15.

2

T A B L E XVI

DISTRIBUTION OF JORDAN RIVER VALLEY LAND

<u>No. of Irrigable Dunums Owned Prior to Expropriation</u>	<u>No. of Dunums Allotted</u>
40 - 50	All
51 - 100	50 dunums plus 25% of area exceeding 50 dunums.
101 - 500	62 dunums plus 17% of area exceeding 100 dunums
501 -1000	130 dunums plus 12% of area exceeding 500 dunums
1000 and over	200 dunum limit

Source: Jordan Valley Development Law (1977) Article No. 22

initial intensive search for factors causing social inequities and the undertaking of remedial measures thereof will be advantageous to achieve accelerated economic growth without the accompaniment of deterioration to the index of equality among the not well-to-do recipients.

Whether the government can modify policies to produce a more equitable distribution of the benefits of economic growth or initiate structural changes will be at the heart of this development process. If the larger landowners should receive greater benefits the economic gap between them and the small farmers will be widened. Ricardo stated in his correspondence to Malthus: "Political economy, you think is an inquiry into the nature and cause of wealth - I think it should be called an inquiry into the laws which determine the division of the produce of industries amongst the classes who concur in its formation." Nevertheless this project will increase the size of the pie to be divided among the recipients if no solution to income distribution is made.

An analysis of the water rights of the sovereign riparian states adjoining the Yarmouk River was conducted by a Mission from the American Society for International Law and culminated in a report dated July 31, 1977. It was entitled "Legal Questions Arising out of the Construction of a Dam at Maqarin on the Yarmouk River". The Mission compiled literature of historical value and reviewed the legal analysis of the allocation of the waters of the river since the British and French mandate periods until the date of the report. The study identified the legal international principles and legal consequences related to the construction of the Maqarin dam and offered a comprehensive analysis of the legal implications for the riparian states. Also it pointed out apprehension from the problems of future water salinity in the Jordan River (Appendix A) and possible measures to cope with that problem.

(Appendix A.)

The Problem of Salinity

The Jordan River presently has an extremely high level of salinity (The concentration of dissolved solids in the water), which increases as the river flows southward from Lake Tiberias to the Dead Sea.

Two processes typically account for such an increase in the levels of salinity. Salt loading occurs when additional solids are added to the river. Salt concentration results when water is removed so that the same amount of salts is suspended in a lesser quantity of water. These processes occur both naturally and as a result of man's activities.

Since the climate of the Jordan River Basin is extremely arid, there has not been the precipitation over time to leach the salts from the characteristically saline soils of the region. Thus, when land is picked up from the soil and added to the river in return flows. This process, known as salt loading, also occurs naturally as the water washes salts from the beds and banks of the river and its tributaries. Natural point sources, mainly saline springs, contribute additional salts to the river. Salt concentration, the process whereby water is removed and salts are left behind, results from evaporation and transpiration and from human depletion and consumptive uses of river water. Diversions of water from Lake Tiberias or the Yarmuk, for example, remove water that would otherwise dilute the more saline waters of the lower reaches of the Jordan.

Salinity usually begins to create problems for water users when the level of concentration exceeds 1,000 milligrams per liter. The

problems created by salinity are chiefly economic and may include decreased crop yields on irrigated lands, increased treatment costs for municipal and industrial users, pipe corrosion, and decreased potability of drinking water. In the ecological field, increased salinity levels may adversely affect fish, wildlife, and natural vegetation.

For most practical purposes, legal issues of respecting salinity can be treated as, in effect, issues of general river pollution. The absence of relevant legal rules applicable to the general problems of Jordan basin pollution has already been discussed. There is little more which can be added in terms of potentially applicable norms with respect to the specific problem of salinity. However, there is at least one fairly close analogy in international experience to the Jordan Basin problem-- the dispute between the U.S. and Mexico over the salinity of the Colorado River -- which deserves mention.

The Colorado River arises in and drains a vast area in the southwest United States, flows across the Mexican border into the Mexicali Valley in Northwest Mexico, and then empties into the Gulf of California. The waters of the river are vital to the economies of both countries. In 1944 the two countries entered into a treaty concerning the uses of the Colorado River, under which the U.S. agreed to deliver a certain quantity of water to Mexico each year. However, nothing was expressly said in the agreement about the quality of the water. Increasing development in the southwest United States in the post-war years resulted in intense and rapidly growing demands for the domestic use of these waters.

In 1957, the United States began to divert a significant amount of water from the Colorado in order to open up new areas to irrigation; the most important of these projects was the Wellton-Mohawk diversion. These diverted waters eventually returned to the river before it reached Mexico, thus fulfilling the treaty's requirements of water quantity. However, during their use for irrigation, the water picked up great quantities of minerals, and this highly saline return flow almost doubled the salinity of the waters eventually reaching Mexico. Reportedly, when U.S. agencies were planning the Wellton-Mohawk diversion, they gave little formal consideration to the potential effects on Mexico or the probable Mexican reaction.

In 1961, Mexico complained to the United States. It claimed that the waters it was receiving were too saline to irrigate crops in the Mexicali Valley, that the livelihood of Mexican farmers was being severely affected, and that the delivery of waters of such poor quality was in violation of the treaty of 1944. The U.S. took the position that the treaty was not being violated. However, the matter was referred to the U.S.-Mexican International Boundary Waters Commission, which undertook scientific studies and provided a forum for negotiations. In 1965, the two countries, within the framework of the Commission, reached a five-year agreement providing for measures to deal with the problem of salinity. This agreement was subsequently extended for two more years.

In 1972, President Echeverria of Mexico, during an official visit to the United States, addressed the Congress, emphasizing the importance to Mexico of the Colorado River problem. Soon afterwards, President Nixon

appointed former Attorney General Brownell as his special representative to find a solution to the problem. Mr. Brownell established a task force to study the matter and reported back to President Nixon in December 1972, with his recommendations. The two countries resumed negotiations on the basis of these recommendations, and in August 1973, reached an agreement which was embodied in the International Boundary Water Commission's Minute No. 242. This agreement is expressly stated to be a "permanent and definitive solution" of the salinity problem. Under the agreement, the United States promised to provide Mexico with the continued annual delivery of stated quantities of water which meet certain standards of average quality. To accomplish this, the U.S. would build the world's largest desalinization plant in Arizona to process the water from the Wellton-Mohawk diversion, decreasing its mineral content before it is returned to the Colorado and crosses into Mexico. The U.S. would also construct, at its expense, a lined bypass drain to carry the wastes produced by the treatment of Wellton-Mohawk drainage directly to the Gulf of California, bypassing the river entirely. The U.S. would also support Mexican efforts to obtain appropriate financing for improvements and rehabilitation in the Mexicali Valley. The total cost of the agreement to the U.S. was estimated at \$115 million.

The U.S. - Mexican experience does not yield precise legal guidance with respect to the Jordan Basin problem. However, it does indicate that a state is required to refrain from causing harm to a co-basin state by a substantial and harmful increase in the level of the salinity of a river. It also underlines the advisability of negotiating a compromise in such a situation.

Source: Legal Questions Arising Out of the Construction of a
Dam at Maqarin on the Yarmuk River. July 31, 1977
(pp93-98)