Historical Trajectory of a River Basin in the Middle East:

The Lower Jordan River Basin (in Jordan)

Mauro Van Aken
Rémy Courcier
Jean-Philippe Venot
François Molle

IWMI International Water Management Institute

MREA FRENCH REGIONAL MISSION FOR WATER & AGRICULTURE

COMPREHENSIVE Assessment of water management in agriculture

The Authors

Mauro Van Aken is researcher in Cultural Anthropology and Anthropology of Development at the University of Milano-Bicocca (Italy) and has worked as associated researcher at IFPO (Institut Français du Proche-Orient, Amman).

Remy Courcier was the head of the French Regional Mission for Water and Agriculture (MREA) in Amman from April 2000 to October 2004.

Francois Molle is a Senior Researcher at the Institut de Recherche pour le Développement (IRD), France, currently holding a joint appointment with the International Water Management Institute, Colombo.

Jean-Philippe Venot was formerly an MSc student at the 'Institut National Agronomique de Paris-Grignon' working with the French Regional Mission for Water and Agriculture (MREA) in Amman. He is now a PhD student with the International Water Management Institute (Hyderabad, India) and the GECKO Laboratory at the University of Paris X-Nanterre.

Acknowledgements

This work would not have been made possible without the earlier participation of Khadija Darmane, Aida Jridi, James Nachbaur and Rebieh Suleiman. Many thanks are also due to the different persons who have worked with the MREA during the last seven years: Ahmed Abed, Majd Arrabyat, Mohammed Al-Azzam, Carmen Ghandour, Charlotte Guerin, Julien Guillaud, Abdallah Khair, Haithar Malhas, Guillaume Panzani, Céline Papin, Feras Al Qyam, and Adrien Peyre for their daily help and support. Particular thanks to Thabet Al-Qadoumi for his help and translation during many surveys and interviews with farmers. The help of Suzan Taha from the Ministry of Water and Irrigation; Tayseer Ghazawi, Yousef Hassan and Naief Seder from the Jordan Valley Authority; and Khair Al-Haddidi from the Water Authority of Jordan have been indispensable to the realisation of this study. Finally, Jochen Regner and Philipp Magiera from the GTZ brought their knowledge of the Jordanian water sector and supported our study in many different ways. Thanks to all.

Many farmers, employees, migrants, labourers and more generally inhabitants of the Jordan Valley, devoted time, hospitality, and offered ideas and opinions on the issues addressed by this report: a list of names would be impossible to make but much of this research would not have been possible without their help.

This research contributes to the Comprehensive Assessment of Water Management in Agriculture (www.iwmi.org\assessment) and was supported by a grant from the Government of Netherlands to the Comprehensive Assessment, as well as by the Ministry of Foreign Affairs, France through its Regional Mission for Water and Agriculture (MREA, Amman).

Quote: Van Aken, M.; Courcier, R.; Venot, J.-P.; Molle, F. 2007. Historical Trajectory of a River Basin in the Middle East: The Lower Jordan River Basin (in Jordan). International Water Management Institute and French Regional Mission for Water and Agriculture, Amman.

Cover Photo Credit: Alice Arrighi de Casanova, Rémy Courcier, Julien Guillaud, Jeremy Leroy Céline Papin and Jean-Philippe Venot.

Historical Trajectory of a River Basin in the Middle East:

The Lower Jordan River Basin (in Jordan)

Mauro Van Aken

Rémy Courcier

Jean-Philippe Venot

François Molle

With the collaboration of

Alice Arrighi de Casanova

Abbreviations

ARD: Associates in Rural Development, Inc. (an USAID contractor)
ASL: Above Sea Level
AZB: Amman-Zarqa Basin
BOT: Build Operate and Transfer
BSL: Below Sea Level
CRBW: Controlled Renewable Blue Water
CSCN: Royal Society for Conservation of Nature
DA: Development Area
DOS: Jordanian Department of Statistics
EC: Electro conductivity
EIB: European Investment Bank
ET : EvapoTranspiration
ETP: Potential EvapoTranspiration
inh: inhabitants
FAO: United Nations Food and Agriculture Organization
FTO: Farm Turn Out
GAFTA: Great Arab Free Trade Agreement
GDP: Gross Domestic Product
GTZ: Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation)
IMF: International Monetary Fund
KAC: King Abdallah Canal
KTD: King Talal Dam
KTR: King Talal reservoir
LJRB: Lower Jordan River Basin in Jordan
JV: Jordan Valley
JVA: Jordan Valley Authority
MoA: Ministry of Agriculture
MoP: Ministry of Planning
MREA : Mission Régionale Eau et Agriculture (French Regional Mission for Water and Agriculture in Jordan)
M&I: Municipal and Industrial
MWI: Jordanian Ministry of Water and Irrigation
NGO: Non Governmental Organisation
O&M: Operation and Maintenance
RBW: Renewable Blue Water
RO: Reverse Osmosis
TDS: Total Dissolved Solids
TWW: Treated wastewater
UNDP: United Nation's Development Program
UNEP: United Nation's Environment Program
UNESCO: United Nations's Educational, Scientific and Cultural Organisation
UNESOB: United Nations' Economic and Social Office in Beirut
UNRWA: United Nations Relief and Works Agency
USAID: United States Agency for International Development
VAT: Value Added Tax
WAJ: Water Authority of Jordan
WB: World Bank
WTO: World Trade Organisation
WUA: Water User Association

Abbreviations: Units

Bm^3: billion (10^9) cubic meters
du: dunum (one dunum is equal to 0.1 ha)
JD: Jordanian Dinar (one JD is equal to US$1.41)
lpcd: litre per capita and per day
Mm^3: Million of cubic meter
US$: United States Dollar
yr: year

This document is a preliminary version (non-edited)

Comments are welcome

Table of Contents

Figures

1 Introduction

This report is part of a comparative study on river basin development and management carried out as a contribution to the Comprehensive Assessment of Water Management in Agriculture (CA). Using a variety of scales of analyses, ranging from crops, to field and river-basin levels, to countries and regions, and to the global scale, the aim of the CA was to take stock on past experiences, identify knowledge gaps, assess likely evolutions and proposes promise pathways[1]. This report is the fruit of the collaboration between the French Regional Mission for Water and Agriculture (MREA) in Amman and its Jordanian partners from the Jordan Valley Authority, and the International Water Management Institute. It largely builds on seven years of experience of the MREA, on the existing literature, and on original historical analyses of water use developed under the CA.

The main purpose of CA basin case studies is to contribute to address Integrated Water resources Management challenges by generating, synthesizing and disseminating useful information and knowledge on basin level water management for use by practitioners, development agencies, planners, policy makers, and donors. To achieve this goal the project included in-depth analyses and comparisons of the historical development and present status of a number of selected basins. The aim of the study is to derive generic understanding on how societies manage water resources under growing population and basin closure, which kind of problems are faced, and which range of solutions (technical, institutional) are available for a given physical and social context.

As societies develop, water resources within a given basin become increasingly diverted, controlled, and used. Water flowing out of subbasins is often committed to other downstream uses, and outflow to the sea has several often overlooked functions: flushing out sediments, diluting polluted water, controlling salinity intrusion, and sustaining estuarine and coastal ecosystems (Molle *et al.* 2007). When river discharges fall short of meeting such commitments during part of or all of the year, basins (or subbasins) are said to be closing or closed. Basin closure generally prompts crises that, in turn, lead to technological innovations, adjustments of users to scarcity, and wider institutional and economic changes. More often than not, it also comes with environmental degradation since water is often used with limited concern for ecosystems.

We are interested here in the analysis of societal responses to water scarcity both at the individual and national levels. These responses are partly interdependent because basin closure induces increased interconnectedness between water uses and ecosystems through the water cycle. Responses are shaped by hydrological, physical, economical and social constraints but also by the distribution of human agency and power among actors, as well as their respective interests and strategies. In other words relationships between societies and their (water) environment are complex and cannot be understood as a mere rational and technical "development" of natural resources.

The lower Jordan River basin, more specifically its Jordanian part, was selected for the study. It represents a situation of climatic aridity with pressure over water resources and high competition between water uses. The study first addresses the past transformations of the basin, periodizing change and recounting the history of water resource development in its human context. The social, political and economic context of present day water management present situation is then investigated in more details. Last, a third part provides projections and scenarios and reflects on possible courses of action.

[1] See http://www.iwmi.cgiar.org/Assessment/Synthesis/index.htm

Although presented here in a preliminary (non-edited) draft version, this report is an attempt to capture the complexity of the society-environment nexus through a focus on water resources at the basin level, how they are developed, used (or misused) by individuals, social groups or the state, all pursuing particular objectives around a same scarce resource.

2 Human and physical setting of the lower Jordan River Basin (LJRB)

2.1 General Presentation of the LJRB

Jordan covers about 90,000 km^2 of land extending from the border of Syria in the north to the tip of the Red Sea in the south, and from the Jordan River bordering Israel and the West Bank in the west to the deserts bordering Iraq and Saudi Arabia in the east (Figure 2-1).

Figure 2-1: Map of Jordan

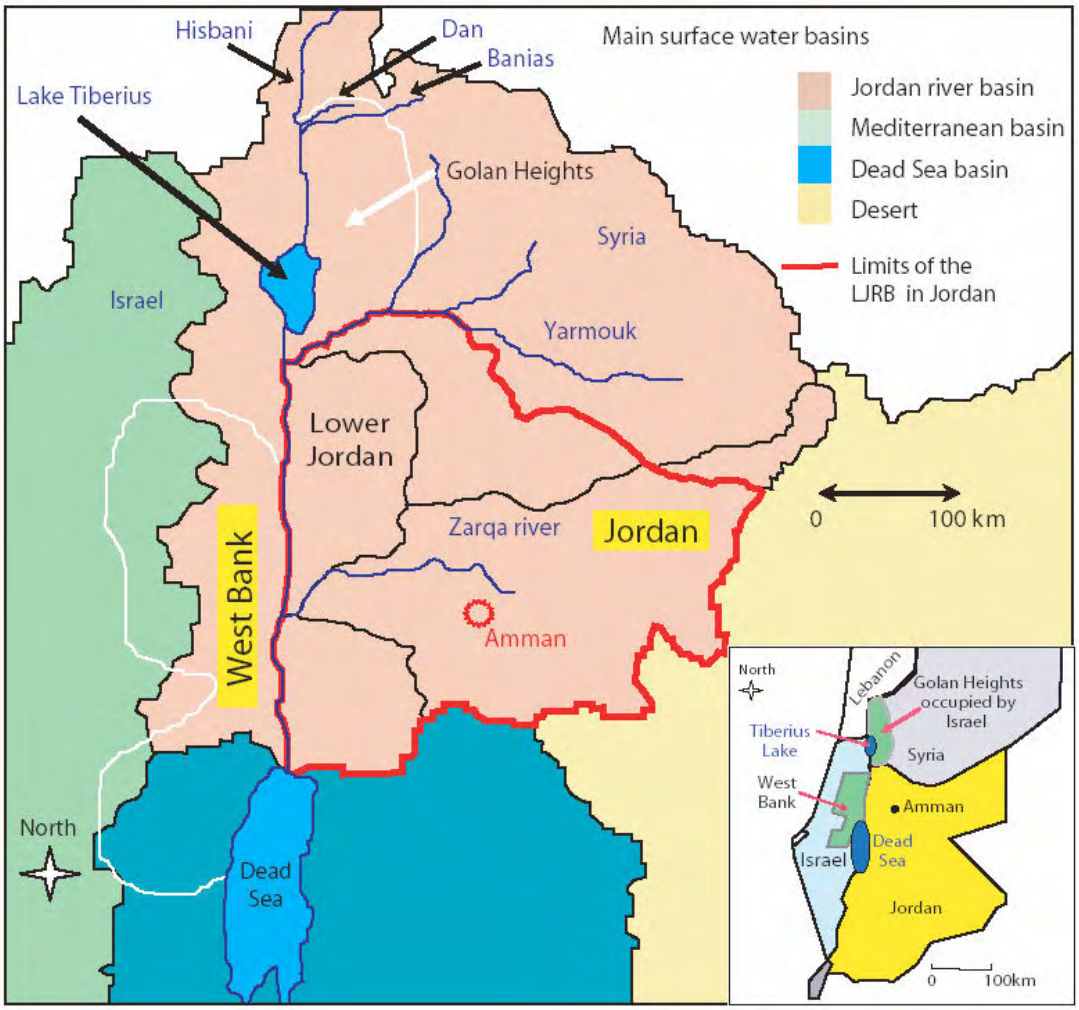
The Jordan River is an international river which drains a total area of about 18,000 km². Its three tributaries originating from the slopes of Mount Hermon drain the Upper Jordan River basin (2,853 km²; THKJ, 1977) and flow southward into Lake Tiberius. They are the Hisbani, coming from Lebanon, the Banias, coming from Syria and the Dan coming from the Syrian Golan Heights, occupied by Israel since 1967. Apart from some irrigated agriculture north of Lake Tiberius, almost all water from the three tributaries is collected in the lake, which acts now as a freshwater reservoir currently used almost exclusively by Israel. The outflow of the Jordan River from Lake Tiberius is virtually blocked and only consists of some saline springs and wastewater, as we will see later (chapter 4.2).

The Jordan River flows southward in a nearly 130-km-long longitudinal depression (the Jordan Valley) before discharging into the Dead Sea. The valley results from a continental rift located between the Indo-Australian, the Eurasian and the African plates and extending from Ethiopia through the Read Sea to Lake Tiberius and the Bekkaa Valley in Lebanon. This rift induced a lowering of the floor down to 400 meters below sea level and to the formation of mountainous ranges on both sides of the Jordan Valley. Ten kilometres downstream of Lake Tiberius, the Lower Jordan River receives the water from its main tributary, the Yarmouk River. Originally, this river coming from the northeast of

Syria contributed almost half of the Lower Jordan River flow, the other half coming from the Upper Jordan River (Figure 2-11). Several temporary streams of lesser importance named "side-wadis," with the exception of the larger Zarqa River, come from the two mountainous banks and feed the lower Jordan River. Prior to water development projects, the original flow of the Jordan River into the Dead Sea varied between 1,100 and 1,400 Mm^3/yr. (Klein 1998; Al-Weshah 2000; El-Nasser 1998.) Our study focuses on the Jordanian part of the Lower Jordan River basin and does not address issues related to water sharing between the riparian states of the Jordan River. The Yarmouk River (and the Upper Jordan) are thus considered as mere inflows to the basin. Moreover, the other streams draining to the Dead Sea from the south and from Israel are also not analyzed and are considered as mere contributions to the basin.

What will be referred to as the LJRB in what follows represents 40 percent of the entire Jordan River basin but only 7.8 percent of the Jordanian territory (7,163 km^2; Figure 2-2).

Figure 2-2. Limits and Drainage Area of the Lower Jordan River Basin (pink) and its extent in Jordan (red line) [Source. Courcier et al.*, 2005]*

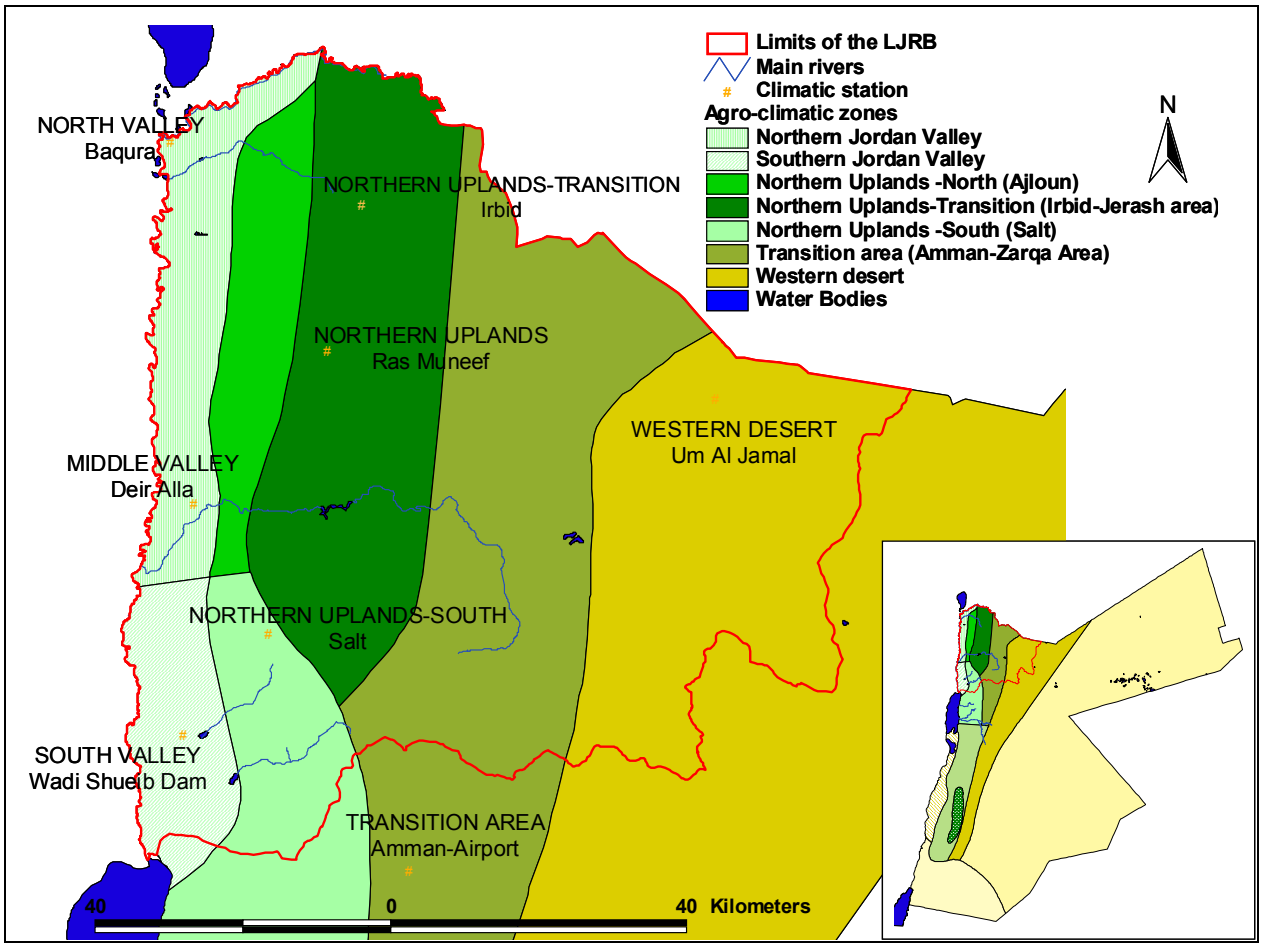


2.2 Agro-Climatic Zoning: Topography and Climate

2.2.1 Agro-climatic Zoning

The topography of the country partially explains the diversity of climates observed in Jordan: temperature, humidity and rainfall are very variable and the country has been divided in twelve agro-climatic zones (Figure 2-3). The LJRB intersects seven of them: the Northern Jordan Valley; the Southern Jordan Valley, the Northern Uplands-North; the Northern Uplands-Transition; the Northern uplands-South; the Transition Area and the Western Deserts. Average rainfall in each of this zone is indicated in Figure 2-5.

Figure 2-3. Agro-Climatic Zoning of the Lower Jordan River Basin in Jordan (after MWI database)



A simpler classification, based on the topography presented in Figure 2-4 identifies three main regions in Jordan as well as in the Lower Jordan River basin:

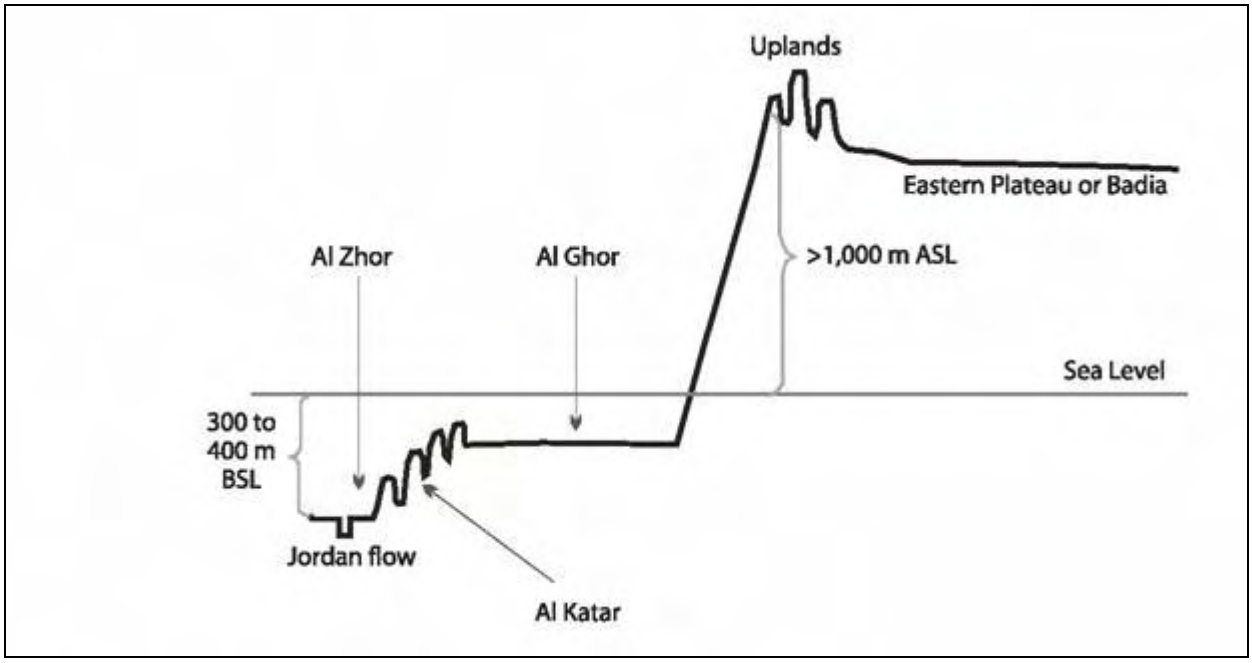
- In the west, the Jordan Rift Valley depression with an average elevation of 250 meters below sea level runs along the full length of Jordan on 360 km. It encompasses from the north (Lake Tiberius) to the south (Red Sea) the Jordan Valley, the Dead Sea and the Wadi Araba. It has a semi-arid to arid climate with hot summers and warm winters.

- The mountains running alongside the Jordan Rift valley (called *Uplands* in this synthesis). They cross the country from north to south with a width of 30 to 60 km. Their altitude reaches 1,000 m

above sea level in the LJRB. Mountains gradually slope to the east and south. The climate is Mediterranean with moderately warm and dry summers and cold and wet winters.

- The east and the south of the country is a desert area with a semitropical climate. It is called the *Badia* and is the domain of transhumant and semi-settled herders. What will be referred to as *Highlands* in what follows encompasses the Uplands and the Eastern plateau. The LJRB is thus composed of the Valley and the highlands.

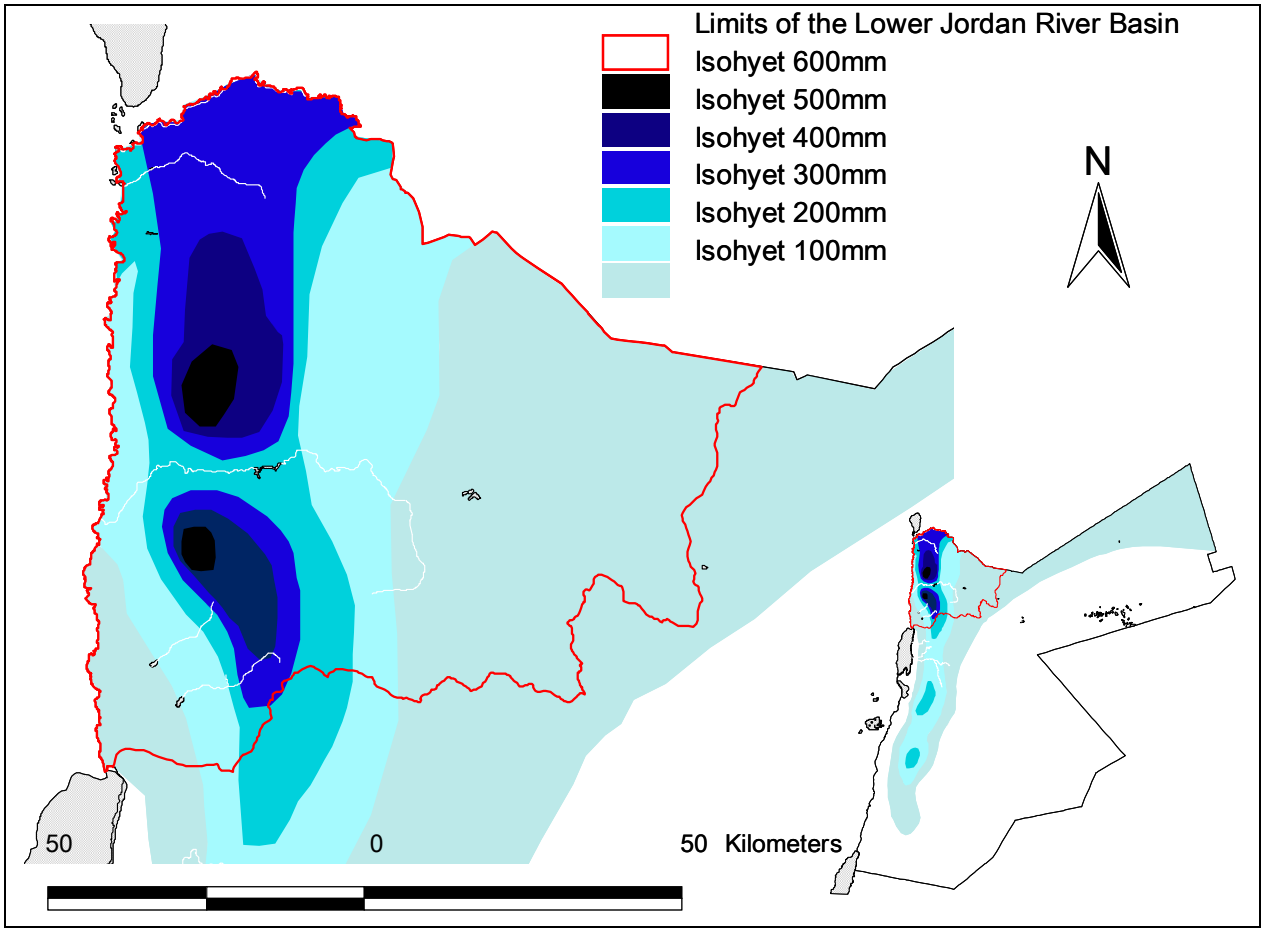
Figure 2-4. Topography of the Lower Jordan River Basin (Courcier et al., 2005)



2.2.2 Rainfall Distribution

Precipitations are spatially and temporally uneven (Appendix 1). They are concentrated in the western mountains of the LJRB and rapidly decrease towards the south and the east of the country (Figure 2-5): 87% of the country receives less than 200 mm per year and average rainfall is higher than 300 mm on only 3.2% of the Jordanian territory (Al-Weshah, 2000). Second, there is a high inter-annual variation common to all semi-arid/arid regions (floods and droughts seem to occur twice and once a decade, respectively). Third, there is a high intra-annual variability with a strong distinction between the wet period characterized by fluctuating and uneven rainfall (October-May) and the dry season (June-September). The intensity of the rain is very variable and closely related to winter depressions approaching Jordan from the west and the northwest. Consequently, water resources are scarce, fluctuating and uneven both spatially and temporally. According to THKJ (2004), the lion's share of rain is evaporated (91.8%) and the remaining infiltrates (5%) or contributes to surface runoff (3.2%). Chapter 5.6 gives a detailed water accounting of the LJRB: the influence of climate change on water resources availability is disregarded in what follows.

Figure 2-5. Rainfall Distribution in Jordan and in the LJRB (adap. from EXACT, 1998 and THKJ, 2004)



Agro-Climatic Zone	Mean Precipitation (mm)	Agro-Climatic Zone	Mean Precipitation (mm)
Northern Jordan Valley	345	Northern Uplands-South	295
Southern Jordan Valley	220	Transition Area	210
Northern Uplands-North	485	Western Desert	115
Northern Uplands-Transition	415	Average LJRB	293

The LJRB is the wettest area in Jordan (on average, it receives 2.1 km^3/yr, e.g. 25% of the 8.5 km^3/yr raining in Jordan on only 8% of the country's territory). It supplies 80 percent of the national controllable water resources and irrigated agriculture, the main user of water (chapter 2.3), is also mainly concentrated in this area (chapter 4 and V).

2.2.3 Description of the Three Regions of the LJRB

2.2.3.1 The Jordan Valley

The Jordan Valley is the northern part of the Jordan rift valley. It is 105 km long and 5 to 20 km large. It mainly lies on quaternary non-consolidated sediments except for a small area in the north where eruptive basalt can be found. The Jordan Valley altitude ranges between 212 m Below Sea Level (BSL) near the Lake Tiberius (in the north) and 413 m BSL at the Dead Sea shore (in the south) [Figure 2-4]. The Jordan Valley can be considered as a natural greenhouse (temperature increases by

1°C as the altitude decreases by 100m) where irrigated agriculture has been developed on nearly 21,000 ha and produce profitable off-season fruits and vegetables (chapter 4.1 and 5.11). Industry is limited to potash extraction on the Dead Sea shore (out of the LJRB) that also attracts tourists due to the region's importance for the main monotheist religions (Baptism site, tombs of companion of the prophets etc.); a unique landscape and the medicinal value of the Dead Sea mud (chapter 4.4).

On a west-east axis, the valley is divided in three main regions: Al Zhor, Al Katar and Al-Ghor (Figure 2-4). 'Al Zhor' is the narrow flood plain of the Jordan River. It flows in a 30-to-60 meters-deep gorge and is composed of calcareous alluvial soils (loamy sand near the river, clay loam towards 'Al-Katar').

Figure 2-6: Al Zhor During an Exceptional Winter Flood (Source: Julien Guillaud, February 2003)

Originally, this area was covered by meadows prone to flooding and by forests (Lavergne, 1996). 'Al-Zhor' is large of 200 meters to 2 km (Khouri, 1981). It is now a 'borderland' where population remains limited to a few Pakistani and Egyptians. In winter during exceptional flood flows, the Jordan River can change its course, overtop its banks and flood this area.

Figure 2-7: 'Al Katar' (Source: Jeremy Leroy, 2004)

'Al-Katar' is made of calcareous marls of marine origin (THKJ and JVC, 1972). These saline lands are uncultivated and the sparse vegetation is dominated by Ziziphus (Lavergne, 1996). Bedouins flocks graze the area. It is a transition region between 'Al-Zhor' and the rest of the valley floor. 'Al-Katar' is larger in the south than in the north of the valley.

Figure 2-8: 'Al Ghor' (Source. Jeremy Leroy, 2002)

'Al-Ghor' (also called Sahel) is a plain 20-km large in the south; it narrows down to 4 km in the middle and widen to 10 km in the north of the Jordan Valley. The plain is made of deep clay loam soils, thicker near the mountains and thinner close to the river (THKJ and JVC, 1972). Remains of Neolithic villages reveal that the Jordan Valley is one of the cradles of humankind.

Slowly slopping from the mountains (1.5 to 2.5 %; Khouri, 1981), 'Al-Ghor' is a fertile area formed by colluviums that have been eroded and washed down from the neighbouring mountains. They lay on saline alluvial sediments that deposited until 14,000 years ago when the Lake Lisan was covering the area extending from the Lake Tiberius to the Dead Sea. Before the development of large scale irrigated agriculture in the 1960s and 1970s, 'Al-Ghor' was covered by meadows, steppes and pastures, including wild cereals (chapter 3). Irrigation remained located along side-wadis and in the neighbouring of springs.

In addition to this topographic division, and from north to south, three agro-climatic regions can also be delineated (chapter 5.1 maps the Jordan Valley in further details according to the farming systems). The northern region is suitable for all kind of crops: soils are deep, with a high permeability; a fine and well balanced structure and a low salinity (Hanbali, 2001). Mean temperatures ranging from 13°C (in January) to 30°C (in September); average precipitation of 400 mm/yr and high humidity rate are propitious conditions for citrus and banana orchards (Appendix 1). In the middle of the valley, soils are shallower and slightly more saline; rainfall averages 280 mm/yr and the climate is drier: vegetables dominate cropping patterns. In the south; soils are shallow, highly saline and have a low permeability (Hanbali, 2001). Rainfall (170 mm/yr) never exceeds the Potential Evapo-Transpiration (ETP) and temperatures higher than 35°C are common: irrigated areas are concentrated along side-wadis and at the bottom of the mountains where soils are better and more water is available.

2.2.3.2 The Uplands

The Uplands of the LJRB are made of sedimentary rocks (limestone) and incised by several side wadis feeding the Jordan River. Figure 2-3 identified three sub-regions where a Mediterranean climate with cold and wet winter; hot and dry summer prevails. Mean temperatures range between 6°C (in January) and 30°C (in August); rainfall varies between 450 and 600 mm/yr (concentrated between May and October; snowfalls are occasional in January-February where altitude exceeds 700 meters); humidity is relatively high and rainfall exceeds ETP between December and March (Appendix 1). These are conditions propitious to a Mediterranean agriculture: rainfed olive tree orchards; rainfed cereals and small herds have progressively replaced the historical Mediterranean conifer landscape in these densely populated rural areas (Figure 2-9; chapter 5.3).

Figure 2-9: The Uplands of the Lower Jordan River basin (Source: Venot, 2004)

Irrigated agriculture diverts some water from side wadis streams and local springs (chapter 5.1). Finally, industries and tertiary activities are developing in the outskirts of some of the major cities of the LJRB (Irbid: 0.4 million; Jerash, Ajloun) that enjoy a Mediterranean climate.

2.2.3.3 The Eastern Plateau

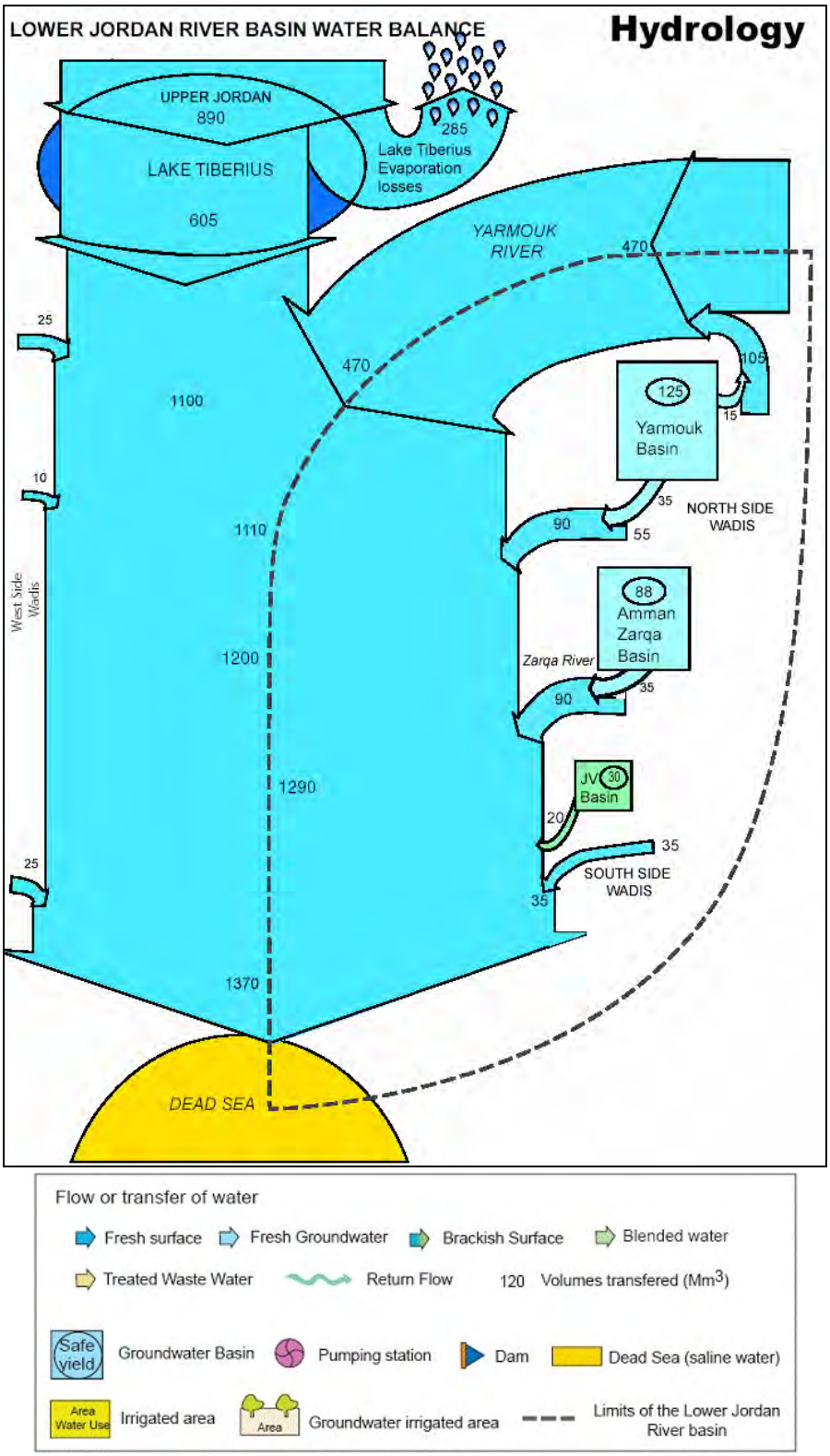
The term 'Eastern Plateau' designates the extreme east of the LJRB and is comprised of two of the twelve agro-climatic zones identified by THKJ (2004): the *transition area* and the *western desert* (Figure 2-3). This region lays south-easterly from the uplands to the mountains of Saudi Arabia and Iraq. A mild climate with dry summer and cool winter (temperature fluctuates between 8 and 25°C; rainfall averages 270 mm/yr and occurs between October and May) prevails in the wide transition area where the main urban centres (notably Amman-Zarqa, 3 million people) and the main industrial and tertiary activities are located. Eastwards, the desert opens, with small transhumant herding and routes to the gulf. The climate is dry and arid: precipitations fall below 130 mm/yr and never exceeds ETP; temperatures higher than 30°C are common in summer while they can fall below the freezing point in winter (Appendix 1). Irrigation is needed for agriculture: vegetables and fruit trees cultivation expanded in the 1980s and 1990s thanks to groundwater exploitation: irrigated areas are as large as in the Jordan Valley (chapter 5.1 and 5.13).

Figure 2-10: The Eastern Plateau of the LJRB: the transition area (left) and the western desert (right) (Source: Venot, 2004)

2.3 Hydrology of the Lower Jordan River Basin

Figure 2-11 depicts the natural or theoretical hydrology of the LJRB prior to any kind of water development. It presents both surface and groundwater resources and can be used as a backdrop to assess the historical transformations that will be described in chapter 3.

Figure 2-11. Hydrology of the Lower Jordan River Basin



Note: Most of the items in the legend are not used in Figure 2-11 (they appear in different figures representing water development and mobilization in chapter 3).

2.3.1 Surface Water Resources

Figure 2-12: Main Watershed of the Lower Jordan River Basin (Source: THKJ, 2004)

Figure 2-12 shows drainage patterns in the Lower Jordan River basin. The LJRB is divided in five surface water sub-basins (white lines): the Yarmouk, the Amman-Zarqa, the northern and southern Side Wadis, and finally the Jordan Valley basins. Surface water in the basin mainly comes from the Upper Jordan River through the Lake Tiberius; the Yarmouk; the Zarqa Rivers, as well as from nine other side-wadis incising the mountains. The Upper Jordan hydrological flow into Lake Tiberius has been estimated at 890 Mm^3/yr and the evaporation within the lake at 285 Mm^3/yr.

The outflow thus averaged 605 Mm^3/yr before the 1950s (Klein, 1998). The bulk of this resource is now diverted by Israel to its National Water Carrier (chapter 3).

- The Yarmouk River is the main tributary of the Lower Jordan River and the main surface water resource of the country. The Yarmouk is also the border between Jordan and Syria and the river is fed by springs and wadis mainly originating in Syria. The annual flow of the Yarmouk River evaluated at the confluence of the Lower Jordan River was 440 to 470 Mm^3/yr for the period 1927–1954 (Salameh and Bannayan 1993). (We have used 470 Mm^3/yr in Figure 2-11).

- The Zarqa River is the second main tributary of the Lower Jordan River. Its historical flow averaged 90 Mm^3/yr (Baker & Harza, 1955; THKJ, 1977). The Zarqa River originates in the west of Amman, flows eastwards to the town of Zarqa, then northwards where it is joined by the Wadi Dhuleil, its main tributary, before draining westwards into the Jordan Valley (Figure 2-12).

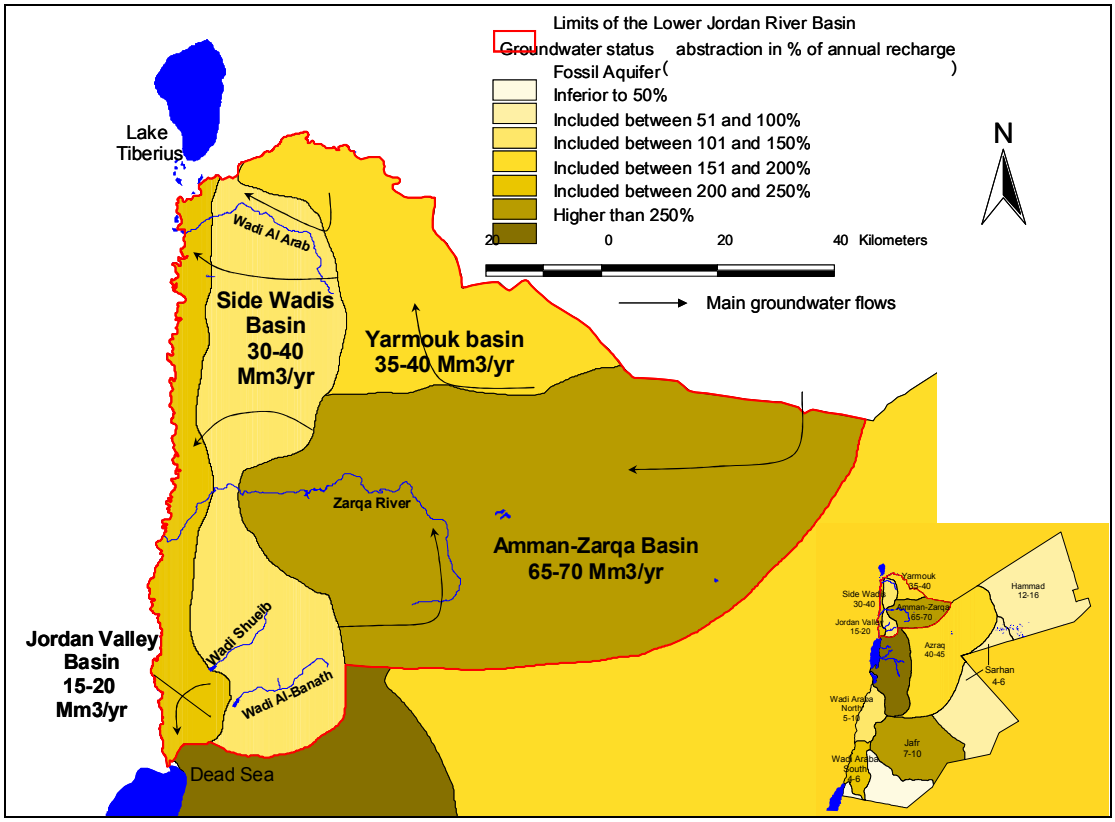
- Before reaching the Dead Sea, the Jordan River is also fed by nine smaller side wadis. To get clearer a representation, we have chosen to pool them in two groups: the northern side-wadis and the southern side-wadis, which contribute 90 and 35 Mm^3/yr respectively (Baker and Harza 1955). The contribution of smaller side-wadis (60 Mm^3/yr) located on the West Bank (Israel and Palestinian territories) is also taken into consideration.

2.3.2 Groundwater Resources

THKJ (2004) identified three main aquifer systems in the LJRB. From base to top: the Ram-Zarqa-Kurnub; the Upper Cretaceous Limestone and the Tertiary–Quaternary Shallow Aquifer Systems (Appendix 2). The hydro-geology of these aquifer systems is not presented here (refer to THKJ, 2004): our unit of study is the 'groundwater basin', recharged through direct rainfall infiltration; inflows from neighbouring aquifers; return flows from irrigated agriculture, reservoirs and sewage plants. Groundwater basins may overlay several aquifers. The LJRB is sub-divided in four

groundwater basins, whose limits partially tally with watersheds boundaries: the Yarmouk, the Amman-Zarqa, the side wadis and the Jordan Valley basins (Figure 2-12 and Figure 2-13).

Figure 2-13: Groundwater Basins in the LJRB and in Jordan, annual recharge and exploitation rate (THKJ, 2004)



2.3.2.1 The Yarmouk Basin

The Yarmouk groundwater basin (7,250 km²) is only partly located in Jordan (1,400 km²). Direct groundwater recharge from rainfall infiltration chiefly takes place in the Djebel el Arab in Syria and in the northern uplands of Jordan. It overlays two interconnected aquifers (Basalt and A7/B5; Appendix 2) that have a total thickness ranging from 180 meters to 400 meters. Groundwater baseflow contributes to surface runoff in the northern side wadis basin and through local springs. Subsurface outflows also drain to the Jordan Valley (Figure 2-13). The Yarmouk and the northern side wadis basins are heavily interconnected: for the sake of simplifying the charts, they have been pooled together into a unique aquifer replenished by water infiltrating in the northern mountains (and are represented by a unique rectangle entitled "Yarmouk basin" in Figure 2-11 and subsequent figures in chapter 3).

The mean total annual usable recharge[2] of this aquifer has been estimated at 125 Mm^3/yr. According to THKJ (2004), the net recharge of the part of the Yarmouk basin located within Jordan is 35 to 40 Mm^3/yr. Base flow to the Yarmouk River is evaluated at 15 Mm^3/yr. The side-wadi basin is annually replenished by 30 to 40 Mm^3/yr. (cf. Figure 2-13). In addition, the latter receives 25 Mm^3/yr of underground transfers from the Yarmouk basin (Salameh, 1990) which are part of the north side-wadis base-flow. Total north side wadis base flow has been estimated at 35 Mm^3/yr.

2.3.2.2 The Amman-Zarqa Basin (AZB)

The Amman-Zarqa basin (4,586 km^2) is mainly located in Jordan (4,074 km^2; [Chebaane, 2004]). It is the main groundwater reservoir of the LJRB and overlays two aquifers (Basalt and A7/B2; Appendix 2). A significant part of the renewable recharge of the A7/B2 aquifer takes place in the Syrian mountains and subsurface flows recharge the Jordanian aquifers. The mean annual recharge of the AZB averages 88 Mm^3/yr, of which 70 Mm^3/yr in Jordan (28 Mm^3/yr in the basalt aquifer and 42 Mm^3/yr in the A7/B2 aquifer; [Cheebane, 2004]). THKJ (2004) also indicates a recharge between 65 and 70 Mm^3/yr. (Figure 2-13). High groundwater abstraction for irrigated agriculture and domestic uses in the large cities of the LJRB (Amman-Zarqa, Balqaa, Jerash) is a major concern of water managers in Jordan (chapter 5.3 and 5.16).

2.3.2.3 The Side Wadis Basin

THKJ (2004) indicates a total recharge of 30 to 40 Mm^3/yr for the side-wadis groundwater basin (Figure 2-13). The northern part of the side wadi basin has been pooled with the Yarmouk basin. The southern part of the side wadis overlays two aquifer systems: the upper and lower cretaceous limestone (Appendix 2); its mean annual recharge averages 10 Mm^3/yr and participates to surface runoff as baseflow.

2.3.2.4 The Jordan Valley Basin

The aquifer is underlying the flood plain of the Jordan River and is recharged from precipitation and infiltration from the river and neighbouring mountains (30 Mm^3/yr.; THKJ 1977; Salameh 1993). THKJ (2004) indicates a total recharge of 15 to 20 Mm^3/yr in Jordan. Unlike other basins, groundwater is slightly brackish or salty and hot springs are common, notably in the south of the valley.

2.4 Human and Social Context: Population and Employment

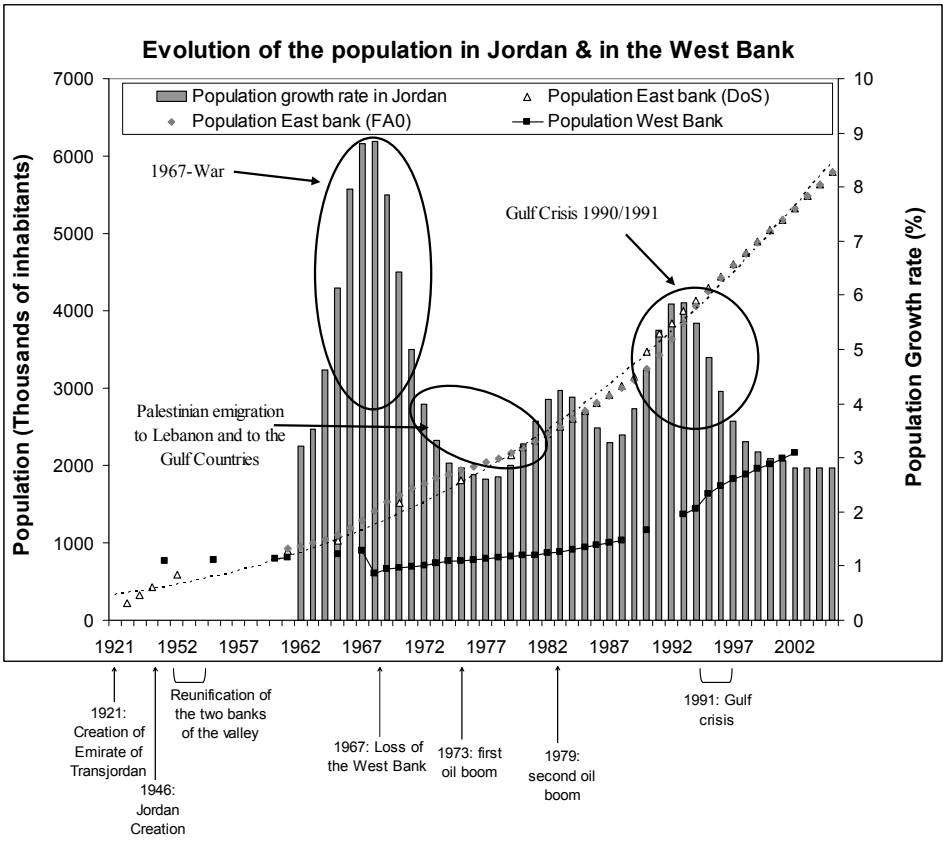
2.4.1 Population: a Historical Perspective

Jordan has witnessed a dramatic population growth during the last 50 years: the population increased from 586,000 in 1952 to 5.79 million in 2005, including 92% of Sunni Muslims and 6% of Christians. Figure 3-14 illustrates the evolution of the population both on the East and West Banks of the Jordan River since 1921.

[2] We define the "usable recharge" as the direct recharge minus the base-flow. We do not use the fuzzy notion of safe yield. Part of the recharge actually returns to the surface through springs or base-flow and abstractions are likely to have severe impact on these flows. In chapters V.3 and V.6, we will compare abstractions with the usable recharge but this does not mean that a rate of 100 percent is optimum or sustainable. Much uncertainty remains on the water balance since aquifers are not static and dynamics of aquifer de-stockage, as well as their impact on base-flows, not fully predicted.

Four main 'external' events have shaped the increase of the population in Jordan. The first one is the creation of the State of Israel in 1948 and the massive influx of Palestinian refugees both to the West Bank (280,000) and to the East bank (70,000) (not shown, chapter 3). The pre-1948 population of the East Bank was evaluated at 430,000 and remained lower than the West Bank's population until 1960. Figure 3-14 puts in sharp relief two successive increases of population. First, the six-days-war of June 1967 and the loss of the West Bank territories led to an increase in the Jordanian population by nearly one third due to the massive migration of 405,000 persons east of the Jordan River. In the early 1970s, population growth has been relatively low (2.6 to 2.8%), due to the emigration of Palestinians to Lebanon and the Gulf countries. Second, the total abandonment of administrative relations with the West Bank in 1988 and the Gulf crisis of 1990-1991 have triggered a third wave of migration: the population increased by 635,000 between 1988 and 1992 (21% of the pre-1988 population; population growth reached 6% in 1991 and 1992!). This mainly affected Amman where most migrants (Jordanian and Palestinian entrepreneurs) settled. Finally, between 2003 and 2005 another half million people (mainly Iraqis) entered Jordan to escape the second Iraq War (not shown on Figure 3-14). It is expected that the Jordanian population will reach 6.97 million in 2010 and 9.2 million in 2020 (World Bank, 2001b).

Figure 2-14: Evolution of the Jordanian Population since 1921 (Source DoS, 1994 and 2007 and FAOstats)[3]



[3] Between 1948 and 1967, the West Bank of the Jordan River was under the administrative authority of His Majesty the King of Jordan. During this period, the population of Jordan pools together the population of the west and east banks of the Jordan River. This period excluded, the population of Jordan (Transjordan before 1946) is located on the East bank of the Jordan River. Most recent data are from DoS (1994). A new population and housing census has been done in October 2004 but results are not yet available online.

According to UNRWA figures (UNRWA, 1999), Palestinians with refugee status in Jordan amount to 1,512,742, they compose 34.4% of the Jordanian population but only 18.2% of them live in the ten recognised refugee camps in Jordan.

Box 2-1. Dynamics of Population in the Jordan Valley

While the total Jordanian population immediately increased after the 1967 six-days-war, the Jordan Valley was almost deserted until 1971 as conflicts flared all along the 'new-border'. People commonly migrated from the uplands to the valley for their agriculture and livestock activities but rarely remained there (chapter 3). After this troubled period, the Jordan Valley witnessed a high population growth (1 to 2% higher than the national average) sustained by irrigation development and a broader economic take-off leading to better economic opportunities (Dajani et al., 1980). Population growth in the valley is still slightly higher than the national average and varies a lot from the densely populated north (1.9% per annum) to the low densely arid south (4.76% per annum). In 2001; 190,000 people were leaving in the Jordan Valley (Salman, 2001b). This amounts to only 4% of the total population of the LJRB.

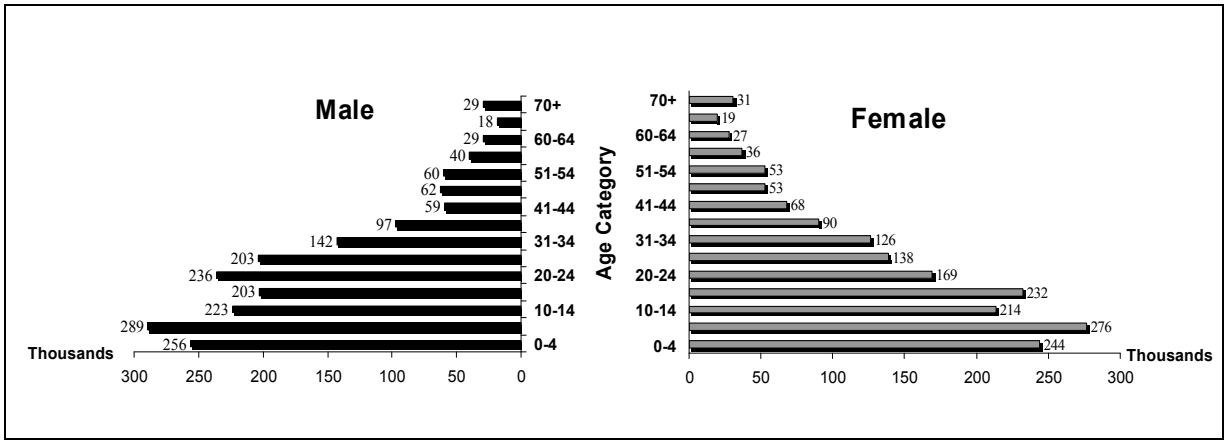
In addition to these 'external' events partially explaining the boom of the Jordanian population, the natural growth in the country is very high, at about 2.26%.[4] It has been continuously decreasing since the 1980s due to an increasing utilization of modern contraceptive devices (by 40% of women in reproductive age against 27% in 1980s) but the fertility rate remains very high (3.7%), while infant mortality is low (34 ‰).

2.4.2 Structure and Repartition of the Jordanian Population

Figure 2-15 presents the sex and age-wise distribution of the population in the country. The Jordanian population is young (one third of the population is below 14 years old; two thirds below 30 years old): this is due to a long term trend of declining death rate linked to an expansion of health, sanitary and social services. The population above 60 years of age accounts for 4.6% of the total population. The working age group (15-64) accounts for 58.7% of the population and the average life expectancy at birth is 71.5 years (70.6 for males and 72.4 for female) (DoS, 2002). The sex ratio (1-1.109) is unbalanced toward males, who account for 52.4% of the total population. This has been the case since 1952 (Salman, 2001b).

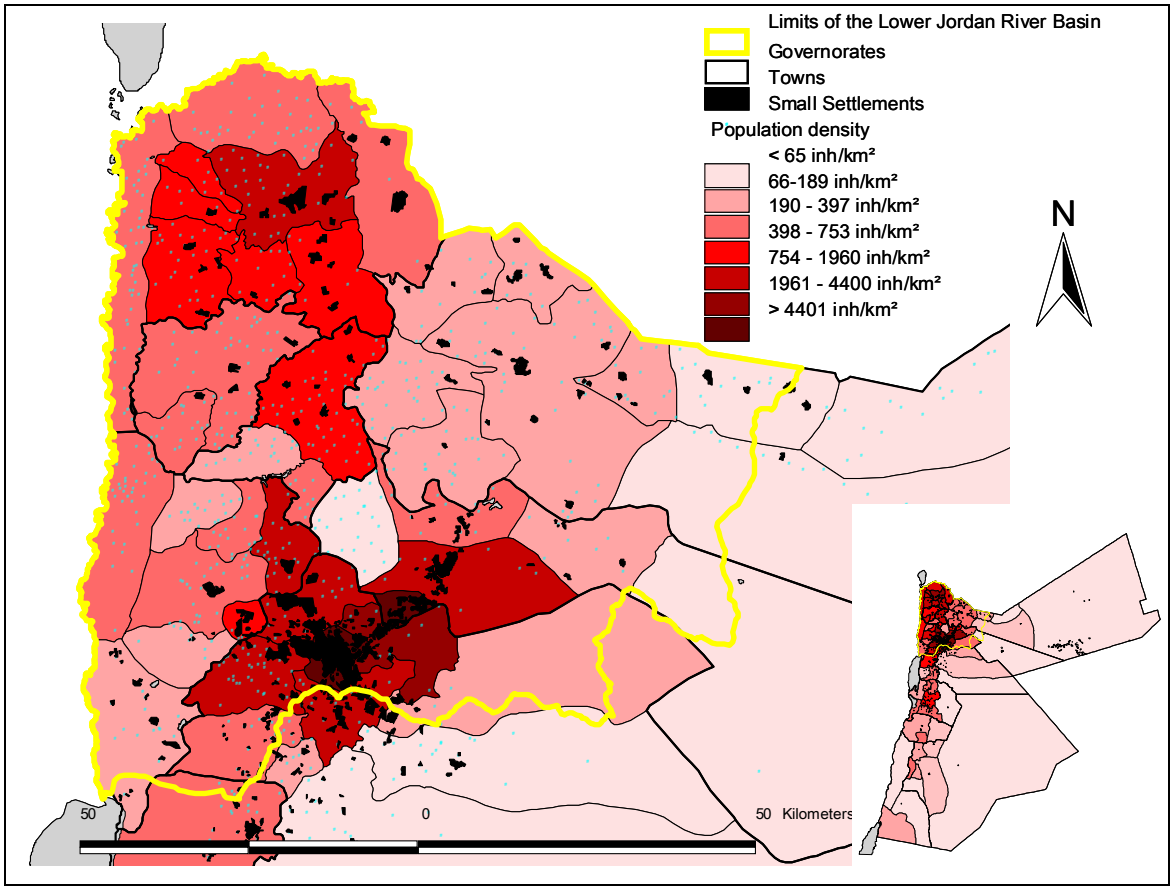
[4] The Department of statistics presents a total growth of 2.82%, migration included. The figure of 3.6% per year is also often presented (El-Naser, 1998; Salman, 2001b; A1-Jayyousi, 2003) but seems very high.

Figure 2-15: Pyramid of the Jordanian Population by sex and age (Source: DoS, 1994)



Population density averages 684 inh/km² but varies from 4 inh/km² in the southern and eastern deserts to more than 10,000 inh/km² in the region of Amman (Figure 2-16). The Jordanian population is increasingly urban (79% in 2003 against 44% in 1961) and concentrated in the northern cities of Amman, Zarqa, Balqa and Irbid. 83% of the population live in the Lower Jordan River Basin and 7.6% of it is non-Jordanian.

Figure 2-16: Density of Population in Jordan (Source. DoS, 2002a)



2.4.3 Structure of Employment and Socio-Economic Stratification

The main characteristics of the Jordanian labour market are:

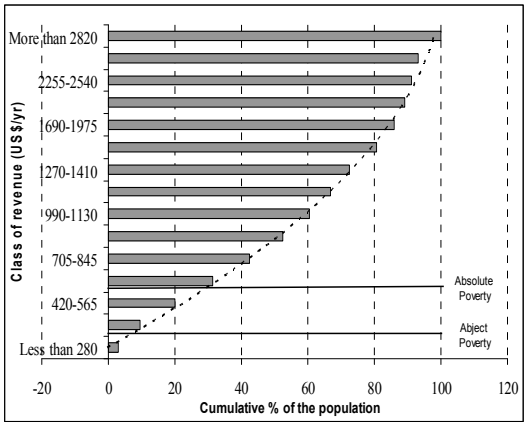
- A high unemployment rate (14.8% in 2005 [Central Bank of Jordan, 2005]) particularly affecting women (27.6% against 12.7% for males in 1998; Salman, 2001b; see chapter 4.3 on the social value of work).

- A low official participation rate (20%), defined as the ratio of the labour force to the working-age population (15-64). This is due to a very low participation of women (11%) and to the magnitude of the youth population (Figure 2-15). However, these official figures do not depict the reality of the labour force in Jordan where informal, flexible and precarious work is common (chapters 4.13, 5.12 and 5.13).

- A historically high employment in the public sector (40% of the workforce in 2005; DoS, 2005). Recruitment in the public sector is progressively restricted and the government is considering various measures to incorporate the private sector in publicly owned companies and utilities (chapter 5.2 and 5.14). Other major sectors of employment are trade and tourism, mining and manufacturing and are dominated by few large companies. The agricultural sector directly employs 3.4% of the labour force (DoS, 2005).

- A substantial number of skilled Jordanians working overseas, in the Gulf States (Salman, 2001b) and a large number of foreign unskilled workers (8% of the labour force [Salman, 2001b]). Most of these foreign workers come from other Arab States and Asia (Egypt, Syria, Iraq, Sri Lanka and Philippines): they have depreciated and precarious jobs mainly in the agriculture, construction and domestic sectors (Salman, 2001b; chapters III and 4.13).

Figure 2-17: Distribution of the population according to per capita revenues (Source. After DoS, 2003)



Officially, 7.5% and one third of the Jordanian population are below the abject ($315/ca/yr) and the absolute ($660/ca/yr) poverty lines[5], respectively (DoS, 2003). Household wise, 4.8 and 28.4% of the Jordanian households are below these two indicators and 68% of all Jordanian households earn less than the average household income of $6,475/yr (Figure 2-17).

The distribution of the Jordanian population among different classes of income is highly uneven: the total income of the 12.5% richest households, mainly located in urban areas, is equivalent to the total income of the 72% poorest households. Moreover, for most households (62%); expenditures are higher than income: this could be explained by unaccounted for secondary activities on the informal labour market or remittances from abroad but this could also put in sharp relief the importance of indebtedness, nearly affecting 85% of the population. Finally, the richest are also those who have small households (Figure 2-17).

[5] As defined by the Jordanian Government, the DFIP and the UNDP

2.5 The Jordanian Economic Context

This section briefly presents the main trends and characteristics of the Jordanian economy. A particular attention is given to the fruit and vegetable sector that is the lion's share of irrigated agriculture in Jordan in chapter 4.1.

Figure 2-18: Composition of the Jordanian GDP in 2005 (Source: Central Bank of Jordan, 2005)

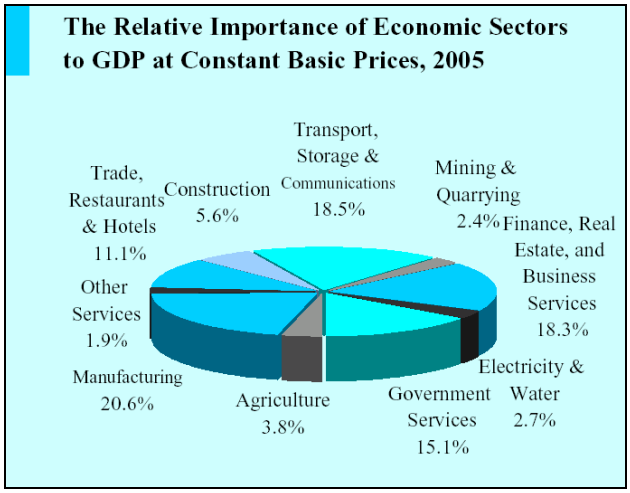
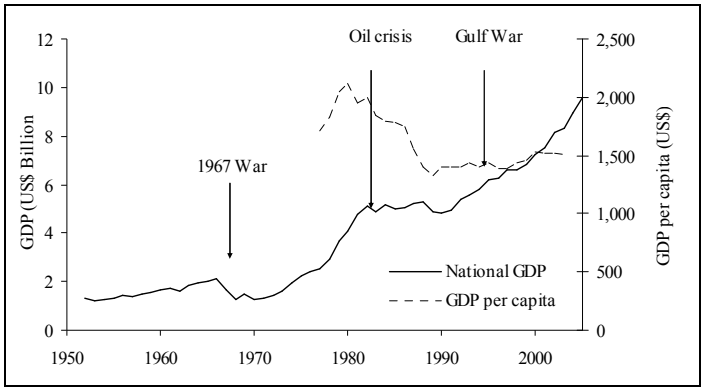


Figure 2-18 provides the relative contribution of each economic sector to the GDP in 2005. Services are the main contributors (64.9%); industries produce 31.3% of the national wealth; and finally agriculture contributes 3.8% of the GDP (Central Bank of Jordan, 2005). Chapter 4.1 gives further details on the agricultural contribution to the national economy.

Jordan witnessed a general economic development during the last fifty years as illustrated by the evolution of the Gross Domestic Product (GDP) shown in Figure 2-19.

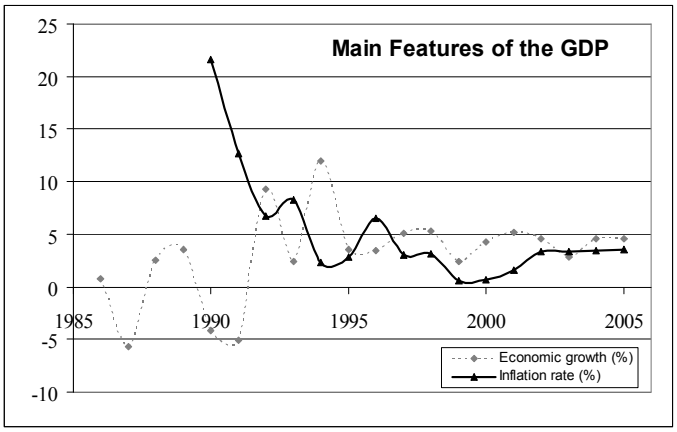
Figure 2-19. Evolution of the national and per capita GDP in Jordan (1952-2005) (in 2000-constant prices) (Source. after Nachbaur, 2004)



The 1967-war; the devaluation of the Jordanian Dinar in 1989 and the first Gulf war (1991) had strong implication on the Jordanian economy: in current prices, the national GDP decreased by half due to the Jordanian Dinar devaluation in 1989 (not shown).

In constant prices, the national GDP decreased by 7% between 1988 and 1991 and the per capita GDP dramatically dropped by one fourth down to $1,327 during the same period: the first gulf war dramatically affected the purchasing power of the Jordanian population (Figure 2-19) but the following influx of rich entrepreneurs from Palestinian and Jordanian origin (chapter 3) stimulated the economic growth (+9.2% in 1992) and limited the inflation (+6.7% in 1992) (Figure 2-20). In 2005, the GDP per-capita amounted to $1,509 per year.

Figure 2-20: Economic growth and inflation in Jordan (1985-2005) (Source. after Central Bank of Jordan, 1996; 2001 and 2005)



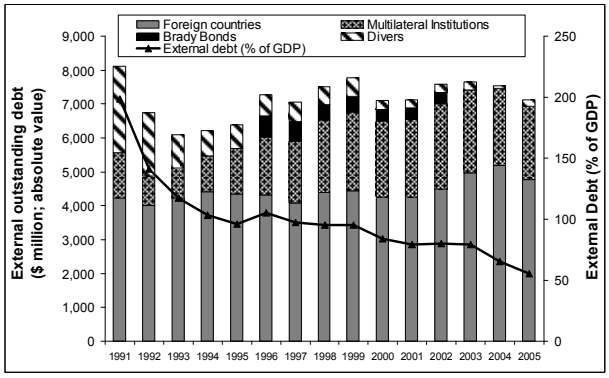
Since 1996, the Jordanian economy is relatively stable: economic growth fluctuates between 2.5 and 5.3% while inflation is contained below 3.5% (Figure 2-20). High external outstanding debt and trade deficit are two other main characteristics of the Jordanian economy (Figure 2-21).

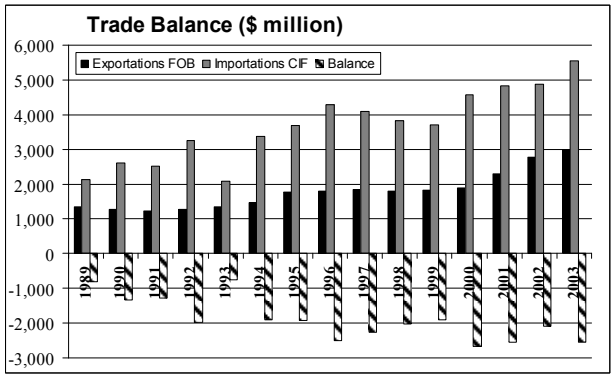
The external outstanding debt averaged $7.15 billion in 1991-2005. In 2005, it represented 55% of the national GDP (against 198% in 1991) thanks to debt re-scheduling. Bilateral loans (among which Japanese and French loans are the highest) account for two thirds of the total external debt (Central Bank of Jordan, 2005, Figure 2-21). In addition, in 2005, domestic debt amounted to $2.437 billion (e.g. 19% of the GDP) and public deficit represented 1.3% of the GDP ($154 millions in 2004). Finally, total debt amounts to 75% of the national GDP (Central Bank of Jordan, 2005). In 2005, loans in the water sector amounted to 14.4% of all loans (behind loans for the energy -45.5%- and the health -21.7%- sectors; Central Bank of Jordan, 2005).

Figure 2-21 also illustrates the large trade deficit of Jordan. With only little natural resources (potash and phosphates- Jordan is the second producer in the world) and few productive activities (pharmacy, textile) and an economy oriented towards services (trade, bank, tourism, medical activities), Jordan highly depends on imports. In 2005, the trade balance deficit amounted to $2.45 billion (27% of the GDP; this is partially counterbalanced by high remittances from abroad and investments in construction and other non-productive assets by Iraqis who left their country after 2003). The main commercial partners of Jordan are the USA, India, Iraq and Saudi Arabia (the last two are the main suppliers of energy in Jordan)[6]. Arab countries supply 33.8% and absorb 42.6% of all Jordanian imports and exports, respectively. The trade balance shows a deficit for all regions of the world but the USA (Central Bank of Jordan, 2005).

[6] USA, India, Iraq, Saudi Arabia and Syria are the main destinations for Jordanian products; importations mainly come from Saudi Arabia, China, Germany and USA (Central bank of Jordan, 2005). Commercial exchanges with Iraq have been highly disrupted by the second Gulf war of 2003: this had strong consequences on the energy sector. Additional international aid (notably $700 and $100 million from the USA and Japan, respectively) and free oil supply from other Arab countries at the beginning of the war ($170 million over three months) partially attenuated the loss of the Iraq market. This did not impede, between 2003 and 2007, a general increase of gazoline consumer prices by 30 to 50% and an increase of the VAT.

Figure 2-21: External outstanding debt (left) and trade deficit (right) of Jordan in current prices (Source. After Central Bank of Jordan, 1996, 2001 and 2005)





3 Social and historical patterns of water management in the Jordan basin

3.1 Ancient settlements and early land development

The Lower Jordan basin is at the heart of historical transformations in the Middle East, due to its central position between Egypt, Palestine, Syria, Arabia (Gubser, 1983). The Jordan Valley and the connected river basin represent one of the most ancient agricultural areas in the world. Some of its features can be traced back looking at the archaeological evidence and the history of the Jordan Basin. "Since the Pleistocene period, the Levant can be regarded as a land bridge for animals and human beings between Africa and Eurasia; a Levantine corridor, a transit route for large and small migrant groups but also an area pinned between powerful states: Egypt to one sides, Northern Syria/Mesopotamia to the other" (van der Koij, Ibrahim, 1989:14). The region has therefore often depended on external political factors and been influenced by events in the wider region.

In the Palaeolithic, hunting of hippopotami and elephants and gathering were the only way of living. Remains of the oldest period have been found in the north of the Jordan Valley (JV) at Ubeidiyeh (700,000 BC). In this period, diets were based on wild grain, young gazelle and goats and later also cattle and pigs, these being probably raised domestically.

On the other hand, during most parts of the last glacial period, the Southern and Central JV were uninhabitable because the valley was occupied by Lake Lisan, which extended from the present Dead Sea to midway Lake Tiberias, with an elevation of 20 m above the floor of the central JV (Van Zeist, 1996).

Only during the terminal phase of the Pleistocene, did the JV become habitable by human. Moreover, according to archaeological evidence, "during the period of c. 14,000-10,000 BC forest vegetations had a greater extension and during the first half of the Holocene, (10-5,000 BC), the climate must have been moister and "inferred higher precipitation… has allowed dry-farming even in the central JV" (Van Zeist, 1998: 202). The desert of Jordan was wetter than today, with huge lakes believed to exist until 8000-6000 BC, when the desert was last occupied. Only around 5500-5000 BC did irrigated agriculture develop in the Valley: earlier inhabitants in Jericho must have obtained agricultural products from farmers settled in the Judean Mountains in exchange of salt, bitumen and sulphur from the Dead Sea.

Periods of development and stagnation have often been related to the presence or absence of a strong authority that could offer security and protection to the Jordan Valley (Khouri, 1988) and could allow a growing population to thrive. Periods of intense settlement have thus often been followed by sparse population and insecurity, and with the abandonment of settlements. In particular, the Jordan Valley has always been a crucial but fragile area "where settled population [would] disappear under changing circumstances" (Van der Steen, 1995:142).

Due to extreme climatic conditions and to its winding course and shallow nature, the Jordan River never became a centre for human activities, as did the Nile, the Euphrates and the Tigris. Yet from antiquity and in spite of frequent problems of malaria, the Valley has remained a pole of attraction for many, thanks to its mild winters and its fertile soils. The trade based on incense and spices made this region a strategic and buffer zone. Two main elements will be important in understanding local changes and dynamics of this area in relation to water management: mobility and flexible patterns in resource management.

3.2 Neolithic: the beginning of agriculture and first techniques of water management

The heavily fortified settlements in Jericho oasis are associated with the Neolithic (c.8000-6000 BC). In this period plants and animals were domesticated, large settlements like Jericho but also Ain Ghazal (near today's Amman) covered 10 hectares of land. Rock basins and pools collecting natural water were modified for storage[7] (Lancaster, 1999).

During late Neolithic times, ovicaprid pastoralism was practiced in the eastern Badia (steppe and arid land) of Jordan. Further, evidence of human activities in the Jordan Valley dating back to 10,000-6,000 BC were found across the southern end of the valley, from Jericho, in the west bank of the Jordan River, which is considered the world's oldest occupied human settlement, to Rama, Wadi Nimrin and Wadi Shu'eib in the East Bank. The economy of this period was mainly pastoral and based on rainfed farming of wheat, barley and legumes. Evidence of domesticated sheep, goats, cattle and pigs were found in the eastern desert (Lancaster, 1999).

In the Calcholotic (fourth millennium) animal husbandry became more important, and cultivated plants included not only wheat and barley but also lentil, bitter vetch, sesame, olives, flax, dates and grapes. Olive was a great source of oil in the Near East, not only for cooking but also for lamps and for rubbing the body. The inhabitants of Deir Alla, located in the middle of the valley, kept dogs, domesticated pigs, they hunted wild pigs, while cows, oxen and bulls were domesticated (van der Koij, Ibrahim, 1989). At certain sites, copper and ivory were worked.

In the Early Bronze Age (from 3000 BC till 1200 BC), new settlements appeared in the foothills of the southern Levant. In the JV, there were large towns, such as Jericho and Bab-el-Dra, on the east bank of the Dead Sea, where fields were cultivated with the help of irrigation. Milk was produced for the first time and crops of olives, dates, figs, grapes, almonds and pomegranate were introduced in the Valley (Lancaster, 1999). Interestingly, camels are thought to be introduced in this period when they provided significant role in transportation services in trading and pilgrimage activities afterwards (Lancaster, 1999).

About 2400 BC, when the Egyptian Old Kingdom collapsed, the southern cities of the Levant were consequently abandoned. Only village life remained in the south and there was an increase of nomadism with livestock. This continuous shift between agriculture and pastoralism, between settlement and mobility, has always been central in local ecological and social adaptations.

In the Middle Bronze Age, the ancient cities were once again inhabited and flourishing and new ones established (1900 BC). This resurgence happened mostly on the coast, but also at Megiddo, Jericho and further east. Trade contacts with North Syria, Mesopotamia as well as the eastern Mediterranean (luxury goods, cylinder seals, pottery) were important in the control of this area: "In this period, alphabetical scripts were developed in the region as the international Mesopotamian cuneiform, as the yet undeciphered script on clay tablets from Deir Alla. Deir Alla with its sanctuary was not the only important settlement at this time" (van der Koij, Ibrahim, 1989:14). Research indicates that the Basin flourished during the late Bronze Age (1550-1200 BC) when it traded with Egypt, Greece, Cyprus, Syria, Iraq, and even Yemen. Settlement patterns in the region of Deir Alla and Sa'idiyeh suggest the presence of an organized society (van Zeist, 1998:153) and most of the settlements of this period were found in the Ghor. Archaeological evidence supports the hypothesis of the existence, already at the

[7] See also ch.V.5. on ancient water techniques.

late bronze Age, of a symbiotic relationship in the Baq'ah valley between the settled population and the semi-nomadic population, which migrated to the valley in the winter (van Zeist, 1989:153), an interconnection between transhumance and settlement that will remain a feature specific of this region.

Later, in the early Iron Age (1200, 918 BC), settlements became denser, with most of the villages situated in the wadis, many of them along the Zarqa Valley: ten out of 13 Iron Age sites are actually found along the Zarqa alone, the main route between the valley and the highland and the very fertile Baq'ah valley in the Highlands. With the start of the Iron Age, "Jordan and the lower reaches of the Zarqa would probably have been flanked by thick river valley forests, with the Euphrates poplar and the tamarisk as the main components" (van der Koij and Ibrahim, 1989:32).

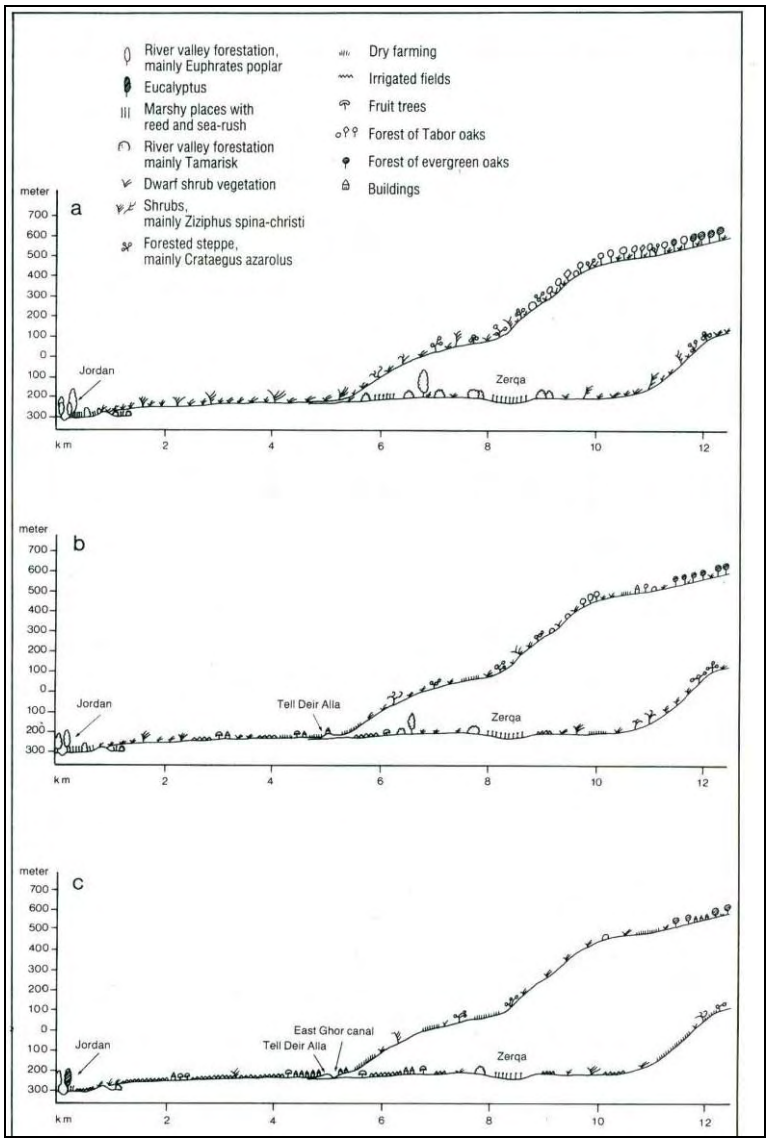
The early Iron Age was a period of strong foreign influence in the JV and one of the few times in history when it was politically separated from the Highlands in the east. The Philistines had invaded Jordan about 1150 BC from their territories along the Mediterranean coast and heartland at Gaza and Asqalan and ruled the Valley for about 150 years. They were later defeated by David, who established a short-lived Israelite Kingdom, which was split up into two states in 922 BC, and defeated by the Egyptians.

The Iron Age witnessed the rebirth and resettlement of eastern Jordan by four Semitic people who tried to fill the power vacuum: the Edomites, Moabites, Ammonites and the Amorites. Their economy was agricultural based but with trading overlay. The Israelites conquered the area during the 10th century B.C., but the Moabites gained strength and regained control of Jordan around 850 BC (Gubser, 1983).

The period from 900 to 300 BC was a flourishing period for the Arabic kingdoms and a peaceful time in the Valley as most of the people were engaged in farming and only few fortified hill cities could be found. The first urban settlements were established in this era. The Edomites moved to the west of Wadi Araba and settled in Palestine, allowing for a new tribe, the Nabataeans, to move from the Arabian Peninsula into southern Jordan. The Nabateans established themselves in the eastern steppe with the help of ingenious hydraulic installations and were able to farm the land at Petra, while maintaining important trading activity.

Figure 3-1. Reconstruction of the historical landscape area around Deir Alla.

An east-west cross section through the uplands around Ajloun to the Jordan River: a) the natural vegetation before the beginnings of arable farming and animal husbandry b) the natural vegetation and arable farming during the Iron Age c) the natural vegetation and arable farming in present days (from: van der Koij, Ibrahim, 1989).



Box 2: Water in Petra

The city of Petra enjoyed a degree of security, since it was naturally defended by the canyons; it enjoyed also the proximity of important trading routes but also the availability of sources of water, in particular Ain Moussa spring. From the beginning of the 3rd century up to 2nd century BC, Petra developed into a city thanks to the wealth acquired by its merchants, and abandoned tribal patterns of life in favour of a Hellenistic monarchy.

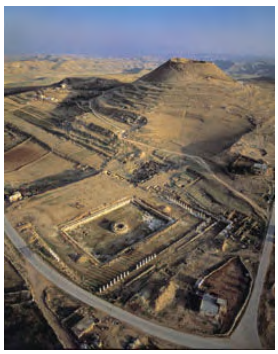
Three perennial sources added to other little sources were canalised and cisterns were built, allowing the life of the city with thousands of inhabitants for many centuries. We can find in Petra cisterns, canalisation network, carved rock to retain rainwater, ladders carved in the rock to go from one cistern to the other. We can also find aqueducts to convey water from one side of the canyon to the other.

The longest canalisation goes up to 3 km, the biggest cisterns were up to 7 meters deep with a diameter of 6 meters. The cisterns collecting rainwater were provided with spillways, allowing the excess of water in the upper cistern to flow into the lower one. Water was also filtered with the help of sedimentation basins. All the hydraulic apparatus was characterized by the simplicity of the techniques adopted and by flexibility in management.

The different mountains of Petra were inhabited according to clan division, which engendered at the beginning a decentralized distribution of water. With the development of the city, this organisation was insufficient; at the beginning of the 2nd century a public body developed distant sources and conveyance of water towards the centre of the city and controlled its distribution. This management required a centralized authority to maintain the structure; the system was in fact regularly cleaned and it is even used today by local Bedouins (Gentelle, 2003).

When Alexander the Great defeated the Persian army in 333 BC and took over the whole empire, Hellenist culture was introduced into the Near East. Transjordan was thus ruled by Greece from 332 to 63 BC, except for the south, which remained dominated by the Nabataeans. Preceding Alexander by about 150 years (i.e. during the 5th century B.C), the Nabateans actually controlled the area from Kerak to the Dead Sea. The Romans took over the region in 70-60 BC. A series of forts were constructed along the eastern steppe strip to protect agricultural land against incursions by camel nomads and their trading activities from the eastern steppe and desert. Various settlements of the early period have been located in the Central part of the JV.

Box 3: Iraq el Amir



The remains of Qasr el Abd reveal a network of hydraulic work connected to a powerful figure, probably a Jew, Hyrcan le Tobiade, who built up a powerful local potentate. This castle was encircled by a lake and the water infrastructures reveal the construction of a big garden, as a "natural" exhibition of power. We can find a dam to retain water and irrigate the sloping garden and cultivated terraces. Even a structure of distribution of potable water has been found.

This castle and the surrounding garden of 500 hectares altogether were short-lived and sticks out as an incongruous feature of the landscape.

After the conquest of Syria and Palestine by the Romans, ten Greek cities joined together into a league of trading centres called Decapolis. From the middle of the first century and for about 100 years, these

cites competed with each other to produce the most modern buildings, monuments and urban complexes, replicating Roman architecture (Khouri, 1981). New villages were built at the edge of the desert. Building of village institutions, houses and water channels were other signs of the period's prosperity. The economy relied on a flourishing irrigated agriculture, trade and Christian pilgrimages (Lancaster, 1999).

In 636 AD the Arabs conquered the Byzantine Empire and took control of Jerusalem. A period of prosperity started, new settlements were established in the entire basin, the JV included. In this period, Transjordan was known as the route to Mecca (van der Koij, Ibrahim, 1989). The Islamic conquest of the seventh century actually reached Jordan in AD 630-636 and the Ummayads ruled the area from their capital in Damascus for about 100 years. Meanwhile, Jordan continued to prosper, being close to the centre of power (Khouri, 1981). The economy was still based on agriculture, trade and crafts.

However, the situation deteriorated when the Abbasids moved the Caliphate to Baghdad in AD 750. Jordan was left at the margin of historical events, away from the main power centres and trade routes. The Abbasid, Fatimid and the Seljuk-Zengid periods (AD 750-1174) were periods of general decline, characterized by few stable communities, little productive activity, and insignificant construction.

After 1070, the European established crusader states. Arabic Islam domination on the basin was restored first by the Ayyubid from Syria and then, in 1250, by the Mamluks from Egypt. In 1187, the Ayyubid leader actually defeated the Crusaders and the unification of Syria and Egypt marked the return of Jordan as a pivotal location in the middle of two great civilizations. The Ayyubid-Mamluk era (1187-1516) was thus a period of general economic revival in the region that lasted until the Ottoman conquest in 1516. The period was characterised by the increase in urbanisation and the formation of the Emirates of Arabs, whose government administration was not necessarily urban but, rather, peasant and Bedouin.

During the first period of the Mamluks, the Jordan Valley reached the peak of its agricultural development, particularly in Zarqa area and in the south. Wherever irrigation was feasible, settlements were set up and sugar mills, driven by water and processing sugar cane, were built in many spots of the Valley. The area was one among few in the Mediterranean countries that had the potentiality to intensively plant and produce sugar cane and to market it regionally, because of its high economic value at that time.

The sugarcane industry declined when sugar industry was developed in Sicily and Spain. However, the prosperity of the Jordan Valley started to decline with the Mongol invasion in 1260 AD, and after a second invasion in 1401, which left Syria and Jordan destroyed. Most of the cities were burned including Damascus, ushering in a period of disarray. The poor administration and the centralized government of the Mamluk aggravated by natural disasters, the spread of epidemic diseases from Europe, and the infrequency of rainfall put an end to the valley's "wet phase" (Khouri, 1981).

3.3 The Ottoman period: new control of land and water

When the Ottomans invaded Jordan in 1516, they inherited an already degraded situation and made it worse by imposing high taxes on agriculture, land, commerce, and other forms of income sectors (Khouri, 1981; Lancaster, 1999; Abujabber, 1988). Only caravan and pilgrims routes were favoured and protected, while nomads prevailed in the control of steppe areas. Cities shrunk to villages and some disappeared.

As Abu Jaber (1989) noted, "the Ottomans administration period has been characterized by instability and depopulation in both the JV and the highland." The population of Transjordan in 1596 was estimated at 52,000 people, of whom approximately 31,000 occupied the main towns and villages of the northern parts of Irbid, al Ramtha, Ajlun, Jarash, al- Gour and Al Salt (Abujaber, 1988). Beside the livestock and agricultural surplus exported to Palestine, the main resource was the control of movement along pilgrimage and commercial routes. In fact, merchants, pilgrims, or travellers crossing the JV could not avoid paying a toll to the tribe for passing in its tribal territory (*dirah*).

As we have seen earlier, the JV has always constituted a region of conjunction and of communication. At the same time, it has often constituted a barrier to communication for multiple reasons: due to the Jordan River in periods of floods, due to the heat of the region, the danger of malaria, due to the political instability, and the fear of attack or robbery by Bedouin tribes who controlled the roads and trade in this region. The Jordan Valley was also on the pilgrimage route to Medina, and therefore the control of this communication link granted power and afforded economic advantages to Bedouin communities, emphasizing the role of mobility and its control as crucial factor.

In the Ottoman period, scattered settlements declined but villages and towns remained the centre of economic and political activity. Farmers occupied through village settlement the northern parts of the country around Al Salt and Ajloun.

Mobile groups of Bedouins occupied the uplands located east of these villages and used JV pastures in the winter. The tribal control of the Valley was characterised by seasonal movements between highland pastures in the summer and the agricultural settlements in the valley near water sources in the mild winters, in a strict interconnection thus between the Highlands and the valley depression. In contrast to the vertical developmental map of the JV used today, which stresses the geographical delimitation from north to south, trade and mobility have always cut the valley horizontally, connecting Palestine with Transjordan[8]. Even nowadays, there are often more social connections between people of villages in the JV and the highland centres than within different parts of the JV from north to south.

In the valley, villages were constructed around martyrs and respected *shuyukh* (tribal representatives) and tombs "marking the martyrdom of companions of the Prophet" (Mundy, 1991), around wadi springs, trade passages and at the junction of routes, all sites that symbolised the history of beduinity and of kinship groups. The tombs of the companions of the Prophet were also a guarantee against stealing of the grains stored. Water and sainthood were crucial elements in the history of settlement in the valley. Communities were organised around a tribal hierarchy that managed the distribution of resources, mainly land and water. Several satellite villages were also positioned near the lateral valleys of the JV that collected the water flow from the highland and utilised the winter pasture for livestock. These villages were often constituted by tribal contiguity (Hazelton, 1978).

[8] Middlemen and merchants played a central role in the connections between Nablus, Jerusalem and Transjordan, through the roads Amman-South Shuneh-Jerusalem or Irbid-North Shuneh-Haifa.

Figure 3-2. Lithograph made by C.W.M. van der Velde

This lithography was made during his journey through the southern Levant (1851-1852). It shows the area south west of Deir Alla, where the Wady far runs into the Jordan Valley

Irrigated agriculture allowed the cultivation in the JV of wheat, maize, barley, and sesame, which was exported to Palestinian cities, mainly Jerusalem and Nablus.

In Western travel accounts of the 19th century, the JV appears as a wild and dangerous place but, at the same time, as a Biblical region with impressive exotic scenery. Although this area has often been depicted as a desolate and empty land by the ethnocentric and primitivist perspective of the first Western explorers, a different image was transmitted by a few of them, such as Mallon in 1931, who described a green pastureland that in winter constituted one "of the most animated area of Palestine". The valley was indeed a large grazing ground and an important centre for different Bedouin tribes: the 'Adwan, the Bani Abbadi, the Bani Sakhr and the Ghazawieh, the most influential tribes in the local management of resources, extended their tribal land (*dirah*: see box 3) to the Ghor, moving to the temperate regions in the highlands in winter. In this respect, the close bonds between the tribes of the East and of the West Bank and the social connections of the entire valley as an ecological unity were central features in resource management of this region.

Box 4: Dirah

The term of dirah derives from *dar* that literally means "house", which may be a construction as much as a tent. Dirah and tribe have to be seen as a system of exchange organized around the *khuwa* (the payment to tribes to obtain their protection); it represented a mutual agreement of payment between the Bedouin and the villages, "the necessary regulatory mechanism for symbiosis where coercion is not possible" (Lancaster, 1981, 123).

The dirah was also a space, both pasture and cultivated land, of pastoral migration of a group. The exclusivenesses of control and management was in reality adjusted according to demographic pressure or climatic conditions, allowing access to other tribes in case of scarcity and existing relations of loyalty and alliance.

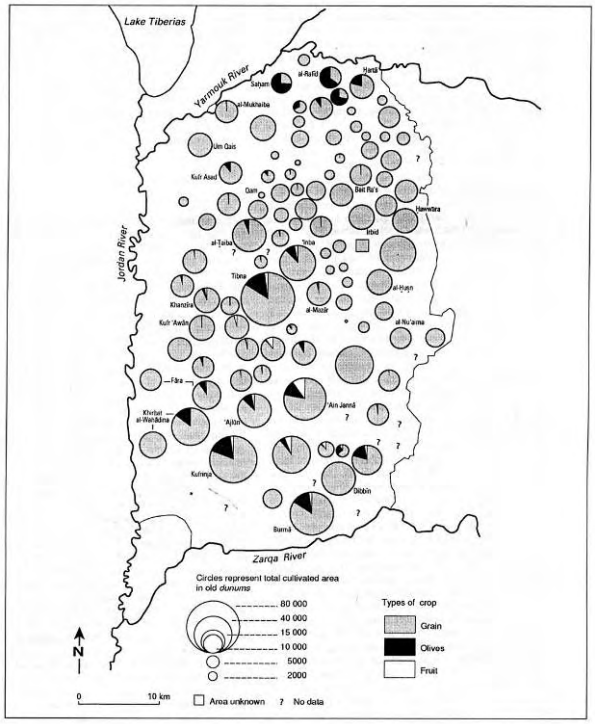
The idiom of group solidarity infused a network based on blood relationship and genealogy that stood behind the idea of dirah: the network of the kin depended on the dirah, the group that managed the resource. A group could leave a territory for another, since the dirah was linked to the dynamic fusion-fission of tribal segmentary model: the manipulation of tribal alliances and conflicts was possible thanks to the flexibility of the notion of dirah and of its border. The dirah constituted therefore a political concept used in a flexible way, which revealed the power relations in the management of resources. Around this perception of territory, the conflict between state sovereignty and tribal management has been crucial and its effects can be sensed today in water management in the valley.

The agricultural economy, which prevailed in the 19th century, defined three landscapes (Suleiman, 2004). The upland relied on producing staple cereals, commercial crops of dried fruits, sheep and goats. The rainfed plains grew grains and provided commercial services. Irrigated valleys produced grains (wheat, maize, barley, and sesame), which were exported to Palestinian cities, mainly Jerusalem and Nablus, and commercial vegetables. Exchange of products and services took place through pilgrimage seasons (Lancaster, 1999).

Land and water were controlled by the sheikh (tribal representative) or by religious figures, such as sufi leaders, who were associated with the tomb of a saint (*wely*). The concept of dirah through which land and water were conceived played a central role in resource management. It was a flexible notion (Bocco, 1987): the border and geographical extension of a dirah were often flexible and were connected to the local perceptions of rangeland, to the pastoral economy and to intertribal relationships.

The main crops cultivated in the north western uplands of the basin and their distribution at the end of the 19th century can be seen in Figure 3-3, where wheat constituted already the main product, followed by olive and with a minor presence of fruit.

Figure 3-3. Land use at the end of the 19th century (from Mundy, 1996)



Bedouins economy incorporated devices aimed at redistributing resources: the razzia (*ghazw*) regulated the relationships between tribes and allowed a redistribution of economic surplus; the *khuwa*, or payment for protection was another system that regulated the relation between nomads and settled populations but also between the Ottoman rule and tribes. Finally, the *surrah* was in fact a yearly payment by Ottoman administrations to tribes that ensured safety on commercial and pilgrimages routes (Bocco 1995). With the Mandatory state, Bedouins will be forced to abandon the khuwa and ghazw and thus pushed to sedentarize.

Water and land distribution followed clan stratification: there were tribes with tribal territory in the Ghor and tribes who just moved with transhumance in the Zor (Ohannessian, 1990). The first ones were organised in patron-client relationships that determined the status hierarchy of different groups working the land. These groups at the bottom of the hierarchy were '*abid*, slaves of African origin: many 'abid families had been introduced in the valley in the preceding century in the sugar industry and were dependent of major tribes controlling these areas.

Further, the Mashalkha tribe was working land in a *ruba'* (a quarter) system, receiving a quarter of the produce at the end of the season. They were also named Ghawarneh or, in a more deprecatory manner, 'Ghorani', 'natives from the Ghor': until today's clan and status segmentation, 'Ghorani' has remained a strong deprecatory term and should not be used in public (Ohannassian, 1991). Linked to that, the past border between 'abid and Ghrawaneh are often vague and manipulated in practice.

Ghawarneh are believed to be descendants of slaves who arrived in the Ghor with the Mameluks or who were abandoned by Ibrahim Pacha when he retreated in 1840 (Lavergne, 1998). They were working in a dependent relationship to their patron, mainly free (*hurr*) or noble (*asil*) tribes, and in some regions, alongside peasants (*fellahin*), who were also structured in a relationship of patronage but without the social stigma attached to Ghawarneh.

Tarawneh (1988) has named this integrated system a 'harrath economy', based on the division of the *harratheen* (literally, the farmers who "ploughed the land"), the tenant, and the sheykh controlling the land. Harratheen differed from the fellahin as pattern of tenancy, who also provided labour and resources for agricultural investment, but who traditionally enjoyed a higher social status (Abu Jaber, 1989). In fact, fellahin provided resources and the work required for the agricultural season as *sharaka* (partnership) or as *muzara'* (farming arrangements with the landowner), all terms which have acquired a new meaning in the modernization process in the last half-century.

A large part of the agricultural surplus was also spent by patron tribes "on banquets and guest-meals, to establish and maintain the social relations on which the sheikh's status depended" (Tarawneh, 1989; p.121): hospitality and performance of generosity remain important symbolic resources until today. The patron and client tribes established a relation of production that has been reproduced in contemporary tenancy relations as a crucial model of both economic and political security as much as of dependence.

In contrast to common wisdom, most tribes in the Basin area combined "collective, genealogical models of identity with individualistic models of land ownership" (Shryock 1997b: 41). Private ownership in fact has not been an external, modern or urban introduction, but was already present at the beginning of the 19th century. Thus, when Jordanian official, under British supervision, later conducted the first land settlement, they encountered forms of common propriety as much as private ownership. As Shryock argues, "individual ownership is not based on individualism; instead, private ownership is collective property defined and guaranteed by one's position in a tribal group and tribal groups" (1997b: 49).

3.3.1 Perceptions of land and water

Fishbach (2000) refers to the "high degree of local social control over the ownership and exploitation of land in the absence of government apparatus": what is important here is the indigenous concept of control of resources that differed from the exogenous model of individual ownership of land or water, which was later introduced. As Lancaster (1999:31) showed "ownership comes through access, use,

action and is validated by defence and reputation". In fact, the notion of vivification of land (*ihya al mawat*) through ameliorations and work, and not the ownership of land by itself, granted the rights and the control of land and was applied also to water resources (Bocco, 1987). In contrast with the system later imposed by the British Mandate, "ownership is function of claims and access to resources, rather than a system of control and absolute right of disposal (…)" (Lancaster, 1999:198).

According to Islamic Law, to Ottoman codes and to customary practices, different kinds of waters were distinguished, mainly defined according to private and common good: "once water gushes within a privately owned land, whether by individual or a group, it is considered the property of the landowner" (Nims, 2001:4). Therefore, there was a strong relationship between land and water ownership. Again, using the words of Lancaster (1999:68), "owning comes from developing a resources beyond its natural capacities, which includes, irrigation systems, wells, cisterns, perennial cultivation": therefore, "only developed land could be owned", an element that will remain important in contemporary practices within the national state of tribes who farm in order to affirm their control and ownership on land (see par.III.8.2).

Box 5 Ownership of water

Water had to be contained and stored by artificial works in order to become a commercial object and it was acquired by inheritance. On the other hand, other waters that come from God were conceived as free to all and could not be owned. The rights to water were linked to this main distinction, although according to Islam and customary law two crucial rights were recognized, rights that today in case of conflict are sometimes called upon:

- The right of thirst and watering domestic animals and land.
- The right of irrigation from common and public water.

Different types of rainfall were identified according to quantity and duration as *matar*, *ghayat*, or *wabel*. In the *hamad* (open, gravely country) and in the *harra* (mountainous arid area variably covered with black basalt boulders), "knowledge of water movement and the associated soil structures is important, so herders may predict the location and duration of stored water" (Lancaster, 1999:106).

The tribe of Bani Sakhr, who mostly resided in north Jordan, made a distinction between different sources of water (Bocco, 1987):

- The *ain*, a natural source of water, that recharges naturally and seasonally and which does not need of specific infrastructure to be tapped.
- *ghadir*, sea of water, which formed in the desert after rain periods, generally situated at the end of a wadi.
- *barqa*, artificial cistern constructed to conserve water.
- *bir*, a well.

Even nowadays, water is perceived by Badia users -but this could be applied to all the Jordan Valley basin- not so much as a scarce resource, "but as a varying and unpredictable resource" (Lancaster, 1999:142), which reveals how the present notion of water scarcity is also a cultural construction, which depends on the use and on the social relations in which is embedded.

In facing drought, local communities adopted multiple strategies: they increased mobility, reduced the numbers of herds, opted for raiding, or shifted to wage labour or sharecropping (Lancaster, 1999). Therefore, agriculture was inevitably linked to -and not opposed to- mobility, to pastoralism, to migration according to the needs, political alliances, or changes in the environment. A context thus characterized by high flexibility and resilience, in a strong and dynamic adaptation to the environment, where agriculture and pastoralism are tightly associated. Against a stereotypical image of an immutable local management, local land use systems were not static before the birth of nation states.

Strong seasonal changes have always been linked to the routes of transhumance and to the continuous shift from agriculture to pastoralism and the other way round.

3.3.2 Distribution of water

Weirs and canals were built around the side wadis by packing mud in between stones, tree branches and shrubs, to direct the water into earth channels that led to the planted fields (Suleiman, 2004). From the main feeder channel, subsidiary channels would take the flow of water to parcels of land (Lancaster, 1999). In the southern Ghor, the left bank side-wadis were tapped by little channels, so that the whole Ghor could be turned into a watered meadow (Lancaster, 1999). Much water evaporated or was absorbed by the soil before it reached the cultivated area, which were flooded three or four times a year. Heavy rains would wash out the irrigation systems which often had to be rebuilt (Khori, 1981).

In the JV, water for irrigation was distributed by 12-hour turns to *harratheen* on what was called the *maosim* principle, based on sheikh control and distribution of this resource. Surface irrigation was practiced with a specific knowledge through a distribution of water in a network of canals branching off side wadis.

According to Lancaster (1999: 110) "each parcels gets so many hours of water a day and the amount of water a parcel gets decides what crop can be grown". It is important to note that this linkage between available water, according to the season and the size of the community, and the choice of the type and quantity of crop to be cultivated in relation to the water available, is still important today. In summary, water was directly linked to the tribal community with regard to management (*jama'a*), distribution, maintenance of canals and disputes resolution.

According to Nims (2001), irrigation water in the JV was distributed through a three-level system of management:

- A common property regime, distributing river water between landowners (tribes or individuals) based on the cultivated area and seasonal water availability. Members of the regime, or those working for them, would build canals, which channelled floodwater to the different plots that were designated for the use of those individuals or tribe members. They would agree on the time and duration when the canals would be opened;

- A system of water distribution between different sharecroppers decided by the owner of the land they were sharecropping. This system would give them right to access the water for irrigation purposes;

- Over and above that, landowners had private property right to spring water found in their land and from water wells. They would give the right to access that water to sharecroppers according to their agreements;

Water was thus linked to the notion of irrigation hour, a temporal frame explicit in the words of a farmer from the 'Adwani tribe in south JV:

> "The exchange of hours was called *muqara* or *mdawwar*, it was done in order to irrigate in summer more frequently. The Ghawarneh were working in the *mraba'* system, getting only bread and water for their work. Now this is *mahal masri* (the work of Egyptians)!"

As this quote shows, patterns of rotation of water and even of exchange of turns of water were part of a hierarchic system that saw Ghawarneh at the bottom place, today often substituted by Egyptian migrants (see chapter 3.8.1.).

In parallel to this tribal management of the natural resources, the Ottoman Sultan Abdul Hamid II enacted the first law with regard to water resources management in the region. The law provided the basis for the resolution of disputes over water and land ownership (Nazzal, 2000) although there is no evidence of an effective implementation.

3.3.3 The flexibility of resource management

Risk and flexible coping strategies were prevalent features of life in the region. Villages in the mountains were better protected than in the valley from raiding and robbing and, sometimes, the presence of a sheikh from an important tribal family guaranteed against raiding. In the face of unpredictable rainfall and availability of water, the main response to insecurity were thus migration and the shift between transhumance and seasonal agriculture. Already in the 19th century, tribes such as the Bani Sakhr, the Bashatwah, the Balawneh, the Ghaddab and the Dayyat came from the east to the valley. From the west farmers often came from Nablus, Ramallah and Jerusalem region.

Flexibility was thus the most significant response of Bedouin society. The main strategy was exploring a multitude of income resources: sheep, goats and camels were main economic sources but also a form of prestige; camel trade remained crucial, aside robbing and raiding and caravan-escort. But in case these resources decreased, they could also engage in smuggling and farming. Nomadism was attached to the tent habitat (*bait a-shahr*) that is still used today for ritual and hospitality occasions, even in settled contexts. Moreover, the distinction between nomads and settled population has always been in a flux since "nomadic tribes had begun to diversify their economies by establishing and controlling farming communities, cultivated by their own tribesmen or by peasant tenants" (Wilson, 1987:55). In the absence of state security, tribal organisation accorded a protective role based on kinship and the tribes of Transjordan "filled every economic niche from nomadic camel breeders to settled farmers, forming a complex web of integrative social alliances" (Wilson, 1987:57).

For populations settled in the Highland, land was the material basis of the family (*a'ilah*), a unit of solidarity and mutual obligation, which was constituted by several households (Mundy and Smith, 1990). This important form of pooling labour in local strategies and in political organization was further tied to the nomination of representatives on the council supervising the annual re-allocation of land and facilitating mutual cooperation.

The *rabtah*, as a system of cooperation between two or more households, declined with the introduction of olive production and tree crops, which did not require the same degree of cooperation between the owners of adjacent plots. In fact, we do not face here a static farming village society, but small communities well used to constant changes, setting up coping strategy in order to face the risks of agro-pastoral endeavour.

3.3.4 Land registration

Ottoman land legislation in 1848 did not transform local management of resources but definitely introduced new concepts of land and water and, more important, a first bureaucratic presence that will have a major impact in the decades to come. Later in fact, "British and Jordanian officials maintained Ottoman land legislation as the basis of the country's regime" (Fishbach, 2000).

The history of this period, in particular between 1850 and 1948, has often been neglected in historical analysis and held as a mere period of stagnation, obscuring the changes that occurred in order to emphasize the ensuing "modernization" of the British mandate, the influx of Palestinians, and the planned intervention following 1948. However, Ottoman intervention did have a crucial impact on local resource management.

First of all, the Ottoman introduced a new, western style bureaucratic and military presence. Secondly, land registration was carried out in order to introduce a system of land taxation. Thirdly, in this land registration process, Ottomans offered lands to powerful damascene families to exploit new territories in Transjordan, starting a process of introduction of urban and merchant elites in rural areas that will increase in the 20th century. Sheikhs became big landlords but, more importantly, this land reform represented the first encounter between the idea of state and society in Transjordan; in fact, sheikhs were appointed *multazim*, state tax-collector for their territory and were therefore co-opted in the new administration.

Land registration was carried out between 1870 and 1900. The registration system required every landowner to obtain a title to verify his lawful ownership. Indeed, for the new administration, the most pressing need was to collect as many taxes as possible and to solve the frequent bitter disputes around village boundaries. Many sheikhs registered and cooperated with this integration process for fear of losing these rights.

Five legal categories of land were defined:

1. *Miri,* "belonging to the Emir", state owned land, with usufructuary rights; the ownership or 'neck' (raqaba) of this land vested in the rules or the state, while the farmer who tilled the land enjoyed usufructuary rights (tasarruf).

2. *Milk*, as private freehold land, with legal title; like moveable propriety, it was inherited according to the Islamic Shari'a law.

3. *Waqf*, endowed to support a religious institution;

4. *Matruka*, 'given over', non-arable land set aside for public purpose; it included land left for the general use of the public and land for the inhabitants generally of a village or town, also communal forests, places where cattle gathered.

5. 'Dead land', was unoccupied land not set aside for the use of the public.

Issues and trade of land passed from Islamic court to tapu Bureau of the Ottoman bureaucracy: an important shift in the increasing construction of a bureaucracy dealing with land and water, which anticipated the shift to contemporary centralized organizations (see par.III.5). Interestingly, this classification has remained as the basis of the actual categorization of land in contemporary Jordan.

Previously, land was conceived in terms of *faddan*, defined by the area ploughed by a team of oxen in a day, and not in relation to human labour itself. This measure was mainly used in the plains of the Highlands, while in upland villages the basic unit of measurement "was cast in terms of a man's labour, in *zalama* as the villagers say" (Mundy, 1991:69). These terms were later translated and expressed in terms of dunum, a new quantitative measure reflecting also a new productive reality (see chapter 5.2).

A context of many small-scale cultivators in a relatively equitable distribution has been pictured by Fishbach (1994) in this period, when again the mobility of outsiders became influent in local resource management. Moreover, the Ottoman legislation overlapped with the local patterns of land management, where the *musha* system constituted one of the main elements: of 439 villages in Transjordan, 207 villages were on musha, mostly concentrated in the north of the Jordan Valley (see Figure 3-4).

Box 6: The *musha* system

Musha consisted in a set of different kind of collective systems, based on village community. Every farmer received a new plot in a new location through a redistribution process every 5 or 8 years. In fact, musha meant "joint ownership', 'joint tenancy', where agricultural land is owned by village community and redistributed among heads of families" (Wahlin, 1988:24).

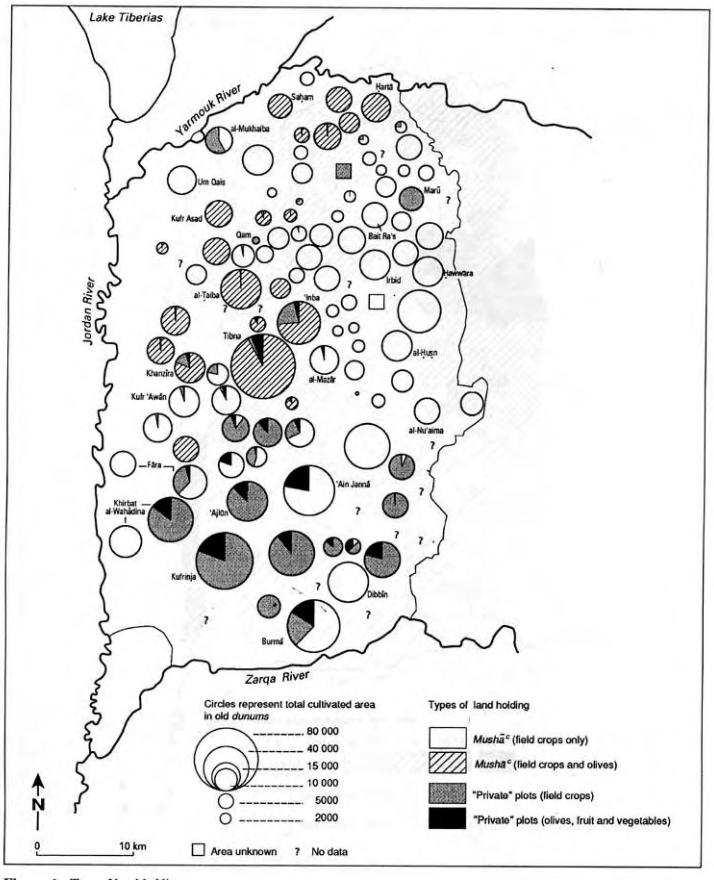
Not all the land was organized on patterns of *musha*, but generally, "poorer, more sedentarized tribes, whose number drew a greatest share of their subsistence from agriculture, tended to communal tenure of tribal properties" (Rogan, 1999:88).

As explained by Atran (1986:286), "the general structure of cooperation between members of the village was expressed in the idiom of affinity (*nasab*); villagers interpreted their mutual dependence in all masha'a operations other than those of the joint farm in terms of the duties and obligations that belong to affinal relationships".

In this context, villages "had evolved flexible, self-sustaining mechanisms of economic isolation and internal social integration" (Atran, 1986:279). Sharecropping was already present and constituted "an historical way to distribute risk, more than gain" (Atran, 1986:279).

In the late nineteenth century, according to Figure 3-4, we can see how the land use was varied in the same region, combining collective musha and privately owned fields.

Figure 3-4. Types of landholding in a delimited area as case study in late 19th century (from Mundy, 1996).



3.3.5 New immigrants and settlements

Following the 1848 Land Code, land was commodified and registered in shiukhs (tribal representatives) and other notable names. Large holding were anyway not a prominent feature and the society was characterized by tribal cohesiveness and the prevalence of "landowning peasants with a strong egalitarian ethos" (Wahlin, 1994:33).

In 1869, the Ottomans asserted higher control in the area and people in the Highlands started to settle in villages. The Ottoman state came to integrate so this frontier district through the extension of its bureaucratic network and its linkages with the wider regional market.

The Ottoman first concern was to populate the lands between administrative centres with cultivators; towards this end, between 1867 and 1910 they strategically gave land titles to local peasants, to Circassian (in Jerash, Salt and Zarqa), to Turkmen in Karak, Chechen in Zarqa, all migrants who in return maintained great loyalty to the Ottoman. Later, the Bedouin tribes, alarmed by the Government expropriation of their dirah, were led to settle sharecroppers on their lands in plantation villages, farmed mostly by Palestinian and Egyptians, as a means to strengthen their claims of ownership.

The emergence of Circassian, Chechens, Turcoman and new Christian settlements (as in the case of Salt) caused high distress among Transjordanian tribes; this was paralleled by the introduction of new powerful landowners, often urban-based outsiders from Palestine, Syria, Christian Arabs and officials

from the Ottoman administration. They often acquired land through usury, lending money against land, as a first form of capital penetration in rural areas leading to a strong dynamic of indebtedness.

In parallel to that, larger farming operations started to emerge in the eastern districts. They resorted to the traditional system common in the north and in Palestine, based on crop-sharing in the form of yearly agreements between the landlords and the workers. These labourers were mainly Palestinians migrating from Nablus region, from Jerusalem area, from Ramallah district but also Egyptians, revealing the crucial important of migration in local management of resources.

Transjordanian society witnessed the extension of cultivated areas and the increase of exportation of wheat. This two main factors led to the formation of an economic-political elite made of Bedouin high status families and important merchant families who had bought land in the vast areas of 'Ajloun and Balqa (Tell, 1993).

Jerash, Ajlun and the slopes used to have intensive tree cultivation, including oak, butm, seyal, and sidr (Suleiman, 2004). In the late 19th century, the expansion of agriculture, the increase in population, the replacement of local tree products by imported ones, the increase in the Ottoman central government demands for wood for construction or charcoal, all contributed to the destruction of the trees (Lancaster, 1999).

Further, the extension of communication westwards to Palestine opened Jordan to regional markets. Commerce was stimulated with settlements and connections: the primary commodity at that time was grain. Jordan represented in fact a new granary for the merchants of Palestine and Syria (Rogan, 1999).

Towards the end of the Ottoman period, "the lack of centrally administered law and order had made the population adopt an alternative security of kinship-based tribal system generally associated with animal husbandry but extended into agricultural villages and towns" (Wahlin 1993).

Looking at Figure 3-5, we can see that the settlement development in the 16th and in 19th century was highly concentrated in the Highland of the basin, with patterns of depopulation in the southern part and increase of settlements between Zarqa and Yarmouk Rivers.

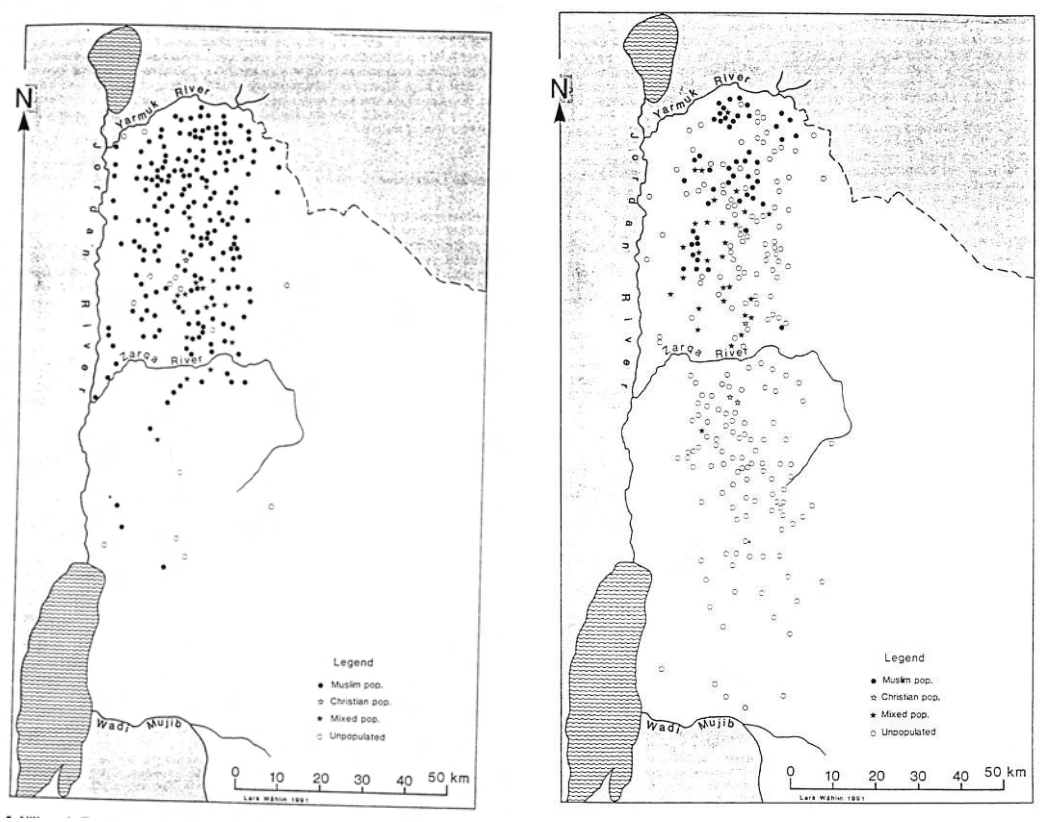
In 1918 the revolt of the Arab revolution by mainly tribal forces had instilled doubt in this new and unstable class of landowners who would live in the years to come in the continuous fears of Bedouin attacks and razzia. Following the expulsion of king Faysal by the French, the danger of new revolts in Transjordan convinced the representatives of tribes, the minorities and the merchants to support the stabilisation efforts of H. Samuel, High Commissioner for Palestine, with the establishment of local governments in the summer of 1920. These efforts, however, were undermined by the incapacity of the political elite to cooperate and Transjordan witnessed a process of fragmentation along tribal lines.

These ineffective local authorities were deposed with the arrival of Emir 'Abdallah in Ma'an in November 1920, who therefore attracted the loyalty of the local notability and was supported by the British for the formation of a centralized government in Amman. Tribal factionalism allowed this new government to repress revolts. Lacking financial resources in this endeavour, Abdallah was forced to rely on the interested aid of the British, with the transfer of administrative control to the Palestine government under British full control, establishing a relationship of full dependence later sealed by the British Jordanian Treaty in 1928. Jordanian elites showed little cohesion and capacity to oppose British colonization efforts and to constitute an independent state (Tell, 1993). The Transjordanian

elite, together with a new Royal elite of bureaucrats, merchants and tribe shiukhs, was thus to be co-opted in the fully British controlled mandatory state.

Figure 3-5: Villages in 1596, according to the Ottoman tax register

(from Hutteroth and Abdulfattah. Historical geography of Palestine, 1977, pp.162-174). Village sites in 1838 (from: Robinson and Smith, Palestina Reise in 1838, 1842, band III, pp.164, 169-171).



3.4 The British Mandate and the first planning interventions: 1921-1948

The beginning of the 20th century witnessed the first attempts to intensify agriculture: first, as a result of urban merchants' investment and their slow appropriation of land in the JV, and secondly, through Ottoman attempts to integrate the area under their effective control, a process they never completely achieved. What speeded up the changes in land management was the settlement of land under the British Mandate.

The Arab revolt exploded against the Ottoman. During 1917-18, the forces of Sharif Hussein of Mecca and the British conquered Palestine, East Jordan, and Syria and in 1920 Jordan came under the control of British indirect mandate. At the end of the First World War, Transjordan, previously called the "south east Bilad al Sham" area, came into existence in 1926 under the temporary British administration. It became fully independent in 1946 as the Hashemite Kingdom of Jordan, but with the right for the British to remain with troops and exert a strong influence on the internal politics of the country.

State intervention in land affairs began in 1929 with the establishment of the Department of Land and Surveys. In 1933, the Land Settlement Law was promulgated and opened the way to cadastral

registration of land titles and to the fiscal survey. Between 1927 and 1933, a fiscal survey was actually conducted in which village boundaries, state domains and forests in agricultural lands were demarcated and mapped. Financial expenses between 1924 and 1944 represented 75% of the national budget, and most of the British aid was targeted for defence and for the construction of strategic roads for the control of the territory in the new state frame.

The about 450 villages in Transjordan were divided in blocks of similar land fertility. A Land Settlement Court was put up with the power to determine the real ownership of land. In this frame, intensification of agriculture in the JV took place, particularly in Zarqa area and in the south, but it is only around 1970 that settlement had been effected in most agricultural region of the country.

For the British Middle East Office (BMEO), the settlement of land title was based mainly on the idea that agrarian reform would do away with indigenous land practices, such as the *musha* system, and would attract the loyalty of the rural elite and tribes through land grants designed to promote political stability. Land titling was thus the first step in the attempt to fix uncontrolled and moving communities to land and to construct a 'peasant community' out of a transhumant population.

Musha was strongly opposed since it was perceived as the cause of land fragmentation, of inefficiency in agricultural management, and of the lack of investment in agriculture. It is important to add that the British were less interested in dismantling the musha system in semi-desert and desert land (Razzaz, 1994), a laissez-faire attitude in the relation with the tribes of these sub-regions that has also influenced contemporary dynamics.

We have to read this process of land registration also in the wider frame of the pressure of Zionist interests on the natural resources of the area: in fact, as early as 1916, British Zionists asked the British Government to claim all the Jordan River for mandated Palestine (Ghobasky, 1973). Later in the 1930s, Zionist hydrological and agricultural surveys were motivated by the desire to find a solution to the increasing tensions between Palestinians and Jews in historical Palestine (Ghobasky, 1973).

The land settlement was thus also meant to avoid land purchase by Zionists in Transjordan and the hydrologic studies conducted in the Jordan Valley already in the 1930s where meant to prepare the settlement of Palestinians in Transjordan (Fishbach, 2000) or the settlements of Jews immigrants.

In 1926 the British mandate conceded for 60 years the exclusive use of the waters of Yarmouk and Jordan Rivers to the Palestine Electric Corporation, called Rutenberg Concession by the name of the Zionist investor. This private concession blocked for years the development of irrigated agriculture according to plans already drawn at the time (Goichon, 1967). The Jordan Valley started thus to become a security and strategic zone, an area of irrigation priority and with competing claims for settlement by Zionist politics and Transjordan.

Besides, Bedouins lost two important sources of income: with the introduction of the railway and later of the automobile, the camel was gradually replaced as main source of income for large groups of Bedouin and as the main transport medium. Further, trade between nomads and Islamic pilgrims was suspended and with the decrease of camel raising, the pastureland in the desert also became less relevant, while the railways made military action and control of the desert stronger (Barhan, 1989). Besides, mechanical transport in the 1920-30s led to an easier export of fresh agricultural products to Palestine.

From that moment, Bedouins acquired a privileged political position, due to their importance in the stability and settlement of the future state, but at the same time this position was not paralleled by economic power. National borders became "perhaps the greatest causes of resentment among tribal and herding population, who feel the access to their former seasonal areas markets and agricultural land made difficult or impossible" (Lancaster, 1999:128). Cut off from their traditional grazing areas, Bedouins were gradually forced to settle. The spread of rainfed cultivation and the decrease of pasture in rangeland were the two main consequences.

Land titling also led to the legalisation of tribal ownership, through units of land granted to tribal chiefs. With the registration of land in the 1950s, local farmers were forced to graze their flocks on their own land rather than on common range land of the village. Besides, land registration was associated in villagers' mind with the penetration of money lenders and thus with the subsequent drastic incorporation of villages into a wider market network.

Further, the following increase in land value augmented capital investment in the JV by city merchants who thus gained important control of the future resources within the development programme.

Only after 1930 did the first development of agricultural production start: local officials were convinced that the key of stability lied in the control and loyalty of tribal communities and so invested primarily in rural development, after years of water scarcity, invasions of locusts, and the food crisis of the end of the 1920s. Political measures were taken that covered the minimum and vital needs of Bedouins and farmers (Tell, 1993).

Agricultural development for Bedouins was viewed by the British as a first step of a detribalisation process and as a political mean to distance tribes from the political influence of Ibn Saud in Saudi Arabia. Besides, a new peasantry would have helped the British in stabilizing the country through settlements, in an explicit policy in favour of little and medium land owners. Yet, urban moneylenders acquired growing importance and landowners in the valley often had to give up their land to get out of debt. In 1950, 454 villages in the JV Basin had undergone land settlement and the average plot size per family was 65 dunum (Fishbach, 1994).

In this context, the set up of the Desert Patrol Force was strategic in overcoming the economic crisis that impacted on the Bedouins. Glubb, head of the Arab Legion since 1939, had an important role in the construction of this military group, as a main attempt to co-opt local unsettled tribes within a new political organization.[9]

In short, the Land settlement built up a form of a 'partnership' between the state, represented by the Land and Survey Department, and landowners for managing land and irrigation water resources. Further, the Water Law in 1946 recognized traditional water rights, which had to be registered with the Department of the Lands and Survey. It issued registration bonds indicating water shares (m^3/hour) per unit of land. The law also recognized the joint responsibility of irrigation water management between the state and the landowner but only addressed the management of surface water (Nims, 2001:6). This

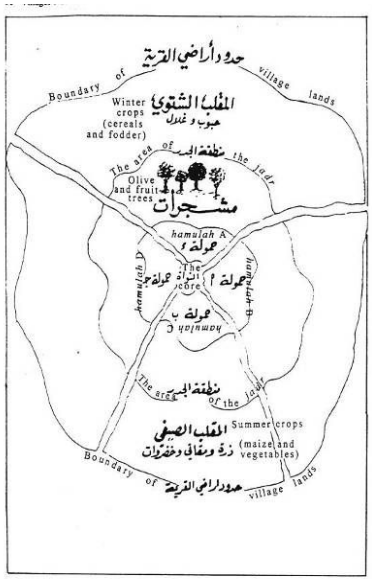
[9] Interestingly, J.Glubb admitted that the security and 'reforms' introduced by the mandate had not always served the country's cultivators: "There was less inequality in wealth and social position in the old insecure chaotic time than there was under the new theoretical "democracy". The establishment of law and order resulted in the rich becoming richer and the poor growing poorer… the establishment of public security deprived the farmer of the power to threaten the usurer with violence" (quoted in Fishbach, 1994:106).

system distinguished between water rights and rights to water use, and "established for the first time the concept of 'payment' for water" (Nims, 2001: 7).

As Tell argues, until 1946 the lack of water rights legislation hindered the development of irrigation (Tell, 2000). The diffusion and fragmentation of water laws in many different customary practices was a phenomenon that exasperated British engineers and that has been allowed also by the laisser-faire policies of the Ottoman in Palestine. Indeed, the attempt to bring water under one central agency was a consequence of this heterogeneity.

As we have seen, ownership was not a total innovation and, in this context, "where one finds sharecroppers and slave farmers, one usually finds privately held propriety" (Shryock 1997b).

Figure 3-6. Layout of an idealized Palestinian village (from Wahlin, 1993).



The spatial centre is symbolized by the hamula (tribe), and then followed by olive trees, close to the hamula control, and more distant summer and winter crops.

The inheritance system inspired by Islamic thinking was, and still is, based on "partible" inheritance, where all sons and daughters inherit equal parts of the propriety, a system that constituted a redistributive mechanism of land within the tribe (Wahlin, L, 1994a). This aspect has been traditionally paralleled by the strong reluctance to sell the land outside the tribe, an important aspect that has influenced the resource management in the Highlands.

A sense of autonomy was linked to the association with the dirah or with the tribe owned land against foreign attempts to buy and settle. The idea of keeping land within the tribe and farming just in order to reaffirm a control is still crucial today in the Basin, which shows the symbolic importance, parallel to the economic role, of land and water resources.

Everywhere villagers produced grain, barley, wheat, Indian sorghum and vegetable crops for household consumption. Cash crops differed: in the plains this was primarily wheat and to a lesser extent lentils, in the hill villages, olive oil, grapes. Animal production was central everywhere to peasant strategies for obtaining cash income (Mundy 1996).

The pervasive urge to keep land within the tribes was performed also through strategies to maintain or to acquire land by marriage. The distribution of inheritance was almost always followed by one or more rounds of consolidation through sale or exchange to bring down the number of partners in the land. At the same time, the efforts to diversify the household income helped to keep even small land holdings productive and that is still the case today (see chapter 4.5).

Land consolidation was thus linked to the tribal ethos and to the avoidance of land alienation: possession is important for the tribe, not for the individual.

3.4.1 The rise of a merchant economy

The origin of interest groups in Jordan dates back to the late 19th century, when merchant were attracted by the political stability of the Ottomans, later by the establishment of the British Mandate and the creation of the Emirate in 1921. They established strong ties with the high-ranking state officials, bureaucrats and British officers in Transjordan, while merchants represented an important source of finance, allowing them to gain influential positions in the new state apparatus.

From 1870 to 1940, mainly merchants from Palestine and Syria settled in the main towns of Transjordan, a trend that accelerated during the war with the creation of the Middle East Supply Centre (MESC) and the establishment of an import-quota system that allowed the mercantile community to acquire power. Contraband trade and smuggling flourished due to shortages in neighbouring countries, the speculation on the grain market became a main investment and Jordan the main exporter.

Besides, the quota system allowed a class of merchant to enrich rapidly, since it established monopolies in crucial aspects of economic life. Although trade activity was negatively perceived in Transjordan by many Jordanians and Bedouins, merchants acquired social status and even close political relationships with the Emir (Amawi, 1992).

Following the development of ‘Aqaba, of the army and migration works in Palestine, the need of manpower in agriculture increased locally and for the first time a lack of labourers was evident. Even tribes enriched in this period, thanks to a revival of camel transport in the smuggling that highly increased in wartime.

Settlement in the basin has always been interlinked with mobility. From 1922 onwards, the North-West Jordan witnessed an increase in emigration (Seccombe, 1987) due to stagnation of agricultural production, poor harvest and drought conditions. Besides, a British grant to Transjordan was to become the basis of the subsidiary or rentier economy of Jordan.

Land titling and the land market were paralleled by the first hydrologic studies and irrigation planning. The status, value, and management of land radically changed and consequently so did the local hierarchy linked to it, while the military and bureaucratic elite formed the new power and interest group. Villages in this period became increasingly dependent on external resources, indebtedness rose, partly because of the fragility of the agricultural economy due to climatic instability, as illustrated by the water crisis of 1947.

In contrast to other contexts of the Middle East, strong rural social conflicts did not arise in Jordan due to the high land fragmentation but also thanks to exterior resources linked to migrant work. In

summary, the British land settlement shaped a sense of Jordanianess, by naturalizing a sense of place, setting up a new national community in relation to the construction of a western-style bureaucracy.

The land settlement engendered a strengthening of the individual right, the curtailment of legal independence of religious endowment of land and brought socially controlled lands such as pasture under state ownership (Fishbach, 2000).

The monarchy thus held power and stability thanks to the consensus of rural areas and of the loyalty of the army mostly constituted by "tribesmen in uniform" (Axelord, 1978). Besides, Transjordan "is the only country in the Middle East where the elite who had cooperated with the colonial power has resisted to the instability of the first decades following independence" (Tell, 1993:95, my translation).

In the future national frame, the JV took a different road: while in the rest of Jordan the land program followed a laissez faire attitude, leaving space for customary rights in management of resources, in the JV land was nationalized, a unique exception in the land policies and management. Following the declaration of independence of 1946, the coalition of bureaucrats, merchants and landowners kept control of the economy of the country, and would also become the main beneficiaries of the development programmes to be financed in the years to come by the US and Gulf states.

3.4.2 New ideologies of irrigation

The many hydrological surveys of this period reveal the influence of an evolutionary conception of local communities and of their relationship with the state. A hierarchy was set up according to different levels of "modernity" and "backwardness", a moral hierarchy that is one of the crucial issues at stake even more today in the relationships between farmers, bureaucrats and experts (see ch.IV.5 and 5.12)

The first plans and studies in the JV focused on physical resources in order to estimate the 'absorptive capacity' of the region in view of settling Jewish immigrants[10], Bedouin tribes, or, especially after 1948, Palestinian refugees (Merril, S., 1881; Mallon, 1931; Luke, Keith-Roach, 1934; Lowdermilk, 1944; Konikoff, 1946; Ionides, 1946b). Since the end of the 19th century, the Jordan Valley has been the object of numerous hydraulic and agricultural feasibility studies,[11] being one of the regions with the highest potential for agricultural extension. For foreign experts the valley was a symbol of high productivity disrupted by abandonment, thus requiring urgent external intervention and prompting Merril (1881: 139) to declare that "The American farmer would look with envious eyes upon the fertile portions of this valley".

In the accounts of travel and expeditions in this region, local inhabitants were depicted as "conservative, ignorant, wretchedly poor, unable to contend with the forces of nature" (Gottman, 1937:556), living in 'empty lands'[12], fuelling the strong rhetoric of that period of "a land without people for a people without land", central in Zionist discourse. The valley represented a 'scene of wildness', the inhabitants of the black tents and encampments were depicted as 'wild Arabs' that befits the prejudice of an exotic and primitive scenery.

[10] It was estimated that 4 million Jews from Europe could settle in the JV (Lowdermilk, 1944).
[11] Ionides (1939), British Director of Development Office in Transjordan, played a major role in planning in the valley: his hydrological studies have been the most important in light of subsequent effective implementation.
[12] 'These empty lands, the domain of nomads, call for pioneers seeking a "place in the sun"' (Gottman, 1937:550).

These representations of backwardness and moral judgements on the local population squarely disregarded the existence of local patterns of management of resources. They were fuelled by a technical optimism and to the new ideologies of irrigation where the transfer of resources and expertise from outside would solve any problem of the local population. These disparaging judgements on the local population and local management are not alien to the understanding of water management today. On the contrary, they have been one of the causes that hindered any honest participation of client groups in local transformations.

Irrigation planning was seen as the first step to bring "new farmers to a neglected land" (Lowdermilk, 1944). At the core of the development effort was the explicit belief that agriculture was the basis of any future national development against Bedouins' tribal management of territory. Within this evolutionary paradigm of modernisation the valley was thus increasingly understood as a place to transform nomad herders into sedentarized farmers. Modernisation was identified with de-tribalisation and this could be achieved through settlements under the aegis of various planning agencies dealing with Bedouins (Bocco, 2000). The main tool of such a modernization was irrigated agriculture.

On the other hand, we know today that dichotomies such as state vis-à-vis tribe, or Bedouins vis-à-vis farmers, do not help much in understanding local dynamics. Indeed, the tribalisation process overlapped with modernization and Bedouins did indeed settle but tribal solidarity did not fade away and was, on the contrary, reinforced.

In the 1930s, the first wells were dug and water was pumped from Azraq to Mafreq (Lancaster, 1999), initiating the exploitation of groundwater resources. However, significant exploitation of groundwater in the highlands only started in the 1950s and 1960s, with the introduction of diesel motors pumps (Suleiman, 2004), opening the way to an overexploitation of resources from the 1980s onward (cf. chapter 5.3).

3.5 Water and the building of a new nation: 1948-1973

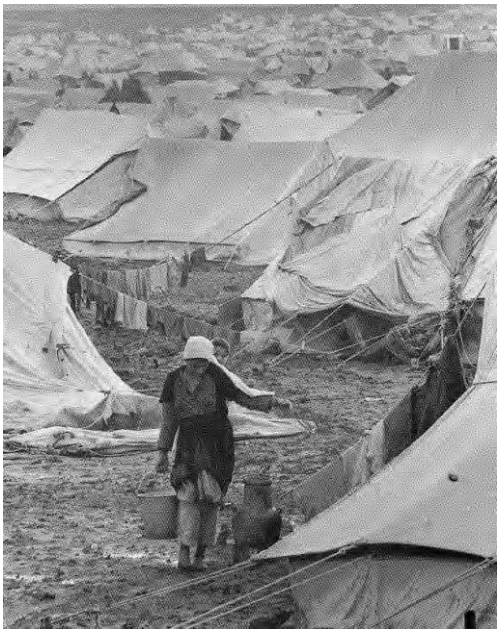
3.5.1 1948-1967: conflict and resettlement

In 1948, 774,000 Palestinians were displaced following the creation of Israel[13], of whom 70,000–110,000 escaped directly to the East Bank, which at the time had an indigenous population of about 440,000 (Brand, 1995). Jordan thus annexed the West Bank and granted Jordanian citizenship to its inhabitants. In 1959, King Abdallah annexed the part of central Palestine that had not fall in Jewish hands. He extended citizenship to all the Palestinians of the West Bank, including 220,000 refugees, as well as to the refugees of the east bank, as a basis for the unity of the two banks (see fig.11, ch.II).

In the Jordan Valley, 81,000 refugees found shelter in eleven refugee camps set up by UNRWA (United Nations Relief and Works Agency for Palestinian refugees in the Near East). Refugee displacement in 1948 did not change the plans and the vision already established for the region but only added to the urgency of developing irrigation.

[13] Estimates of the "1948 refugees" have varied from a 520,000 low (initial Israeli official estimates) to a 850,000-900,000 high (initial Palestinian sources). However, most historians today agree that the figures displayed in September 1949 by the Economic Survey Mission of the United Nations are the most accurate. In its Interim report, the Mission estimated that the total number of refugees did not exceed 774,000, including 48,000 in Israel, of whom 17,000 were Jews. Most of the remaining 726,000 refugees settled in the neighboring regions and countries: about 280,000 in the West Bank of the Jordan (annexed to Jordan in 1950) and 200,000 in the Gaza Strip then under controlled by Egypt, 70,000 in (Trans)Jordan, 97,000 in Lebanon and 75,000 in Syria. Source: *First Interim Report of U.N. Survey Mission for Middle East*. UN Document A/1106, 17 November 1949.

Figure 3-7: Women carrying water in Baq'ah refugee camp

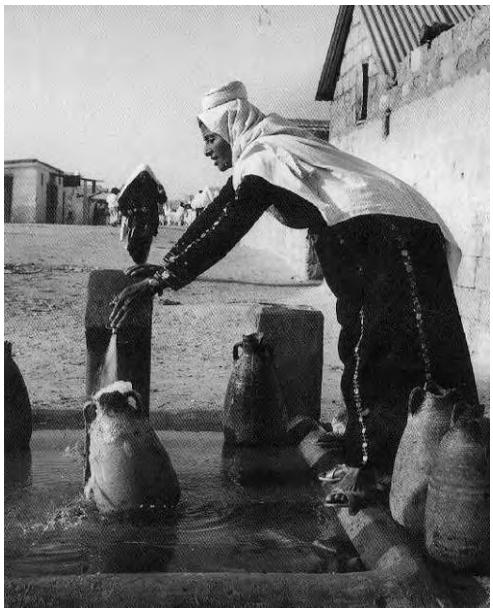


Palestinians were incorporated in the general framework of 'poverty' and backward technology: in such a perspective, the solution, divorced as it was from the local political reality of dislocation and dispossession of refugees, could only be technical aid. Three external factors had much influence on the Basin in this period: the influx of Palestinian, the intrusion of merchant capital and usury. In addition, the planning of the JV incorporated several purposes:

- The building up of a fragile and young Jordanian nation and the attempt to incorporate economically the West Bank
- Strategic and military interests in the tense political context of the Zionist ambition to expand on the East Bank of the JV;
- The necessity to assist and integrate a large dislocated refugee population, linked to the first plans of a central management of water resources.

UNRWA mandate fostered economic plans in the JV centred on a resettlement programme, thus neutralising political issues and delaying any right of return by giving priority to an objective of modernisation. UNRWA acted in the 1950s as a kind of regional coordinator for different development agencies and contributed in the setting up of the local technical assistance boards and the Jordan Development Bank. The first wells were drilled by UNRWA in the JV. In 1952, UNRWA implemented a malaria control plan in the Valley as a precondition for any larger settlement in the region, promoted some housing schemes, while attempts were made to solve broader political problems by a "unified project" of Israel and the Arab states regarding the strategic water resources of the JV.

Figure 3-8: Water fountains in UNRWA refugee camps became a crucial space of socialization



This was linked to a Jordanian policy of integrating a vast new population, in a strategy of national construction in the face of a mobile population of dispossessed refugees. This was followed by the annexation of the West Bank after 1948 and the Jordanian nationality Law of 1954, which granted Palestinians full citizenship.

In some cases in the JV, refugee cards were exchanged for plots of land in the JV, as in the case of Wadi Yabis, in order to settle "permanently refugees in the west of Jordan on a self supporting basis" (UNRWA, 1953), but generally these kind of projects met wide opposition since it amounted to a denial of the right of return to Palestine.

Box 7: The Tennessee Valley Authority in Jordan

The resettlement programme in the Jordan Valley was highly influenced by USAID and the World Bank and modelled on the 'integrated development' scheme of the Tennessee Valley Authority (TVA) in the US. Icon of the water miracle and of large-scale hydraulic planning projects, the TVA scheme was presented as an ideal economic development based on irrigated agriculture and technology transfer, which could be a comprehensive solution for the different problems of political and social instability in the JV.

The TVA aimed at regional modernization of river basins with a multipurpose character: the control of flooding, hydropower generation, agricultural extension, urbanization and water distribution, but was also seen as a "mean to achieve development democratically" (Ekbladh, 2002: 361): an utopian project based on local participation, an ideal of administrative agility, self-reliance and grass-roots participation, all ideals that poorly matched local realities.

As symbol of the model of foreign assistance in the 1950s, the TVA has been exported to many countries in South America (Escobar, 1984), Africa and Asia in the 1960s, a modernist vision of resource development and management "as a tool to solve social and political problems" (Ekbladh, 2002: 361), an aspect that has been central in its application in the JV. Although idealized as a push towards decentralization and local participation, in order to compete against centralized communist model of development assistance, its implementation in the JV has been characterized by a typical top-down approach, with the constitution of a local and rigid bureaucracy.

This approach was widely supported and legitimised by US Point IV 'development assistance', where aid was strictly connected to US foreign policy and security concerns.

The transition between past traditions of irrigation towards centralized irrigation planning, techniques and organization through pilot projects was well described by Davies in 1956. All the projects put in place did not envision at that time any large dams on the wadis, nor a gravity canal, which was later built and named East Ghor Canal.

In this period, earth canals were substituted by concrete canal, reducing water losses. A dam in the north of the valley (inherited from the Brutland concession near Tiberias lake) was used for agriculture purpose. Davies describes the disputes around water and the difficulties in maintaining the channel infrastructure due to the "endless troubles over the division of waters or irrigation works washed away" (Davies, 1956:267). At the same time, he presents the local system of water allocation, with turns "every 10 to 14 days in winter and every 6-7 days in summer" (Davies, 1956:270).

In the wadi valleys water was not enough to cultivate the entire land available. A system of rotational irrigation on a three or four year basis was practiced. The problems of downstream irrigators getting less supply than the up-stream ones was already noticed and the shift from communal/tribal management to scheme based on individual users was already taking place.

The introduction of tractors, water tanks and water pumps during the 1950s induced crucial changes in water management. The Jordan Valley was therefore characterized by different systems of irrigation (wadi, diversion, canal, reservoirs, springs, pumps) and multiple actors were involved (UNRWA, Jordanian state, British consultants, World Bank, USAID).

3.5.2 Water Development in the 1950s: the Pre-Exploitation Phase[14]

We review here water resources development and use in the LJRB since the 1950s. Analysis is based on three successive charts, illustrating the situation of water use patterns at three different points in time: 1950 (which can be considered as an initial "predevelopment" state), 1975 (for which a complete study of the hydrological situation of Jordan is available [THKJ 1977]) and 2000 (presented in chapter 4.1.2). We will particularly focus on water resources and the process of mobilization and utilization of these resources for each of the three different periods. The figures presented in this historical description are expressed in Mm^3/yr and have generally been rounded up to 5 Mm^3/yr. Moreover, we used average figures for a 5 to 10 year period straddling the date indicated on the charts (1950, 1975 and 2000). These figures were extracted from a comprehensive list of references presented in Courcier *et al.* (2005). Despite their importance, we do not consider the year-to-year variability that can affect the water balance and focus here on long-term evolutions characterized by average balances.

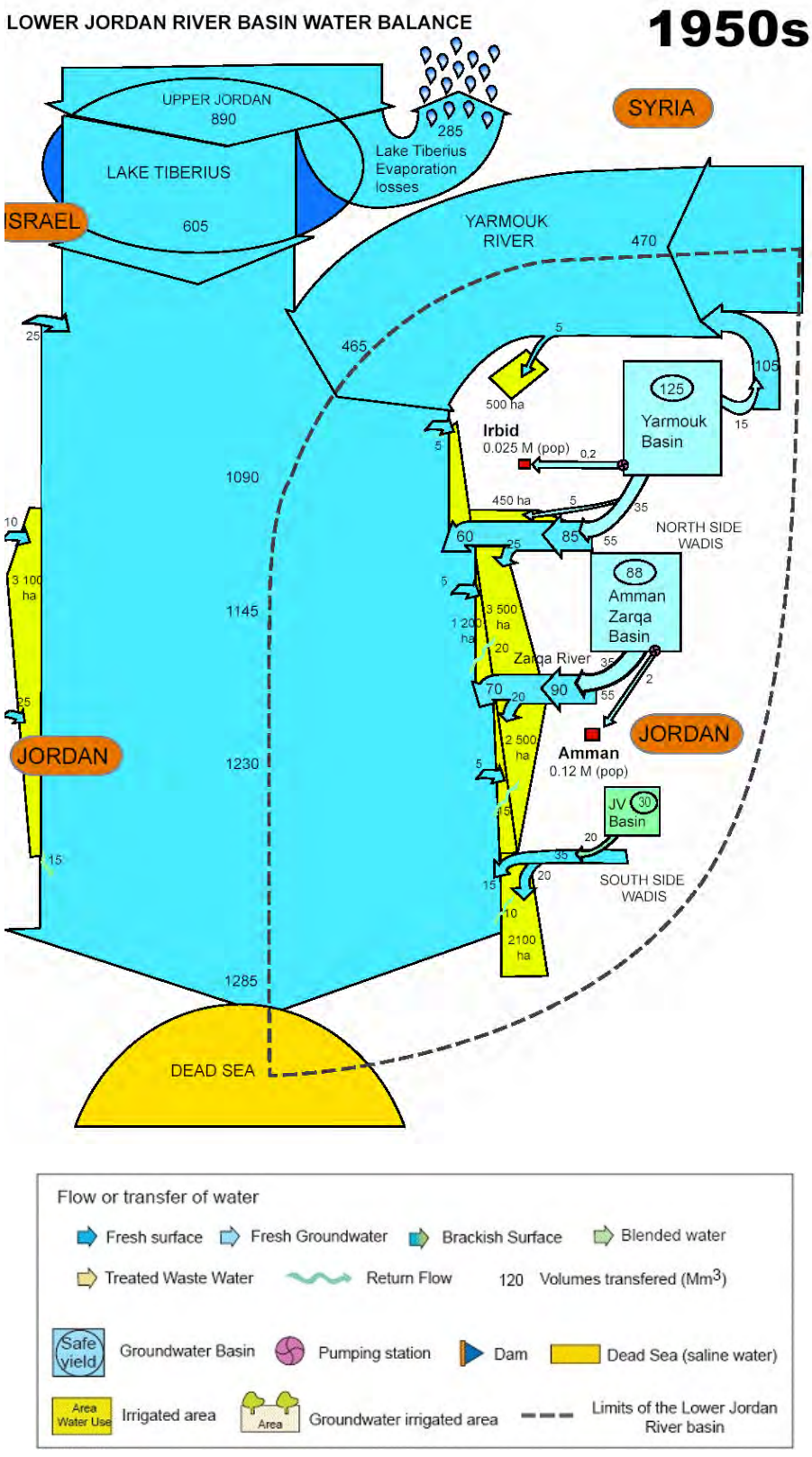
In our representations of water flows, we used arrows to represent natural river flows and water transfers from one place to another. The bigger the flow/transfer the larger the arrow. Water quality is also suggested, with a variation from freshwater (blue) to wastewater (green) or saline water (yellow). We used rectangles to represent groundwater basins and their capacity[15] as well as geometrical shapes to represent the irrigated areas. Again, the larger the water resources/irrigated areas the bigger the rectangles and other geometrical shapes. We do not distinguish between river base-flows and winter runoff flows ("floods").

[14] See more details in Courcier et al. (2005)

[15] Charts indicate the total safe yield of each aquifer. It may not always correspond to the Jordanian safe yield (corresponding to the sustainable rate of groundwater exploitation in Jordan) since some aquifers are shared with neighbouring countries (chapter 2).

Figure 3-9 illustrates the situation regarding water resources use on a territory then called Transjordan before the creation of the State of Israel. Main features include:

Figure 3-9. Water resources development in the LJRB around 1950, before the development of major diversion schemes (Source: Courcier et al., 2005)



- Cities are essentially supplied by neighboring springs.

- Surface water coming from the Yarmouk River, the side-wadis and the Jordan River itself allows the irrigation of small areas located along these rivers (around 13,000 ha using 125 Mm3/yr [Baker and Harza 1955], i.e., 9% of the Lower Jordan River flow) and in the alluvial fans of the valleys (chapter 3).

- No significant groundwater exploitation is observed.

3.5.3 Water and settlement policies

The Middle East British foreign policies in the Middle East (BMEO) focused on the development of agricultural cooperation but clashed with the US model of development. British modernisation policies privileged projects that could enhance local administrative capacity and expertise through experimental farms and smaller pilot projects, more in tune with local conditions. Therefore, the priority objectives were small-scale projects that could bypass the regional political gridlock regarding the use of water resources in the Jordan basin (Kinston, 1996).

The knowledge acquired through their experience in their colonial empire and indirect rule led them to favour reliance on indigenous resources. British school of irrigation was based on the colonial experience in India and Punjab, where they developed the basic hydraulic technologies of modern-large scale irrigation and water management, later exported to the Middle East.

This approach was opposed by wider US plans for an integrated water development in the Jordan Valley, which attempted an impossible mediation between Israel and the neighbouring Arab states and tried to overcome highly political interstate problems through technical solutions. US Point IV approach in Jordan, based on an aversion to delegating any authority to local institutions, technology transfer, rapid change, and the creation of new bureaucratic structures as a form of consensus building and economic redistribution in the new national construction (see ch. 5.12.2), while allowing the political influence of external actors.

The different development models of that time did agree on one main pattern: it was universally believed that the refugee question could be solved by economic development, specifically agricultural development and water management. Control of land in this context meant control of mobile communities, both refugees and Bedouins.

Despite the political discussions around the Bunger, Main, and Johnston plans, the Division of Irrigation pursued its separate agenda so that by the mid-1950s dams had been completed on most of the eastern wadis draining into the Jordan River except the southernmost Wady Shu'ayb, boosting irrigation in the valley (Kingston, 1996).

In the 1950s, Jordan was thus characterized by a fragmented process of state formation: UNRWA (seen as a "blue" state within the state), US Point 4 agenda, the UK Development Board, a tentative nationalist ideology of development and autonomy from foreign donors, and (poorly coordinated) large scale state-led development.

After the official failure and refusal of the resettlement programmes by UNRWA at the end of the 1950s, the irrigation resettlement plans were assimilated into Jordan's agricultural policies, supported by international agencies, mainly USAID and IBRD (later renamed World Bank), with the construction of the East Ghor Canal Authority that started in 1957. The canal construction was halted

during the war of attrition and phase had to wait for the 1973-1975 period when the canal arrived in Karameh area and could be extended to the south of the JV (Cf. Chapter 6.2).

Box 8: Musa Alami project

In 1951, an interesting self-help program for Palestinian refugees was set up under the coordination of Musa Alami on the west bank of the valley, a project which explicitly did not preclude the return of refugees but was aimed at making refugees autonomous and self-sufficient, on the base of agriculture. By drilling wells and pumping underground waters, a village was built up as a resettlement model and as an experimental station where Palestinians could look after their own interests.

This project well showed how irrigation endeavours have inevitable political implications in this context but it was exhibited as a model of self-help which did not need to depend on Western assistance, although it was based on a similar pattern of irrigation and technology input. Neither the wells nor the pumps using the Jordan River could have permitted the large irrigation schemes developed later because wells are basically saline in the JV and pumping from Jordan River is almost impossible in summer; but this project displayed another model of water use in an emergency situation and attempted to build the autonomy of dislocated populations. It was initially opposed even by UNRWA.

Figure 3-10. Construction of the first tract off the East Ghor Canal in the Jordan Valley, as first act of technical and symbolical domestication of this area (USAID, 1990)

Through irrigation it was possible to disguise the planned resettlement scheme, avoiding refugees' protests and legitimising de facto settlement in the Valley. On the other hand, the US-backed plan for regional water schemes, as a joint endeavour between riparian states, was marred by political conflict and led to unilateral development schemes in Jordan and Israel, especially after the 1967 conflict when the Valley was divided by a new political and military border coinciding with the river Jordan.

3.5.4 Land redistribution in the Jordan Valley

In contrast to the Highlands, where no land redistribution program took place and where groundwater and capital availability induced a private land attribution process in the 1980s, the JV has been the main focus of public policies in Jordan.

What is important to note is that in Jordan the land reform was not motivated by political aims, as in other cases of the Middle East, but rather was linked to a development policy and presented as a mere technical process. In contrast to the reforms applied in similar years in Egypt and Iraq, the legislation omitted to regulate the relationship between landlord and tenant, a problem which is still crucial today.

According to an UNRWA census in 1954, 70% of the West Jordan Valley and 84.4% of the East Jordan Valley population were Palestinian refugees (UNRWA, 1954), a percentage that decreased in 1961 to 61% of a total population of 29,357 in both the east and west banks (Sutcliff, 1973). The irrigation resettlement schemes, as an attempt to root a new population, partly failed: "the project farmers were significantly more concerned with the Palestine problem than the non-project farmers were (…) The project was a political failure as a refugee resettlement project, i.e. it failed to change the project farmers' political identity" (Sutcliff, 1973:480).

The land redistribution programme initiated in 1962, based on expropriation with compensation, was meant to create "a community of owner-operators", though to be essential for the social integration and the construction of a 'new rural community' (Spencer, 1954:54). Yet, still in 1961, 70% of the project farmers were sharecroppers, 5% tenants and only 20% owner-operators[16] (Sutcliff, 1973:478). This class of self-supporting and productive owner-operators on a unit of land with their 'family farms', were implicitly patterned on a western notion of conjugal family that poorly fit the notion of "family" in Jordan. The principal social unit remained the a'ila, the patrilineal extended family.

In fact, the land redistribution law, due to its legal loopholes, did not prevent the circulation of part of the land within the pre-reform families of landowners. Although the priority was placed on the landless farmers living within the project area (Sutcliffe, 1973), the main beneficiaries were large owners, government officials, and merchants, often living in urban centres outside the JV. Large owners partially lost their land, and part of the landless managed to get access to irrigated land: refugees in particular seldom bought land due to economic constraints or mainly due to their political refusal to invest in Jordan while waiting to return to their land in Palestine. Merchants from outside the JV and civil servants were able to buy important quantities of irrigated land.

In short, the reform engendered contradictory results and was limited in scope and imperfect in implementation, but with local variations: the primary impact of the reform was to narrow down the size-range of holdings, with a substantial increase of holders, reducing the average size of ownership for the entire area.[17] At the same time, sharecropping strongly increased, mostly fuelled by landless Palestinian refugees; this was the main secondary effect of the reform.

As shown in Table 3-1, instead of a majority of owner operators, sharecroppers highly increased revealing the flexible relation to land of local inhabitants. In fact, "46.6% of the sharecroppers were Palestinian and 88% were landless" (Sharab, 1975). Moreover, at that time, 65% of land owners were living outside the valley, a percentage that shows well who managed the land or gained most from the land reform program, an institutional bias reproduced with time.

[16] Interestingly, in the same year, 97% of project farmers in the JV had mud-brick houses and 75% received their drinking water from a reservoir or canal

[17] In the pre-redistribution period, an UNRWA survey of 1955 showed a high concentration of land ownership on both banks of the river, where 4,646 owners owned 434,388 dunums. Owners with less than 100 dunums represented 84% of total land-owners but held only 21% of the land. On the other hand, 54 owners (or 1% of the owners), owned 35% of the total area.

Table 3-1: Increase of sharecroppers and owner-operator from 1960s to 1975 (figures are in %)

	1960 (DoS)	1973 (Hazelton, 1987)	1974 (Sharab, 1975)
Owner-operator	32,5	35,9	40,7
Sharecropper	39,0	47,2	59,3
Lease	1,8	2,7	
Mixed tenure	23,8	14,2	
others	2,9		

As this table shows, instead of a majority of owner operators, sharecroppers highly increased revealing the flexible relation to land of local inhabitants. In fact, "46.6% of the sharecroppers were Palestinian and 88% were landless" (Sharab, 1975). Moreover, at that time, 65% of land owners were living outside the valley, a percentage that shows well who managed the land or gained most from the land reform program, an institutional bias reproduced with time.

Sharecropping represented a reproduction of a patron-client relationship within the new land setting. The main pattern accorded half of the product to the owner: the owner covered the cost of inputs, while hiring labour remained the tenant's task. Many Palestinians refugees relied on sharecropping in order to reduce economic risk. The implicit bias in favour of big-landowners and capital investors increased initially with the introduction of agribusiness (Elmusa, 1994). In fact, "the transparent bias of policy in favour of the modern capitalist sector is explained in part by the benefits this conferred on commercial farmers, merchants and middlemen, groups well integrated into the ruling elite" (Tell, 2000:97).

This will not impede, or contradict, the later huge investment of small to medium entrepreneurs in agriculture, both in the JV as much, or even more, in the Highlands, who often did not own the land but reinvested other forms of rent (remittances, Gulf experiences and networks, agronomic expertise acquired abroad): this process will illustrate a main shift from the importance of land to that of capital investment, of expertise, and of social and political networks in the access to water as main resources in agriculture.

This new class of farmer operators will have a great impact on the agricultural economy, the suburbanisation process, but also on the water use in agriculture (see ch. 5.12) The management of land and water has been immediately transferred into the hands of a centralised bureaucracy, while new factors like credit facilities, access to agronomic knowledge, seeds or market relations became essential to farming practice but furthered local relations of inequality.

3.5.4.1 Mobility in the Basin

Settlement in the basin, and the related management of resources, should be looked upon within the wider tradition of mobility (Seccombe, 1987) between Palestine and Transjordan since the 1920s. Before 1948, Palestinians commuted for seasonal work in different parts of the JV, and many came as cheap agricultural labourers to undertake the work required for developing infrastructure in Palestine. This mobility, always linked to the regional agricultural crisis and political transformations since the end of the 1960s, has found new directions in recent decades: from the JV, as from other areas of the basin, many migrated to Germany, Saudi Arabia, Kuwait, and also Syria and Lebanon.

According to Seccombe (1987: 118), "the highest rates of emigration occurred in those sub-districts (Ramtha, Irbid, Bani Kinana), which had received relatively large numbers of Palestinian refugees after 1948 war". The emigration of Palestinians who could afford the travel has led to a general and

growing labour shortage in agriculture in the 1970s, with the consequent influx of Egyptian migrants, and the reinvestment of remittances in the Valley and Jordan Basin into house construction, education and agriculture: a dynamic of primary importance even today in the Basin.

More generally, from 1950s, the new patterns of migration and the introduction of agricultural machinery radically changed the agro-pastoral system in the Basin. The harrathin became gradually supervisors of cultivation while, as observed in wadi Zarqa, sharecropping became the dominants form of land use (Mundy, Smith, 1990). Here, vegetable production witnessed an extension due to growth in market demand and to the knowledge, techniques and availability of cheap labour from nearby Palestinian refugee camps. Also the demand in trees crop increased, which were less perishable than vegetable and less dramatically subject to price fluctuation, with the subsequent decline of cereal cultivation.

Besides, since the 1960s the army emerged as a major source of employment for village young men, a dynamic that reduced the size of the pool of family labour, which had a negative impact on both farming systems and livestock production that usually needs permanent labour.

3.5.4.2 Water and settlement in the Highlands

In the 1950s several international organisations launched sedentarisation programmes for Bedouin tribes linked to agricultural irrigated plans, viewed as an essential step to economic integration, stability in the region and control of rangeland (the *badia*). UNESCO, FAO, and ILO, although in different sectors, promoted tribal sedentarisation as a driver of modernisation The construction of settlements was a focal target in order to achieve social emancipation, control of territory, and de-tribalisation of society (Bocco, 1993). Modernisation did not mean by itself the disappearance of tribal solidarity; on the contrary it has readapted to new political and ecological environments. This bias against “tribal” and mobile populations is recurrent in the history of planning in the Jordan basin, where tribal stands often for primitive, obstacle to reform, inefficient management of resource and not as a possible agent of change. These settlement programmes "reproduced the sedentarization policies from the Mandate period up to the 1970s” (Bocco, 2000:198), a tradition in localising delocalised groups through water projects.

Although 91% of Jordan is constituted by rangeland, no long term development policy was set up for the wider area of Jordan. Water development was possible and legitimate mainly in the JV basin, but the political neglect of rangelands development has led to pasture degradation, desertification process, overgrazing of Badia’s pastureland, all trends also observed in other regions of the Middle East.

Further, this process marginalized tribal communities that on the contrary had been pivotal in the construction of consent and stability of the Jordanian state and loyalty to the King: as shown by the case of southern Jordan, in the last decade, protests, and even riots have erupted from these communities.

In the early 1950s there was no water supply in north Badia. At the end of the 1950s, the army became one of the main employers of Bedouins but also of the rural population of Transjordan, and the army salary constituted for many villages the main source of revenue, complementary to agricultural income (Antoun, 1972), a crucial element also in present times. Livestock did not constitute anymore the main source of income for the Bedouins, although herds remained until now an important form of wealth and status, rather than a mere source of income. Other sources of income in 1970s were illegal trade and government subsidies (Abu Jaber et al., 1987).

Groundwater pumping started to increase: in 1965, there were only around 25 wells in Dulayl, an area located nearby Amman where the first Bedouins settlements were established. Fifteen years later (1980) the number of wells had almost quadrupled.

3.5.5 The symbolic meanings of agricultural settlements

Planning in the JV has transformed a border area but it has also put the region under a new spatial organisation. This region, along with the western valley and the occupied West Bank, is probably the most photographed and planned region in the world: planning and mapping have themselves been crucial in freezing conflicts rather than solving them, acting often as a substitute for politics.

Agricultural development has imposed categories of identities, exogenous ideas of family, of work, and exogenous ideas of agriculture. This continuous reproduction of a gap between planners and the "clients" of projects has become structural in the local economy and has engendered a 'construction of ignorance' between planners and farmers (Hobart, 1993), which is not one-sided but based on mutual stereotypes and power inequalities.

In this context, agricultural planning has always played a strategic role, and not just in economic terms, in Jordan as much as in Israel and in the West Bank In fact, Zionist emphasis on agricultural work as redemption and domestication of land, amplified the importance of water. The control of water after the land itself, became the most important target for establishing and sustaining the Jewish state (Rouyer, 2000). The Jordan Valley, as much as the Gholan heights, have been "colonizing frontier zones to ensure the long term protection of the lands" while Jewish settlements were the device chosen to establish de facto 'defensible boundaries' on the ground (Harris, 1978:325).

On the basis of this ideological pressure on the opposite bank, Jordan invested economically but also symbolically in domesticating this border area of the JV through agriculture. Thus, agriculture has been at the same time a strategic economic asset as much as a symbolic resource, and one aspect cannot not be understood detached from the other. Through agricultural ideologies, the idea of rooting new community to new lands has been introduced, in parallel to the attempt of securing and domesticating land.

Therefore, water development, has been strictly linked to the control of borders and to national stability, within the main attempt to detribalise and modernise pastoral groups and resettle refugees. Through the strategic issue of water, international actors such as the US or World Bank have imposed their perspective and projects in Jordan and in the Middle East: as a USAID official stated, in the Middle East "the development of water resources is a critical foreign policy issue for US" (Starr, 1988, 125). The JV witnessed a militarization of the water issue in a strategic area where projects of society and military strategies where inevitably interlinked to water programmes. Between 1913 and 1964, 21 inter-riparian proposals for water management were put forward (Neff, 1992), half of them between 1950 and 1967.

Finally, the technological transfer and the new roles of the experts introduced new forms of expertise paralleled by a "deskilling process": local farming knowledge was obfuscated by scientific development and consequently was made often invisible or censured.

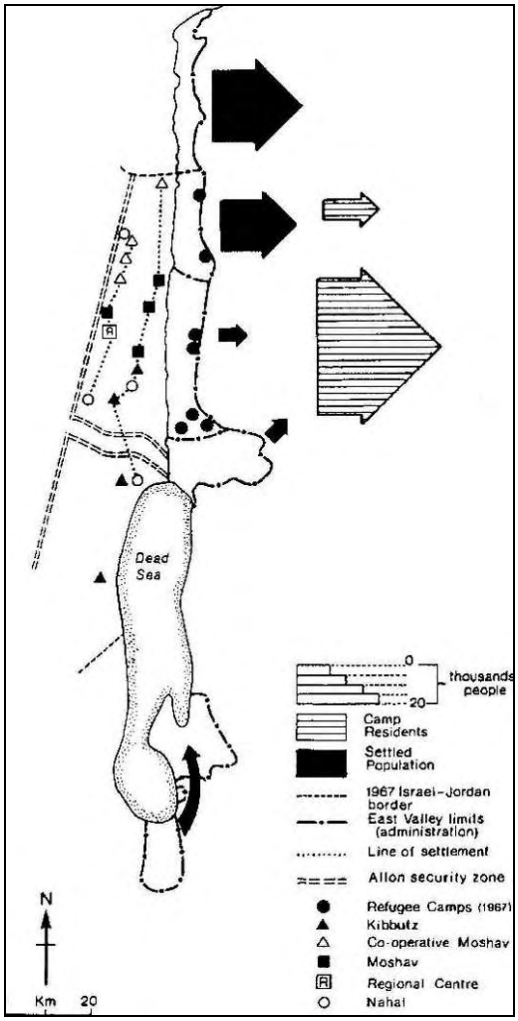
3.5.6 New displacement and insecurity: 1967-1973

Between June and September 1967, 395,000 Palestinians crossed again the Jordan River, including refugees being displaced for the second time, refugees form the Gaza Strip, and non-refugees that

were labelled 'displaced', escaping from Gaza and West Bank[18], due to the renewed conflict with Israel. In the Valley, project implementation was halted during the 1967 conflict until 1971. Israel occupied the West Bank and the JV became for some years a battleground between Palestinian *fida'yyūn* (fighters) and Israel.

Within five days in February (16-21) 1968, 70,000 people fled from the camps in Eastern Jordan Valley and moved to six new camps uphill in a new displacement process, the valley having increasingly become a battlefields and a new frontier area. Within three weeks UNRWA sites were deserted. During the conflict, 60% of the valley population fled to refugee camps in the highland and urban centres, leaving only the younger members of the family in the JV to manage the agricultural fields or to defend the houses, while 65% of the houses were destroyed and new refugee camps were established in the Valley. Mainly villagers and Bedouin Palestinians remained in the valley, while refugees of urban origin tended to move to camps near upland urban centres.

Figure 3-11. East valley population movements caused by the war of attrition (1968-69)(Harris, 1978)



[18] The legal definition of refugees accorded only to displaced Palestinians who could receive aid from UNRWA. Meanwhile thousands of people became stateless in places where UNRWA was not operating, like Iraq, North-Africa, Egypt and the Gulf countries. Besides, many Palestinians fell into an uncertain status, such as the Palestinians displaced from Gaza in 1967, the 'latecomers', or the Gazans expelled by Kuwait after the Gulf War of 1991.

Besides, the Palestinian guerrilla infrastructure set up in the valley, with the overt and covert assistance of Jordanian Army, inaugurated two years of warfare. Israeli strategic bombing targeted mainly the highly vulnerable East Ghor Canal[19] but also villages and farms in the JV, in retaliation for Palestinian 'infiltration' and *fida'yyūn* attacks on the Israeli water infrastructure on the occupied Western side of the vAlley.

Strikingly, notwithstanding the warfare situation, farmers did not abandon their crops returning once a week when possible to the valley from the highland. Many border infiltrations into the Occupied Territories occurred, as refugees were trying to reach "their original houses and properties during harvest time to sow wheat, to bring back some of their herds or to retrieve some of their left assets" (Masriyeh-Hazboun, 1994:88).

In 1970, the Valley became again a battleground. Jordanian forces attacked the Palestinian *fida'yyūn* commando that were concentrated there in the internal strife known as 'Black September'. Palestinian guerrilla movements, through their continuous attacks on Israel, attracted widespread support and thus endangered Jordan stability and security, setting up a 'state within a state' (Gubser, 1983). The Palestinian guerrillas were forced to move their bases from their valley to the highland, which became all of a sudden more unstable than the Ghor, and many people started to go back to the Valley also for security reasons.

In September, the Jordanian army increased its attacks and defeated the guerrillas in Amman and JV, and the remnant was forced to move to Lebanon. This civil strife left a bitter memory in Jordan, and in the Valley in particular, although it is seldom openly talked about. Only after 1971, when the implementation of the JV project resumed, was the former 'rehabilitation for refugees' (UNRWA) renamed as a programme for 'the rehabilitation of the Jordan Valley' (by the East Ghor Canal Authority, later renamed Jordan Valley Authority).

In the 1970s Jordanian economy was already subsidized and linked to direct and indirect rent from oil. Remittances of migrants in the Gulf states contributed to the inflationary process of land prices in what Findlay has called a "charity urbanization", characterised by the expansion of the urban frontier on agricultural land in Amman and Irbid, resulting in a reduction of agricultural land in the Highlands (cf. chapter 2) and in a decrease of agricultural labourers due to the soaring growth of the tertiary sector. Increase in land price was linked to a new process of capital investment in agriculture, mainly by migrants, or the military, who started to spend their money on construction in rural areas, in a process of suburbanisation in north-east Jordan.

This was the start of a dualist model of agricultural growth with, on the one hand, capitalist farms mainly encouraged in the valley through public support and dependent on subsidised water and to external resources; and, on the other hand, a more "traditional" type of farming in the Highlands relying on family labour in a context of land fragmentation and small holding ownership, who received much less financial and political support.

[19] On 31 December 1968, the Canal was blown up and the Ghor was without water for more than 6 weeks.

3.6 New water infrastructure: 1973-1995

3.6.1 Centralized water and state-farmer relationship

The UN Rehabilitation Plan for the Jordan Valley became a national development plan and agricultural production rapidly increased with the extension of irrigation and the increase of technical input. The Jordanian state acted as if it could develop a new regional planning model "from scratch" in the JV. In fact, the JV has been the showcase of rural modernity, a model held up for the rest of the country and the Middle East, essential for attracting foreign aid and displaying the JV as the "cornerstone of national development" (Khouri, 1981). As a result water has been considered through its technical and engineering use but with few regard to other social and cultural implications underlying its management.

In 1973, just after the war, only 64,000 people were living in the JV and in little more than a decade later the population had increased to 127,900 (JVA, 1987).

Table 3-2: The population shift in the JV (see also ch.1.2.4.1)

1900	3580	Steuernagel, 1925
1940	8000	Tarawneh 1989
1952	29,833	Watson 1961
1953	33,767	Watson 1961
1967	97,000	Hazelton 1978
1973	64,012	Dep. Statistics, Statistical Yearbook
1978	75,000	Sorenson 1978
1986	127,903	JVA, 1987
1988	150,000	Khouri, 1988
2002	220,000	Jridi, 2002

The development of water led to the establishment of a new power structure and engendered a bureaucracy, the JVA, allowing state penetration in a crucial rural area. At the end of the 1980s started the transfer of water from the King Abdullah canal to Amman, the need of urban water becoming even more compelling with the inflow of around 300,000 Palestinian returnees from the Gulf countries following the first Gulf war. This increased the competition between urban and agricultural water, which is at the core of the new water policy.

The JVA is a development agency with a monopoly over resources, since it manages water and has been the only owner of land until summer 2001. Farmers are in legal terms "holders" of units of land only, defined as "the person(s) in whose name(s) the land or water or both is registered in accordance with the registration deed" (Law. No.19 of 1988). The exploitation of land units is hereditary, but until summer 2001, no sale of land was allowed although many unofficial and unauthorized land transfers occurred and still are occurring.

JVA is a public corporate agency, established as an autonomous public administration to implement development plans in the JV. It has its own staff, has been largely free from financial and fiscal control by the national authorities, and has had -in the past- a large freedom in planning, implementing policies and spending (Nusair, 1982). This peculiar and autonomous status has given the JVA a considerable weight in local social life, which resulted into the formation of a "powerful lobby" (Tell, 1996).

The JVA has gradually supplanted the authority of local systems of control over resources and has introduced a new system of loyalty, through a centralised administration. Yet, differences can be observed within the JV according to the diverse patterns of adaptation of the bureaucracy to the local environment: the case of the south of the JV, where a major tribe (al'Adwan) still enjoys a large room for manoeuvre vis-à-vis the agency is significant; in other contexts tribal influence has overlapped with the administration itself.

JVA tried to influence cropping patterns through crop-based quotas and allocation, but farmers found many ways to circumvent these regulations. The Government established the Farmers Union, which remained limited to implementing government agricultural policies, not engaging in any form of political action or lobbying, largely because it was funded by the government. Female farmers were excluded from the union and their working conditions were never regulated.

JVA was characterised by a complete lack of participation and involvement of the local population in any phase of project implementation, since 'basic needs' were seen as self-evident and non-problematic by foreign and national planners. Nusair (1982) goes further, claiming that 'the JVA has treated the valley as if it was empty of its people'. The hierarchical nature of JVA planning and its technocratic attitude towards social change were acknowledged by donor partners.[20] The lack of local participation reflects a defensive measure in front of a conflict region as much as a form of cooptation of local elites through employment in state administrations. Indeed, the role of bureaucracy as a social stabilizer has been quite central.[21]

A main feature of this transformation has been the new management of the irrigation system: the tribal hierarchical system of distribution gave way to centralised planning of water, new ideas of "management", and high subsidies for irrigated water. Besides, in the 1990s, JVA invested in expensive underground pressurized networks in order to increase efficiency of its water delivery system, an investment that has further transformed irrigation practices (see ch. 4.15 and 5.12).

In summary, the water projects were intimately linked to a social engineering plan with multipurpose targets, aimed at building up "new farmer communities" under the myth of the social integration of different communities under one common label. Political and social goals were deemed to be achieved through technical means, a dynamic that is crucial in understanding today's lack of confidence between farmers and JVA, and state-citizen relationships in Jordan. In fact, as Tell has argued (2000:95), the implementation of water projects "placed a premium on water rights and turned subsidized irrigation into an important political resource under bureaucratic control".

[20] "There was little or no involvement of the beneficiary population in setting priorities, organizing the implementation or evaluating effectiveness" (JVA-USAid, 1988).

[21] The coercive nature of planning in the valley has been explicit also in the housing schemes that were set up at the beginning of the 1980s, one of the least successful project due to the strong opposition and manipulation of valley inhabitants.

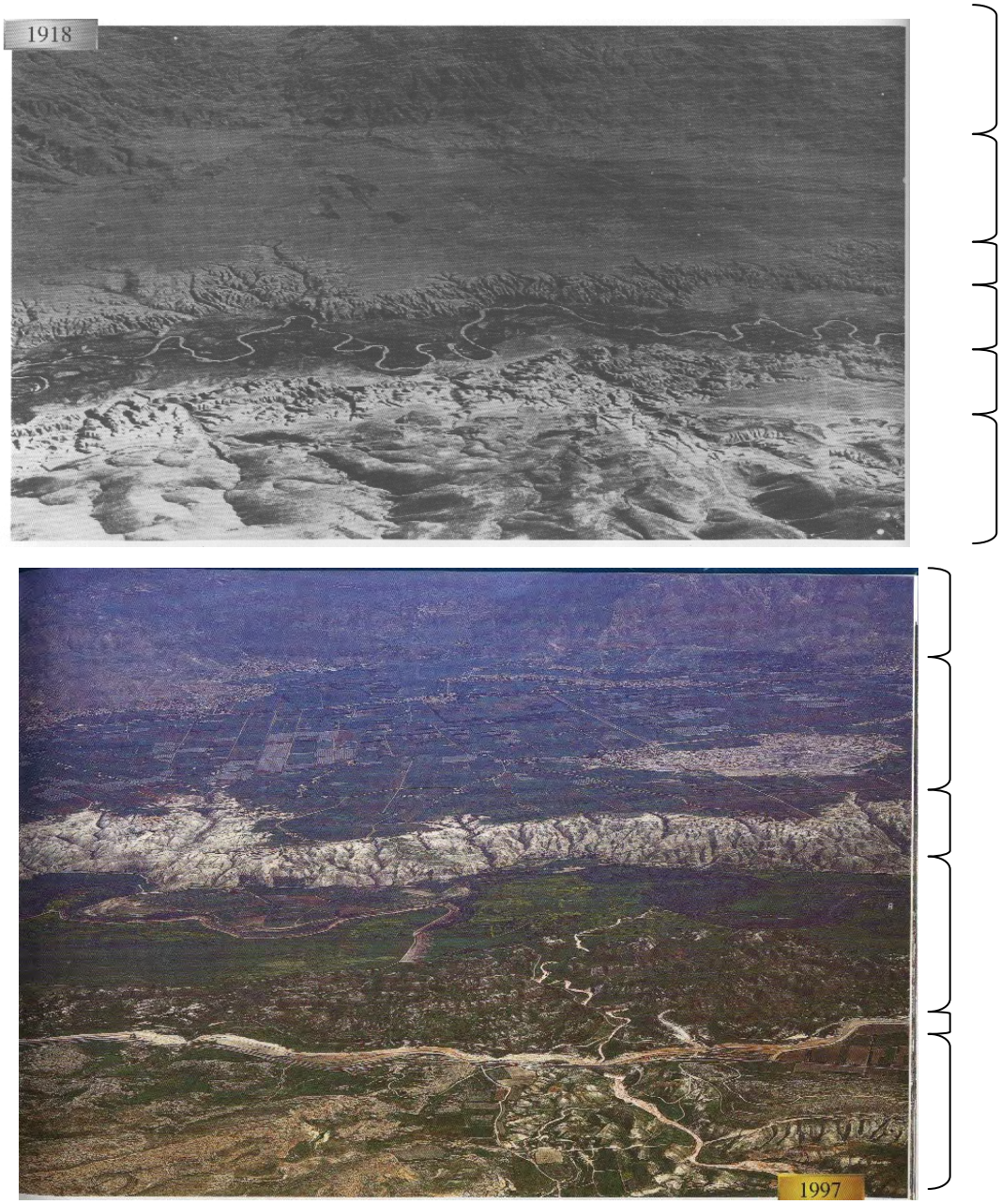


Figure 3-12: Aerial view from the West Bank at different dates

Comparison of two images taken from a similar perspective from the West bank looking at the East Bank: the first taken in 1918 (reference), and the second on in 1997. The transformation of the entire landscape through agricultural extension and notably irrigation development in the Ghor, settlements and sub-urbanisation process are evident.

3.6.2 Situation in the mid 1970s: the Exploitation Phase

In 1977, the Ministry of Water and Irrigation (MWI) published, in collaboration with the German Cooperation, a global assessment of water resources in Jordan after a first phase of large exploitation

(THKJ, 1977). This study is the basis of our presentation (Figure 3-13) of the water resources, their utilization in the middle of the 1970s, and of the changes that occurred since the 1950s.

- Israel developed its use of the Upper Jordan River water resources. In the late 1950s Israel actually increased the level of Lake Tiberias and thus the capacity of the only large reservoir in the area by raising the level of the Degania dam (built in 1932 under the 1921-Rutenburg concession). Together with some local uses, Israel has been pumping from Lake Tiberias nearly 440 Mm^3/yr (PASSIA 2004), transferring this water through its National Water Carrier (NWC) to cities along the Mediterranean coast and to some irrigated schemes down in the Negev desert. The outflow from Lake Tiberias thus dramatically decreased from 605 to 70 Mm^3/yr (Klein 1998), reaching the LJRB only during winter flood flows.

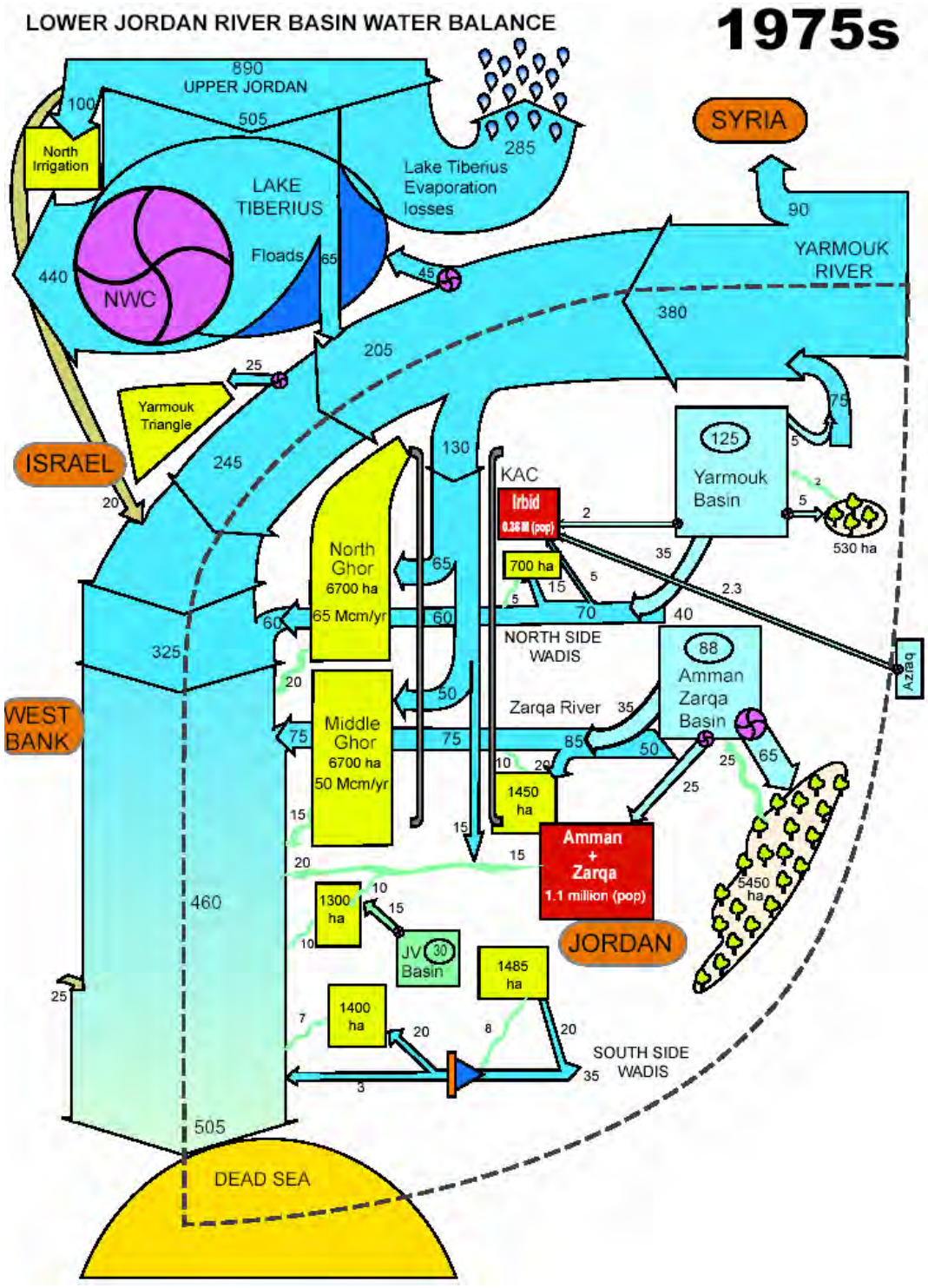
- In addition, in order to preserve the quality of Lake Tiberias' water, mainly used as a reservoir of potable water, Israel diverted saline springs from the north of the lake to the Lower Jordan River, downstream of the lake. At the same time, Israel pumped water from the Yarmouk downstream of the intake of the Jordanian KAC (see below) in order to fill the lake as well as to serve nearby irrigated schemes (70 Mm^3/yr) (PASSIA, 2004).

- In Jordan, irrigated agriculture developed on a large scale thanks to the construction of 69-km long concrete canal (King Abdullah Canal, or KAC), a land reform, several projects of urbanization and settlements (chapter 3 and 5.12). In the northern and middle parts of the Jordan Valley, 13,500 hectares were irrigated owing to the 115 Mm^3/yr (THKJ 1977) coming from the KAC. In the south, water from several side-wadis and pumping from the aquifers allowed the irrigation of around 4,200 hectares with 55 Mm^3/yr (THKJ 1977). In the highlands, 2,150 hectares were also irrigated (35 Mm^3/yr) in the side-wadis and the Zarqa River valleys, while around 5,900 hectares were irrigated with groundwater within the Yarmouk and the Amman-Zarqa basins (respectively depleted by 5 and 65 Mm^3/yr [THKJ 1977]; chapter 5.3)

- The period was also characterized by the strong development of urban areas such as Amman-Zarqa (population of 1.1 million), and Irbid (population of 360.000 million), which then used 30 Mm^3/yr of groundwater (THKJ 1977).

- At the same time, Syria also started to develop its use, essentially for agriculture, of the upper Yarmouk River (90 Mm^3/yr [Hof 1998]), ultimately reducing the flow of the Lower Yarmouk to the Jordan River to 380 Mm^3/yr (Figure 3-13). These diversions are done along the rivers and no reservoir is yet built on the main tributaries of the Lower Jordan River. Because of these combined water uses in Israel, Syria and Jordan, only one-third (505 Mm^3/yr) of the historical flow of the Jordan River still reaches the Dead Sea in1975.

Figure 3-13: Water Resources and Uses Pattern in the LJRB in the mid-1970s (Source. Courcier et al., 2005)



3.6.3 Main characteristics of the "supergreen revolution" in the JV

As Mundy and Smith have shown in their study on the Zarqa River Basin (1991), two main assumptions were included in development planning in agriculture, particularly in the JV:

1. The idea that patterns of landownership would allow a legal land-holder to adhere to long-term planning of land use. Thus the new farming units were expected to be stable in relation to ownership;

2. Land use that would allow the long-term preservation of soils and a shift to higher value production would be more profitable for the farmer even in the short term.

The land redistribution programme in the JV was meant to create a class of small self-supporting (with the aid of their family) farmer-operators, viewed as essential for stability and social integration into a 'new rural community'. Therefore, farming units were redistributed in order to create the basis of a stable environment, both in economic terms through splitting farm units (a unit is equal to 30-40 dunums of land, 10 dunums = 1 hectare), and in social terms, through a symbolic 'rooting' in the nation.

This idealized owner-operator did not emerge as desired in the planning process. In the years to come, many landowners would quit farming because of better opportunities through migration or urban commuting, army or administrative employment, or commercial activities. Agriculture has also become a part-time occupation, often within a "double career" (Mundy, 1990).

Agricultural modernization has certainly transformed the local management of resources, but often not in the planned direction. In 1994, the targeted farmer owner-operator only amounted to 13% of cultivated land (Qasem, 1995). 29% of the holdings were owned by two or more owners, a high level of fragmentation, which was a far cry from the one holder-one unit ideal (Qasem, 1995). In addition, 61% of the total units in the valley were leased, and 68% of the lessees were landless. As a result, leases have become the most important pattern of land management in the JV: in fact, 40% of the cropped land is cultivated by lessees (Qasem, 1995).

Landowners have thus leased their land for other farmer investors (often of Palestinian origin) to develop their modern farming renting the land; sharecropping contract decreased later in favour of lessees that opened the way to a labour and capital intensive agriculture. In the central valley, many small and medium farms have become economically successful. In particular, the majority of greenhouses in the JV have been established, and most technological investments have been undertaken, by entrepreneurial lessees. Agriculture in the valley has become today a mobile investment linked to the access to technology and capital, based on a migrant group of cheap wage labourers. Egyptian labour has reduced the labour costs and allowed the more flexible working patterns needed in agribusiness. This cheap manpower allowed also the reproduction of farms held by smaller farmer-operators, who otherwise would not have been able to afford the new labour intensive cropping patterns.

In contrast with the objective of establishing land-owners and land lease conditions as spelled out in the JV Development Law, "lessees do not have long-term interest to improve the quality of land or to sustain its productivity" (Taha, 1998:51): they often have short term contract, generally of five years, and a decrease in production is generally observed after a few years of intensive cultivation. Indeed, lessees of intensive farms may prefer not to buy the land due to the very high prices but also because they prefer to be able to move when the land is contaminated or salinized. Units of land are also rented

according to the formal, and above all, informal accessibility of water (being closer to the main canal, knowing someone in the local pumping station or stage office as main examples) and according to the quality of water (the tendency to leave waste-water irrigated areas towards fresh water to the north of the valley, Cf 5.15.1). This engenders a permanent change of rented land by lessees.

In the JV, landowners generally do not live in the Valley, or do not work and manage the land but, rather, hire managers, supervisors, engineers, and labourers. Thus, different functions are present on the same unit of land, based on the main division between the execution of agricultural work and the management and supervision of the farm, where the coexistence of traditional water and cultivation patterns with intensive high-tech farm enterprises is striking. Thus one of the main difficulties in the JV is to understand who is the 'cultivator' on a unit of land, what is position in farm decision making, particularly crop and technology choice. Land use patterns are extremely heterogeneous and also highly changing, even in the short term. Land and cropping patterns definitely reflect the economic strategies and investment capabilities within present day agribusiness; but economic strategies can be grasped only if we take into account also local perspectives, which are based on the family network, on mobility and on a flexible strategy of diversification of economic opportunities. In this context, agriculture is just one of the multiple economic activities adopted by local actors.

Increasingly, the household engages in multiple economic activities within or outside the JV in order to reduce the risk attached to agribusiness. Already in 1986, farming (Jordanian sharecroppers, leases or owners), constituted only 15% of economic activities in the valley, while the public sector, including the army, accounted for 17% (USAID, 1988). Farming is therefore just one of the options considered, and for poorer communities in the JV as in the entire basin, it represents often the less favourable activity in the present social segmentation and in a context of high unemployment.[22]

Further, agribusiness changed the values and meanings of agriculture, starting from the word "farmer". The category of 'farmer' (*muzar'e*) refers today in local perceptions to an occupational category linked to marketing capacities and connections, to the knowledge of chemical, to the supervision of labourers and visa management: a category that widely differs from the traditional *fellahin* (peasant) (Cf. 4.15). Thus, being farmer is not linked primarily to owning land or being settled and rooted in a rural area, but is connected to a multiple economy and access to capital. In contrast, the planning efforts of the last decades have contributed to the dissociation of lineage from land but also dispossessed a peasant (fellahin) population of its traditional, family-based knowledge.

Agricultural change has been paralleled by several social transformations. The heterogeneous system of land tenure and management, has led to new social values of work, to migrants' presence and to feminization of agricultural sector. Up to the present day, this process has contributed to the transformation of solidarity network, disrupted tribal relation to land and farming, viewed as a mere productive activity. During the 1980s, the impact of new technology on labour organisation, gender division, and farming practices was so deep that even USAID (1989) planners admitted that labour- and capital-intensive development in the Jordan Valley had "increasingly eroded the original plan's intentions". The process strongly concentrated power in the hands of intermediaries, merchants, and investors from outside the JV residing in urban centres.

It also favoured capital. Poor farmers, mainly ex-'abid (slave) of Palestinian origin, Gharwarneh and some impoverished communities with few other opportunities remained in the valley, trying to live

[22] Official reports record an unemployment rate in the Jordan Valley of 30-35% (in Jordan Times, 28/04/2002). Cf chapter 2.

from the land and family labour but generally unable to invest because they were landless and lacked capital and the necessary social and political networks.

The lower status families in the JV who had access to land have often quitted agriculture or are still farming with low input techniques. Farms relying on family labour or poorer farmers/workers are one of the most vulnerable groups. The army has been and still is perceived as offering safe work that carries with it privileges and access to multiple resources. Besides, it has generated highly mobile 'weekend-husbands', as they are called, who commute regularly from the army to their families in the JV.

Generally, the bias in favour of large landowners before, and capital investors after, has been reproduced, and the technical and capital-intensive nature of water management has increased the gap between farmers. The introduction and spread of microirrigation, especially in vegetable and banana fields, linked to other technical innovations (mechanization, pest control, fertilizers, high producing varieties, labour saving techniques) has been a major transformation. The development of drip irrigation has been the result of several combined causes, including the need for better applying water and fertilizers, its labour saving nature, the development of greenhouses, the shift to pressurized pipelines in the 1990s (see Ch. 5.12.1).

The agrarian transformation has thus radically changed both the cultural values and the actual practices of agriculture. Agriculture today is a context of business but also great uncertainty, due to high investment costs, paralleled by periodic market crisis and continuous price fluctuations. As Qasem (1995:89) put it "variability is the key common element of most issues involving irrigated agriculture". This context becomes so unfavourable for small family or poor farmers with little capital and technical and marketing knowledge but at the same time it remains a highly profitable business for entrepreneurs. The crucial importance does not rely today on the ownership of land, but on the ownership and access to capital, to expert knowledge and access to political networks in the water bureaucracy or in the marketing system. The greenhouse, a transferable and mobile investment, rather than land, has become the symbolic indicator of being a farmer at the local level, and is at the same time a marker of a new modern status hierarchy.

3.6.4 The quite agricultural revolution in the Highlands

According to the case study of Mundy and Smith (1991), we can trace some major trends up to the end of the 1980s in the agricultural development in the Highlands, which followed different trajectories compared to the JV:

1. wheat and barley remained the base of the upland agriculture, offering low economic revenues, related to family subsistence and integrated with animal feeding in dry years;

2. Most of the men looked for employment in the army or civil service, migrated to Europe or to Gulf states and often went back to farming on week-ends or at retirement; this led to the expansion of "part-time farming" in this areas;

3. Plantation of olive trees supported by government projects took place in order to limit land erosion and siltation of dams;

4. Irrigated vegetables and fruit trees expanded to traditional irrigated areas in the mountains;

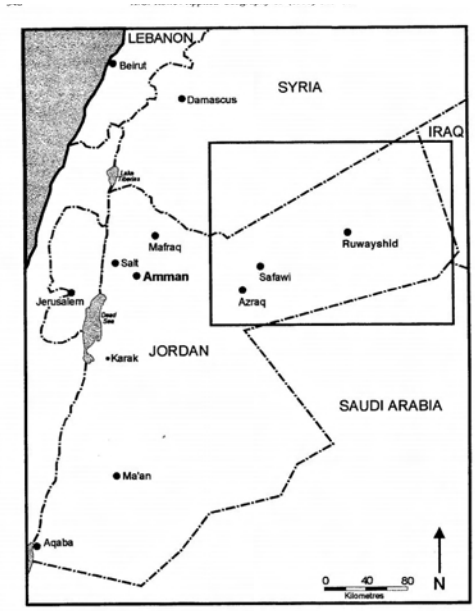
5. Irrigation based on groundwater started to appear with modern farms that employed young women as well as Egyptian migrants in the Highlands;

The first sedentarization process was mainly concentrated in the south of Jordan (outside the Basin) from where also the main tribal allegiance to the Hashemite authority derived[23]. These first projects show the explicit political incentives to irrigated agriculture and even orchard production in arid areas by national policies. They were meant to offer a new source of income, but also a new frame of security and control of population through settlements and a new expertise through the role of engineers in the construction of the nation (Bocco, 1986).

If pastoralism in the Badia has radically declined in favour of rainfed agriculture (and increasingly of irrigated agriculture), the main economic activities remain the service sector, the employment in administrations and in the army. This has led to the extension of State authority into the Badia, to the co-optation of unruly groups and to their integration into a national market.

The first sedentarization process was mainly concentrated in the south of Jordan (outside the Basin) from where also the main tribal consensus to the Hashemite authority derived[24]. These first projects show the explicit political incentives to irrigated agriculture and even orchard production in arid areas by national policies. They were meant to offer a new source of income, but also a new frame of security and control of population through settlements and a new expertise through the role of engineers in the construction of the nation (Bocco, 1986).

Figure 3-14. The area of eastern Badia (from Findlay, Maani, 1999)



[23] Three phases of irrigated agriculture projects in the Badia can be distinguished. 1960-69: a preliminary stage of research and experimentation that encountered the first socio-political problems and friction and mistrust with the tribal population, while agriculture was mainly focused on fodder, maize and wheat; 1969-1976: six projects were implemented (e.g. Qa'disi, sited outside the Basin, 350 km from Amman) and new Bedouin villages were planned; 1977-85: new settlement projects favoured investments in fruit orchard and cooperatives, in the context of the oil boom and increase of agricultural exports.

[24] Three phases of irrigated agriculture projects in the Badia can be distinguished. 1960-69: a preliminary stage of research and experimentation that encountered the first socio-political problems and friction and mistrust with the tribal population, while agriculture was mainly focused on fodder, maize and wheat; 1969-1976: six projects were implemented (e.g. Qa'disi, sited outside the Basin, 350 km from Amman) and new Bedouin villages were planned; 1977-85: new settlement projects favoured investments in fruit orchard and cooperatives, in the context of the oil boom and increase of agricultural exports.

In the late 1970s, the government launched a full-scale development program in north Badia. The program included investment in domestic water supply, roads, schools, clinics, and other public services. The government also decided to encourage the development of irrigated agriculture as an additional reliable source of income with the objective of enhancing social welfare and stability.

This was done by granting licenses and soft loans through the Agricultural Credit Corporation (ACC) for drilling private wells. Favourable export markets to the Gulf countries in early the 1980s, together with subsidized energy prices, the construction of Mafraq Tomato-paste factory, and local market protection during harvesting season, encouraged private investment in irrigated agriculture and resulted in rapid agricultural expansion in AZB highlands. Private investors included high government officials, high ranked Army officials, and farmers from other parts of Jordan, especially from the Jordan Valley, in addition to returnees from Gulf countries after 1990 (cf. Chapter 5.1).

Ironically, when the JVA started to pay attention to the conservation of water in the Valley, at the beginning of the 1980s, the government was launching a program encouraging the development of irrigated agriculture in the Badia granting licenses and soft loans for drilling private wells (Suleiman, 2003). In this way, it encouraged the exploitation of groundwater to expand agriculture into desert land at the expense of the sustainability of groundwater resources, and also using non-renewable water basins[25] far away from the population centres (Hadidi, 2002, cf. chapter 5.3.1).

Initially, the Natural Resources Authority (NRA) was the licensing agency: except for a few wells licensed near the end of their tenure, the NRA's licenses did not state any quantitative limitation on water abstraction. In 1984, WAJ assumed the responsibility for all licensing of privately owned wells, including industrial wells. Licenses issued since then have included limits on abstraction -generally 50 75 and 100,000 m^3/year/well- but these limits have never been enforced (see also 5.13.1). It has also become necessary to own land in order to obtain a well license.

The government's intention was to control people's migration to urban centres and curb unemployment rates. After they legally received their well licenses some Bedouins sold their land proprieties that was attached to the water rights. As a result, the pattern of farm ownership gradually shifted to private investors due also to the good quality of groundwater (no contamination and salinity), the low cost of irrigation water abstraction, and climatic conditions suitable for producing profitable crops.

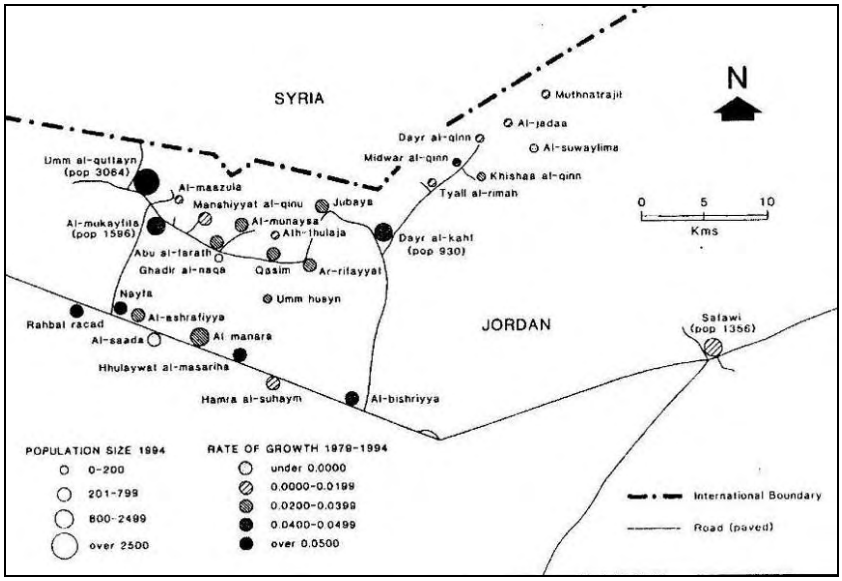
Although Bedouins were recognized as landowners of the area, many external investors from other areas bought some of the land from them. Some of the Bedouins sold their properties right after they manage to obtain their well licenses; others drilled their wells and sold their farms after failing to succeed in the agricultural business. In a survey of the Badia Research and Development Program in 1993 only 22.3% of the population depended on livestock production as the main source of their household income; a further 7.9% looked to other agricultural activities for their income, while the vast majority of the population was dependent on the service sector employment (Findlay 1999).

Other major groups obtained access to irrigated agriculture: investors banked on highly profitable export crops, reinvesting the capital from migration or their rent as notable, or medium entrepreneurs (generally of Palestinian origin) who were in the vegetables and fruit business, as well as part time farmers and week-end farms. The Highlands have thus been the object of an intense and spontaneous

[25] Al-Disy and Al-Jarf basins in south of Jordan.

private investment. In contrast to the idealized small 35 dunum farms of the JV, the farms based on private wells are relatively large in size, 20 hectares (200 dunums) for seasonal farms and twice as much for orchards (400 dunums).

Figure 3-15. Population change in the Badia area of Jordan, 1979-1994 (from Findlay, Maani, 1999).



The Lower Jordan basin is the most developed area in Jordan and the fastest growing region both industrially and in terms of population. The 1973 oil boom and its economic impact on the region contributed to overall economic growth. However, the over-abstraction of water by private and public sectors and the expansion of unplanned irrigated land are threatening what has been achieved to date (Jabarin, 2001).

3.6.5 Quantifying the Evolution in the Lower Jordan River Basin

This section recaps and quantifies the main evolutions of the agriculture sector in the Lower Jordan River Basin (see Courcier *et al.* 2005). The first notable evolution is that of land use. Irrigated areas increased from around 10,200 hectares in 1950 to 24,900 hectares in 1975, and to 45,800 hectares at present (Figure 3-16), including both schemes in the Valley and groundwater-based agriculture in the highlands. Rain-fed cropping areas have significantly increased in the 1950–1975 period (from 108,000 to 165,000 ha), with cereals providing work and food to a growing population. This extensive type of agriculture later declined, with a shift in the economy towards nonagricultural activities (chapter 3).

Figure 3-16: Evolution of Vegetated Areas in the Lower Jordan River Basin (after Courcier et al., 2005)

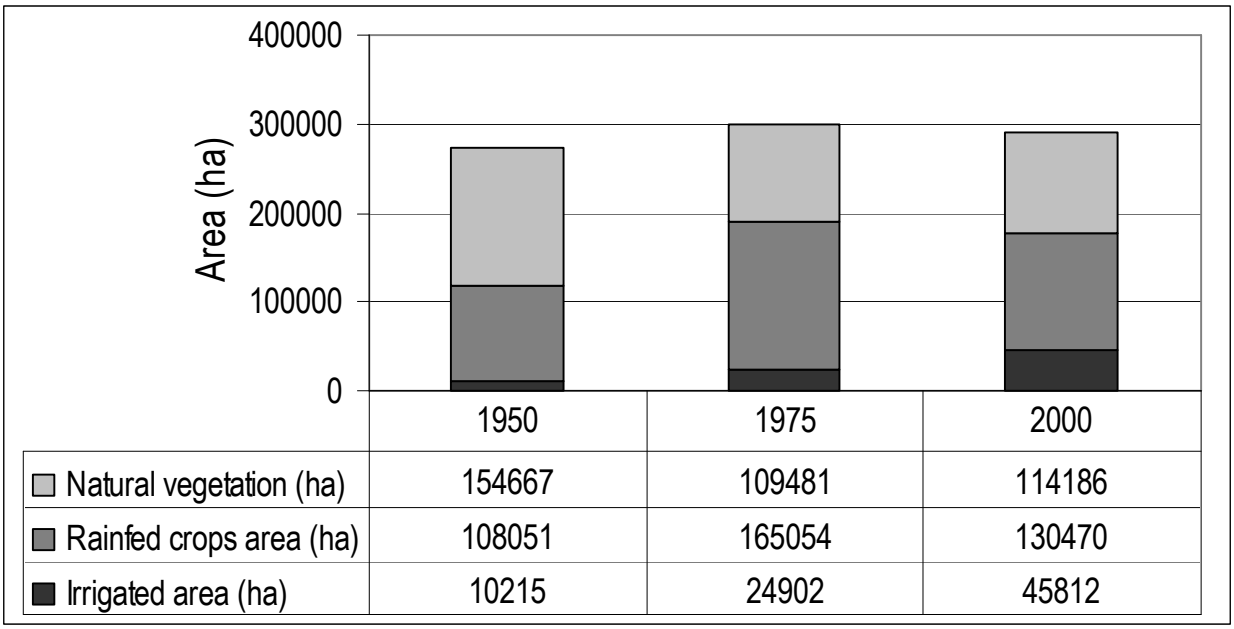
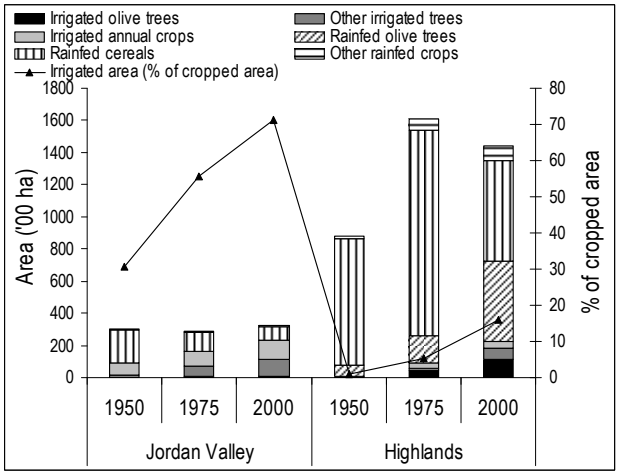


Figure 3-17 shows the evolution of the cropping area between 1950 and 2000 in both the Jordan Valley and the highlands (Courcier et al., 2005). The figure highlights the structural differences existing between the two regions. Cultivated areas are much larger in the highlands (total area of 143,900 ha) than in the Valley (total of 32,300 ha), which reflects the large areas of rain-fed cereals and olive trees planted in the highlands (total of 121,100 ha).

Figure 3-17: Crop-and-Region-Wise Evolution of Cropped Areas in the LJRB since 1950



In the valley, irrigated crops have always constituted a large share of the total cropped area. From 1950s onward, irrigated areas have continuously increased, from 9,300 hectares in 1950 (31% of the total cropped area) to 16,100 hectares in 1975 (56% of the total cropped area), and to 22,970 hectares at present (71% of the total cropped area).

At the same time, rainfed areas (limited to cereals) have continuously decreased (21,000, 12,700 and 9,300 ha in 1950, 1975 and 2000, respectively). In the highlands, rainfed areas (both cereals and olive trees) are predominant and mainly located near the side-wadi basins.

We can see from Figure 3-17 that areas with cereals strongly increased between 1950 and 1975 and then decreased during the last 25 years, while rain-fed olive trees (mainly located in the north side-wadis and south-side wadi basin as well as along the wadi Zarqa) increased significantly between

1975 and 2000 (from 16,900 to 49,300 ha). Irrigated areas are now comparable to those in the valley (22,800 ha in 2000) but their expansion occurred in the early 1980s, much later than in the valley. Moreover, they only represent now 16 percent of the total cropped area (against 1% and 5.5% in 1950 and 1975, respectively). Figure 3-17 clearly shows the importance of irrigated orchards in the highlands and their dramatic increase: irrigated olive trees increased from 420 hectares in 1950 to 3,900 hectares in 1975, and reached about 11,000 hectares at present, i.e., almost half of the irrigated areas in the highlands (the other half consists of vegetables and stone fruit trees), of which 8,170 hectares are located in the midst of the desert (Venot 2004c).

3.7 1995-onwards: the rise of the water challenge in Jordan

Only in the last decade has water been recognized publicly and politically as a main national problem. This included debates between experts and donors on possible water policies and strategies in the face of scarcity, ushering in the official water policies of 1997 and 1998. The concern therefore shifted from the refugees, the main target of the 1950s, towards land as main issue in the 1970s, and finally to water as main problem in the 1990s. Indeed, in 1995, the Jordanian authorities adopted a new strategy about the implementation of a water allocation policy. The priority for water allocation was firstly attributed to the urban sector, then to the industrial and tourism sector, and finally to the agricultural sector.

Water management in the Basin cannot be insulated from the general process of the expansion of Amman as a "primate city" in Jordan, but also from the process of sub-urbanisation of the countryside around the capital, near Irbid, and in the Badia. By this, we refer both to the village schemes implemented, together with social services and infrastructure (schools, health centres), and to the dissemination of urban-fashioned constructions in the countryside, where the status and symbolic meaning of fenced villas has spread. The percentage of water resources for municipal use increased from 18.2% of the total water use in 1985 to 26.9% in 1997. In the same period, the share of the industrial sector rose from 3.4% to 4.3 % of the total (Ferragina, 2001: 357).

The use of the territory has started to take an urban shape: farms have become secondary residences, new villas have increase land fragmentation, the habitat in the Highlands countryside slowly resembles that of Amman, in a process of urbanisation that represents a new phenomenon in the XXth century (Lavergne, 1994). A similar dynamic can easily be observed in the Valley where fenced fruit orchards hide a villa -and sometimes a swimming pool- used on week ends, where the value of prestige and status is higher than the economic efficiency and productivity of the farm itself (see JP, ch.V.2). These fenced villas or fruit orchards represent a *mise en scène* of prestige but also of privacy. They are generally connected to a well, symbol of social status but also icon of one of the most problematic issues.

In the 1980s, Amman and Zarqa cities began to be supplied with drinking water from basins outside the Azraq[26] aquifer. The Azraq aquifer was in fact seriously exploited for drinking purposes since the late 1970s (Suleiman, 2003). Serious droughts in 1991 and 2001 intensified the water crisis but also gradual awareness. In this frame, "the symbolic value of water dominates its economic value and the Jordanian government is responsible for this attitude (…)" (Ferragina, 2001: 365). Indeed, a real public debate on water scarcity lacks in Jordan and water still remains an issue relegated to experts'

[26] It lies in the eastern side of the country

sector and national policies. Besides, water in irrigated agriculture did and does not represent a main cost for farmers.

Mobility remains a crucial key to understand the basin area. Emigrant workers continued to be a structural element of extra-village employment. In mid-1980s, 40% of the active population was working outside Jordan (De Bel Air, 2002).

As a consequence of the Gulf War of 1990–91, in two years around 300,000 people of Palestinian origin had to return to Jordan from Kuwait, and 95% of them resettled mainly in the Basin Area (De Bel Air, 2002). This influx of Jordanians of Palestinian origin, who often had not lived in Jordan earlier, had a strong economic impact on the development of irrigated agriculture in the Highlands but also increased demographic pressure in the capital and therefore, the need to increase its share of water.[27]

This influence could also be felt also in the valley, where a new middle class, mainly of Palestinian origin, reinvested money brought from the Gulf countries and remittances into agriculture, into house construction and in commerce. The "villa farm" became an icon of modernization, where often money from the Gulf was invested. Impact on agriculture also came from their agricultural knowledge, the technology transfers from Israel, and their market networks (see ch.V.2). More generally investments in the modernization of agriculture have come from both Jordanians of Palestinians and of East Bank origin, both in the JV and in the Highlands.

In order to understand the contemporary political frame in relation to water it is useful to remind here some events. In 1988, King Hussein declared Jordanian disengagement from the West Bank, an important political act towards the Jordanian population of Palestinian origin. In April 1989, riots exploded in the southern town of Ma'an, in southern Jordan, when subsidies reductions on certain basic items were announced in accordance with debt rescheduling agreement with the IMF. Riots and oppositions shacked southern Jordan also in the 1996 bread riots, and later in 2003. It is important to note that those demonstrations developed in areas dominated by tribes once highly loyal to the Hashemite regime but that felt marginalized in the redistribution of resources.

As Brand argues, "given the Palestinian private sector/Transjordanian public sector divide, and given the fact that economic liberalization targets a shrinkage in the state sector and an encouragement in the private sector, it is not surprising that Transjordanian felt threatened by the economic restructuring" (Brand, 1995:55).

Regarding water institutions, a main step was the centralization of responsibilities in 1992 of the public management of water within the Ministry of Water and Irrigation (MWI) in order to decrease the fragmentation of institutional roles. Moreover, Participatory Management Approach was introduced in Jordan and pressure to reorganize the central management with more space of manoeuvre for participation has been stressed.

The building up in the last years of the first Water Associations, with the support of MREA and GTZ in the Jordan Valley after years of WB efforts for the development of a Participatory Irrigation

[27] It is relevant here to remember that more than 70% of the returning families had spent more than 20 years abroad; about 30% had been tortured; more than 40% lost over JD 10,000 in salaries, compensation, savings and possessions; and more than 70% owned neither land nor a house to which they could return (Department of Statistics, 1992).

Management (PIM), are a sign of the acknowledgement of the centrality of water scarcity as much of the political role played by water in state-citizen relationships.

3.8 Tribe and resource management in the Basin

Tribal solidarity and its influence on national politics and water management is a main contemporary issue in Jordan. We provide here some elements that are crucial in understanding the wider context of management of land and water and of the historical insertion of the tribes within the nation-state.

The confusion often observed about the notion of tribe is linked to the different idioms and contexts in which "tribe" is used. In fact, the notion of tribe can refer to a native ethno-political ideology, a concept used by state authority for administrative purposes; an implicit practical notion held by the people and not elaborated in formal ideologies; or an anthropological concept. We outline here the contexts and meanings attached to tribe, which are paramount in day to day management of water.

3.8.1 The tribe/state relationships

The reproduction of tribal belonging within the construction of the nation has been a central issue in Jordan. In the literature, great attention has been paid to the redefinition of Bedouin and tribal identity (Bocco, 1993; Lane, 1994; Mundy, 2000) within a new demographic context of a large population of Palestinian origin, a fragile border, and the Hashemite Kingdom's need for legitimacy.

The redefinition of what a "true Bedouin" should be is interlinked to, and often coincides with, the construction and definition of a 'true Jordanian'. Tribal solidarity has often overlapped with the national administrative structure, thus shaping also a national identity and the new bureaucratic apparatus.

As Shryock (1997a:274) has written, from the point of view of Transjordanian tribes there has been an "attempt to define Jordan as an essential tribal nation and tribes as essentially Jordanian (…) The most authentically Jordanian citizens are those who can plunge their roots deepest into Jordanian soil (…) The people without long and local genealogies- immigrants and refugee Palestinians, Ghawarneh, peasants, gypsies, Circassians and others- will always be less surely Jordanian than the Bedu".

At the same time, tribalism has been an explicit component of Hashemite politics in the process of national construction. Bedouins and tribal values have been mobilised in national construction as guarantees of the political stability of the monarchy, in an attempt to legitimise Hashemite authority vis-à-vis a larger tribal context. Besides, tribal solidarity and heritage have been emphasised in face of a large Palestinian demographic presence and the consequent risks of instability, a separate sense of belonging inherent in Palestinian national struggle that could undermine the loyalty to the Kingdom.

Nationalistic discourse in Jordan has therefore been the framework in which Transjordanian tribes think about their history and their present role, often in relation to an explicit anti-Palestinian feeling or accusations of disloyalty towards the kingdom. In the last decade a harsh debate questioned the compatibility of a democratic system with tribalism (*ashairiyyah*), which is at the heart of the identity debate in Jordan.

Today, tribes' place of origin does not coincide with the place of residence and political influence and traditional maps of tribal territory are not pertinent anymore. In the context of this constructed national identity, the absence of a solution and political rights for thousands of refugees and the continuous

extension of settlements as well as occupation of the West Bank are at the core of a Palestinian common feeling of injustice, even for fourth-generation refugees.

Further, tribes in Jordan have acquired a privileged political position, which often has not been paralleled by economic advantages. In practice, tribes have beneficiated from state privilege not as members of Bedu tribes, but on the basis of their relationship with the state, as clients of political personalities, or as members of the public administration or the army (Tell, 1993); this shows not so much the cohesion of tribes in front of the state but their embeddedness in state construction. Palestinians who have achieved notable success in business, even more by reinvesting Gulf remittances, are the pillar of the regime, alongside the Transjordanian staffed army and security forces.

3.8.1.1 The Bedouin tribe as a legal category

'Bedouin' has become the focus of a debate between scientific experts in the context of the sedentarisation projects through irrigated agriculture in the Middle East. This has been paralleled by a juridical definition of the position and role of tribes in the new national frame, with reserved seats in the parliament for representatives communities (Arab Christians, Circassians and Chechens, Bedouins, Transjordanian Muslims). This political system was founded on the representativeness of minorities as the fundament of what has been called a "neo-patrimonial regime" (Abu Jaber, 1972).

Following the influx of large Palestinian population in 1948, the community division of seats was kept only for the Transjordanian population. In 1952, a new Constitution under Talal reign made the government responsible in front of the Parliament. After the coup d'Etat in 1957, the Parliament was dismissed and a law forbad any political party and activity for some three decades. Thus, also after 1967 and 1979, parliamentary life was suspended until 1986, when the regime declared its intention to hold general elections. Seats were augmented according to minority representation, adding 11 seats for Palestinian refugees. The long imposed political censure led inevitably to the shift of political representation through community lines.

Bedouins have acquired a legal and juridical definition during the British Mandate. In the electoral law of 1920, Bedouin was defined as who was a nomad, in a context where only half of the population practiced effective nomadism or transhumance. Some tribes were identified as "Bedouins" in juridical terms: the Bani Sakhr, the Bani Khalid, Sirhan, Issa, Slayt defined as Bedouin of the north; the Huwaytat, Mannayin and Hajaya defined as the tribes of south and were the only ones formally recognized for the elections. This definition was mainly aimed at acquiring the loyalty of tribes which where continuously crossing the new international borders and had strong relationships with the Saudis[28]. Later, new "tribes" were recognized and classified as legitimate in the electoral process, while others have disappeared.

In 1986, the first general elections were hold in what can be described as a parliamentary monarchy, where political parties have been largely censured.

[28] For example, the Bani Hassan, the Bani Hamida and the 'Abbad, who were not crossing those borders were excluded from this definition (Bocco, 1989).

3.8.1.2 The tribe as a local political value system

Being Bedouin has been defined as a 'primordial identity' (Lane, 1994) because it stresses the ancient and apparently 'essential' criteria of belonging. Often presented as a static identity, the term 'Bedouin' today on the contrary is the result of the process of national incorporation through administrative and development labels.

The category of Bedouin has thus been a government discourse, which is linked to narratives of foundation (the origin and the genealogy), to a system of values, to a pattern of economic cooperation and to marriage patterns (mainly the preferential and idealised endogamous marriage with the daughter of the brother of the father).

In local perceptions, being Bedu is linked to the concept of 'nobility', '*asil'*, which is implicit in the genealogical memory of Bedouins and in the hierarchy of reputation among tribes. 'Having an origin' is indeed a fundamental term of distinction from a tribal point of view: identity is defined through an idiom of descent, and history is interpreted as a genealogical past that can be traced back to the origins of the 'ashira, the tribe, and to common ancestors. Therefore, the origin, 'asil, gives legitimacy to the hierarchy of values among tribes, but is anchored ideally in the tribal land of origin: from this symbolic value derives the ideal attachment to land and the pervasiveness of legal pluralism in relation to resource management, as land and water (see ch. 4.15).

Bedu tribes use a genealogical model in defining solidarity: the '*asabīyya*, or tribal feeling of solidarity, which is linked to the basic values of honour, generosity, and hospitality. Ideally, there is no honour without origin; the direct consequence of this cultural assumption is that identity feelings are thought to be related to blood and hereditary, and so naturalised in the lines of descent. Therefore, the ideal identity of Bedouin has often assimilated different tribal identities against a wide inflow of refugees. Being Bedu is not coincident with pastoral nomadism, but with being 'Arab, even more in a context where pastoral workers themselves are often not Bedu anymore but may be hired Egyptians.

The definition of 'Bedouin' today is undergoing a process of change: the tribal management of resources has been disrupted, new international borders have severed pastoral routes, and the cement blockhouse has replaced the goat-wool tent. Bedu have shifted from pastoralism to army employment, irrigated agriculture, out-migration, transport, or development administrations.

3.8.1.3 Tribes and land

Although the relationship to land has inevitably changed, the symbolic meaning of tribal ownership remains crucial in the relation with the state. "*Al 'ird al 'ard*" ("honour is land") is a famous proverb: honour is linked intimately to protecting the tribal land where the land stands as the main source of honour. In this framework, "tribesmen use genealogical identities to mobilize against planners, to resist the agendas of other tribesmen, to lobby the King and so on" (Shryock, 1997b:42): the genealogical political model is thus crucial in the manipulation and distribution of state resources.

From the tribes' perspective thus, the reality of urbanity and planning is related to acquiescence to the Hashemite rule, although strong disagreements arise today when discussing land or water ownership. If the tribal territory has inevitably changed with state centralized management and with the new spatial organisation, Bedu values have adjusted to the development framework. Selling land has led to a shift from land capital to social capital, by getting access to education and status. Nevertheless, the

anchorage of tribes remains ideally the village, where land remains the symbol of honour and origin (Jungen, 2004).

The framework of tribal solidarity, which unifies both fellahin and Bedu, determines also the meaning of family, which is not coincident with the definition of conjugal family used in planning perspective: the *ailah*, is a "patrilineal descent group, consisting of a number of household (dar) whose blood relationship can be traced back five generations"(Mundy, 1990). This means that although a house of a farmer may be inhabited by a conjugal family, many activities are still performed by the extended family, like the work in the farm or the exchange of water.

The tribe has played thus a central role as a form of patronage and a basis for affiliation (Brand, 1995). By assimilating tribes within the state apparatus, civilian and military, the state has provided crucial subsidies to ensure loyalty and has recruited preferentially key tribes into various parts of administrative state apparatus. Therefore, "tribal identity has become politicized as it continues to be the basic channel for allocation of resources by the central government" (Shami, 1982: 138).

3.8.2 The rentier state and state/citizen relationship

As De Bel-Air has well shown (2002), the state/citizen relationship has been intimately linked to the rentier character of Jordanian economy. The dependence on aid and on migration has allowed the Jordanian economy to remain based on an indirect rent and it has reproduced a clientelistic pattern of redistribution of resources. In fact, Jordan is a subsidized economy, where oil revenues have both direct and indirect effects. The security of the state has always depended on external aid: distributing money through expensive and subsidized bureaucracies, developing the army, security services and extensive infrastructure. Indeed, in Jordan, foreign and domestic policies have always been blurred, since foreign events always have strong effects on domestic stability.

Moreover, Jordan has been highly dependent on external aid from Gulf States since the 1970s and the remittances from migrant workers have increased this rentier nature of the state. In addition to transfers of part of the financial activity of Lebanon to Amman, Gulf states aid in the 1970s and USAid funding in the last decades reproduced a tradition of aid dependency that goes back to the Mandate period. In this buffer state, vulnerable to external shocks and aid, "a division of labour developed in Jordan between Palestinians and Jordanians. The former came to dominate the private sector, while the latter formed the majority in the public sector" (El-Said, 2001: 258).

Jordan foreign policy has been tied to a regime survival, which has led lately to the peace treaty with Israel in order to ensure access to capital flows, a policy tied to the longstanding concern for domestic stability. In this context, Jordan has been integrated also in the Euro-Mediterranean partnership of the European Community, as a country of key importance in the region and as a precursor of private direct investment flows. The so called "peace economic dividends" from the Peace Treaty did not materialize as expected. Jordan pro-western position is increasingly unpopular, even more in the context of Western war against international terrorism and the occupation of nearby Iraq.

This rentier economy often "perpetuates non-democratic political structures," but is also "vulnerable to external factors that undermine sources of rent" (Wiktorowitzs, 2001: 113), as shown by the decline of the oil-rent in Jordan in the last years, following the occupation of Iraq.

In the past, the Jordanian state has redistributed these resources in a selective way, half of the population has been employed in public services, administration and in the army, a pattern of

construction of consensus, of distribution of state resources but also an extension of clientelism between interest groups and elites. This has also been present in the water bureaucracies in the past: irrigation infrastructure have been linked to the construction of consensus and of the administrative apparatus where many valley dwellers found employment, with privileges (health insurance for the family, low cost supermarkets, low cost mobile phones connections) and fixed salaries, in a wider context of economic insecurity.

Besides, since the 1990s, the external Arab aid has highly decreased and Jordan has been forced to disengage from public employment. The network of patronage has remained on the other hand central in determining the circulation of resources, since the capital itself has been mainly social and political, while economic infrastructure have been neglected in the past. Therefore, the structure of power has been linked to this redistribution of rent and to the client network that has organized around this external aid, with processes of social mobility and consumerism that clash today with the economic crisis and the political insecurity of the area.

In the case of the JV, the employment in the army, civil servants, in municipal and development administrations has been therefore a main factor of social stabilizer in the attempt to neutralize a tense social context. In this framework, the family and tribe have traditionally acted as main buffers in state/citizen relationship and as tools to manipulate state bureaucracies from within in order to achieve a "room for manoeuvre", a crucial element also in the access to water resources.

This regularly flowing external capital has led to an image of Jordan as a provider of wealth and jobs, a role that it cannot fulfil anymore due to the actual economic crisis and the agreements with WTO[29]. In 2000, IMF and Jordan signed an agreement to reform Jordanian economy and Jordan recognized that its survival depended on securing western interests in a strategy of rapprochement after the I Gulf War. If the rent has disappeared in the last decade, the social and economic expectations of the population have not, a contradiction visible in the unemployment of Jordanian men in the JV with a concomitant lack of domestic labourers in agribusiness (Cf. Ch.IV.5).

Rent is linked also to remittances from Jordanian migrants, which as we have seen, play a larger role in the economy than subsidies do today, since they allow many Jordanian households to enjoy living standards that they would not otherwise have: 14% of households in Jordan consider remittances from relatives (Cf. chapter 2) as one of their three most important sources of income (Fafo, 1999:300).

In this context, the economic value of agriculture, often criticized nowadays due to its expensive use of precious water and lack of profitability, cannot be detached from the political and social meanings that agricultural development has acquired in Jordan. As Richards has argued, "agriculture is perceived as a side-show, a source of patronage for key constituencies whose support is essential to achieve domestic stability and foreign policy goal or as a source of income for the population" (Richards, 1993). Any water reform is not linked only to economic costs: political costs are important in the wider context of high regional instability, as much as social costs for marginalized groups, who remain outside large networks of redistribution and whose safety nets are more fragile.

[29] Due to this rentier character and redistributive social formation of the state, it is not surprising that a gradual lifting of subsidies has been met with strong opposition and riots have erupted, mainly in southern Badia region of Jordan where tribes traditionally loyal to the regime have felt most marginalized.

In Jordan after the 1990s, a non-liberal state policy has persisted within a context of formal liberalism (Singh, 2001). The political arena was liberalised following the 1991 National Charter but this legitimate political arena has been de facto marginalised by the monarchy since "despite liberalisation, the king still considers himself above political process" (Joffé, 2001: xvi).

The "façade democracy" since the 1980s is constituted by patronage without an effective diffusion of power (Singh, 2001), since this would endanger the authority of the monarchy. In the past radicalism and regional instability have legitimized king Hussein to keep the loyalty of the conservative elite, in a fusion of economic and political interests, an exhaustion of the opposition from the left and cooptation of the Islamists. In the last ten years, we witnessed increasing discourses on civil society and an increase in the number of NGOs and associations, but this mobilisation does not coincide with a democratisation process. Even "the professional syndicates -the major non-governmental arena in Jordan- reflect institutionalised elite interests that have no investment in substantive political change" (Joffé, 2001: xvii).

Civil society did not act in Jordan as a buffer between state and society (as, on the other hand, tribalism partly did). Political liberalisation has represented until now a "tactical 'defensive democratisation'" (Singh, 2001: 76). Further, activities of NGOs have been hindered by the National Charter that requires prior state approval and authorization is linked and controlled by the secrete service. Therefore, the expansion of NGOs must be viewed as a process to maintain stability and social control, and not "by the benevolent desire for enhanced political participation" (Wiktorowick, 2001:114).

In fact, the only legitimate political activity is channelled in political parties, which have had little impact on politics. On the other hand, NGOs are necessarily depoliticized, since any political assertion and opposition by these actors is forbidden and Jordanian state interferes directly in their affairs. The state can disband any NGO, has control on its leadership, while all volunteers and administrative board members must be first approved by the "security department", in a control which is asserted mainly through bureaucratic procedures.

The limitation to opposition, press and political participation constitutes an "embedded authoritarianism", where social control is "projected through a complex array of administrative procedures, legal codes, and informal regulative practices designed to constrain opposition without resorting to violence" (Wiktorowick, 2001: 111). The true agent of control and distribution of power is not the secrete service, the army, but the bureaucracy. The relation between the state and citizens has been shaped by external factors, which gave predominance to the state (Brand, 1995). Associations and local forms of organization of civil society have often been highly controlled in Jordan, censured in case of fear for political instability or co-opted to neutralize their political critique or impact.

4 Context of agriculture and water management

4.1 Jordanian Agriculture: Current Status and Recent Evolution

4.1.1 Introduction

The FAO estimates agricultural land in Jordan at 1,145 thousands hectares (12% of Jordanian territory). Arable land, permanent pastures, and permanent crops cover an area of 295,000; 745,000 and 105,000 hectares respectively (FAOstats).Table 4-1 provides the distribution by crop type in 2005. Field crops, fruits and vegetables represent 49, 36 and 16% of the total cropped area estimated at about 247,000 hectares.

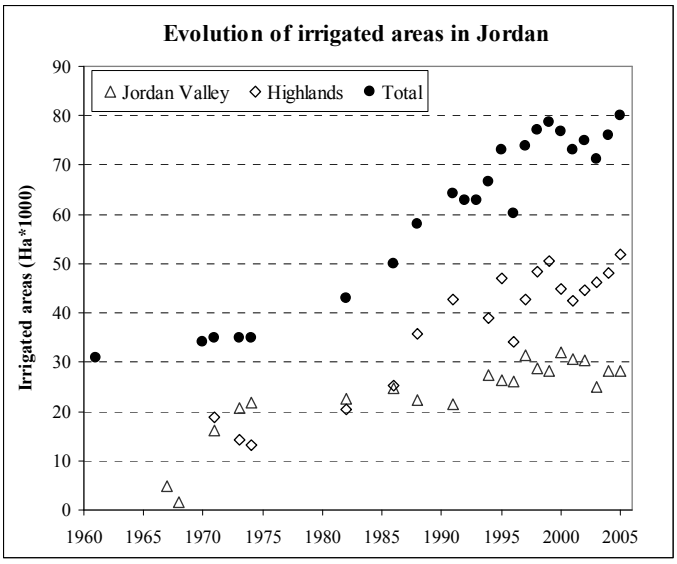
Table 4-1: Crop-wise cropped areas in Jordan in 2005

Cropped area ('000 ha)	Fruit trees	Field crops	Vegetables	Total
Rainfed Area	52.6	112.6	2.1	167.3
Irrigated Area	33.4	8.5	38	79.9
Total	86	121.1	40.1	247.2

Source Department of Statistics: http://www.dos.gov.jo/agr/agr_e/index.htm

Since the 1960s, field crop areas have decreased both in absolute and relative terms. Between 1971-1975 and 1996-2002, they declined from 240,000 to 120,000 hectares. While they represented 80% of the total cropped area in the early 1970s, their share has now decreased to 68% (Medagri, 2003). Rainfed agriculture (mainly olive trees and cereals) has a low economic importance and remains limited to the north-western uplands of the Lower Jordan Basin.

Figure 4-1. Region wise evolution of Irrigated Areas in Jordan (Source. FAOstats and DoS online database)



In the semi-arid to arid climate of Jordan, irrigation has been necessary for large scale development of agriculture. Figure 4-1 shows the evolution of irrigated areas in both the Jordan Valley and the Highlands since the early 1960s. Between 1961 and 2005, total irrigated areas increased from 31,000 to 80,000 ha (i.e. 32% of the total cropped area). Irrigated areas total 30,000 and 50,000 ha in the Jordan Valley and the Highlands, respectively and are an important part of Jordanian agriculture because of their high productivity and profitability.

Fruit irrigated areas have been multiplied by three (from 11,000 to 33,000 ha) and production by five between these two periods. Vegetables areas have decreased from 48,000 to 38,000 ha but production

has increased threefold in the same time, highlighting productivity gains in the fruit and vegetable sector (figures are drawn from Medagri, 2003).

4.1.2 The Agriculture Sector: Past Prosperity and Present Difficulties

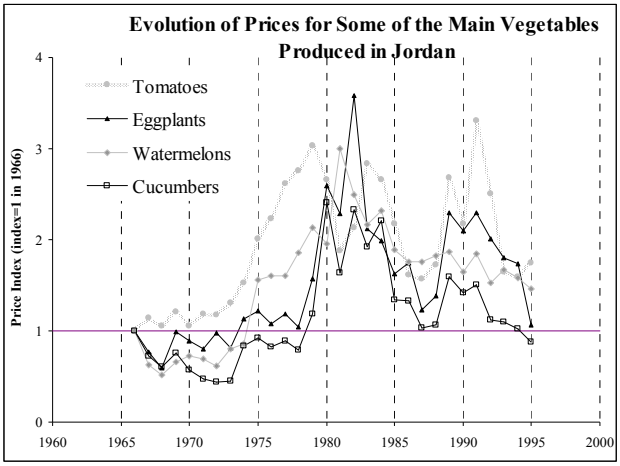
The agriculture sector has witnessed two successive periods of farming prosperity and decline. The first period of prosperity followed the construction of large-scale irrigation projects initiated in the early 1960s, especially in the Jordan Valley (chapter 3 and 5.12). During the 1970s, after a period of regional instability, the agriculture sector witnessed a second period of prosperity. In a context of relative abundance of water, intensive agriculture developed: the technical ability of farmers rapidly increased with the introduction of technologies such as drip irrigation, plastic houses, row tunnels, and mulch systems (chapter 3 and 5.11). Jordanian agriculture evolved from subsistence farming to a market-oriented agriculture producing vegetables and fruit surplus for both local and regional markets. Due to the availability of a cheap workforce from Egypt (chapter 4.3) and to the expansion of the gulf export market that could be reached through kinship ties among Palestinian populations, agricultural development saw its heyday at the end of the 1970s, beginning of the 1980s. Agricultural revenues increased tenfold for vegetables and more than doubled in fruits plantation (Daher, 2001). It caused inward migration and commuting between the cities and the Jordan Valley (chapter 3). In the Jordan Valley, the profitability of irrigated agriculture started to decline in the mid 1980s. In the Highlands, free access to groundwater (chapter 5.3) allowed the development of highly profitable fruit trees orchards until the end of the 1990s. Recent measures to limit groundwater abstraction (chapter 5.3 and VI) have not yet stopped this tendency that slowed down due to both internal and regional reasons.

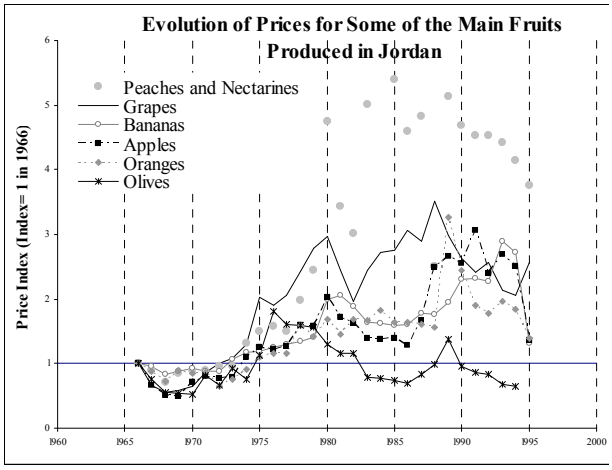
At the domestic level, overproduction due to intensification and productivity increase in vegetable farming as well as to the uncontrolled expansion of fruit trees orchards affected the market. In the mid 1980s, a decrease in price (see Figure 4-2, from Nachbaur, 2004) revealed the first signs of vegetable overproduction and, twenty years after this decline, the FAO and the Department of Statistics point to the weaknesses of the Jordanian agriculture sector in the following terms:

> *"Jordan's production of fresh horticultural produce is not based on a well-established and clear knowledge of market demand in terms of quantity, quality, and timing. For most products, Jordan does not produce the appropriate varieties, with the right production technologies, at the most profitable season, since most producers do not receive any advice or information in these areas."* (DoS and FAO, 2002:10)

At a regional level, some former clients (mainly Saudi Arabia, Lebanon, Syria and Gulf countries) developed highly subsidized vegetables and fruits production. Since the 1960s, irrigated areas, in parallel to a high demographic growth, have generally been multiplied by two in all countries of the region. Irrigation development has been particularly important in the Gulf countries where the volume of production is now similar to that of Jordan (Medagri, 2003). This new production competed with Jordanian products and Jordanian agribusiness began to decline (Nims, 2004). Jordanian entrepreneurs, who are facing high transport costs, poor production practices and weak marketing infrastructure, progressively lost one of their historical and profitable export markets. Jordanian exports decreased although internal production increased and this further accentuated the internal difficulties of the sector. Jordanian exports also decreased because of the regional political situation.

Figure 4-2: Evolution of Prices since 1966 for the Main Vegetables and Fruits Produced in Jordan





During the 1979-1986 Iran-Iraq war, those countries' demand for produce dropped (THKJ et al., 1988). Moreover, with Syria backing Iran and Jordan backing Iraq, Syria reduced its imports of Jordanian vegetables (Elmusa, 1994). The drop of oil prices in 1979 and the civil war in Lebanon in 1982 further reduced the Gulf, Lebanese and Syrian markets (Haddadin, 1999). In the same time, remittances from abroad decreased and local demand also fell down (Hagan & Taha, 1997). In the same time and in many countries imports from Turkey, Cyprus and Egypt replaced imports from Jordan for quality reasons. In 1989, the devaluation (chapter 2) re-boosted Jordanian exports and let to an increase in agricultural prices (Figure 4-2). This phenomenon did not last long and from the beginning of the 1990s, vegetables prices – and then fruit prices- decreased once again as a consequence of regional overproduction. Prices further decreased after the first gulf war (1991) when Jordan supported Iraq and isolated itself from other Arabic countries. The latter closed their borders to Jordanian products (Saudi Arabia invoked treated wastewater use in agriculture to stop its agricultural imports from Jordan) and the Iraqi market did not prove to be sufficient to absorb the entire Jordanian surplus. Local overproduction worsened. Climatic advantages and complementarities between the Jordan Valley and the Highlands did not constitute anymore a decisive advantage on the regional market. Jordan's position as a major fruit and vegetables supplier of the region had been altered.

The recognition of the Jordanian water crisis in the mid 1990s (THKJ and MWI, 1997b) shed the light on the impossibility for agriculture to expand in both the Jordan Valley and the Highlands. Water availability (and decreasing freshwater supply for irrigation) has become a constraining factor for the agriculture sector, which is the residual user of water and is competing with domestic and industrial demands that are given the priority (chapter 4.2, 5.12 and 5.13).

Since the mid 1980s and further after the reorientation of the water policies; the absolute and relative importance of agricultural water use declined. While agriculture made up 78% of the national water use in 1985, the sector's share declined to 64% by 2002 (i.e., 519 Mm^3/yr in 2002, including 71 Mm^3/yr of treated wastewater [THKJ 2004]). This still high agricultural water use is a common situation due to the large amount of water needed for crop production and to the relatively undeveloped nature of the other sectors, but these percentages signal that, because of the overall limited amount of water available, more inter-sectoral transfers are forthcoming. Deterioration of soil and water quality also affects the Jordanian irrigated agriculture (chapter 4.4).

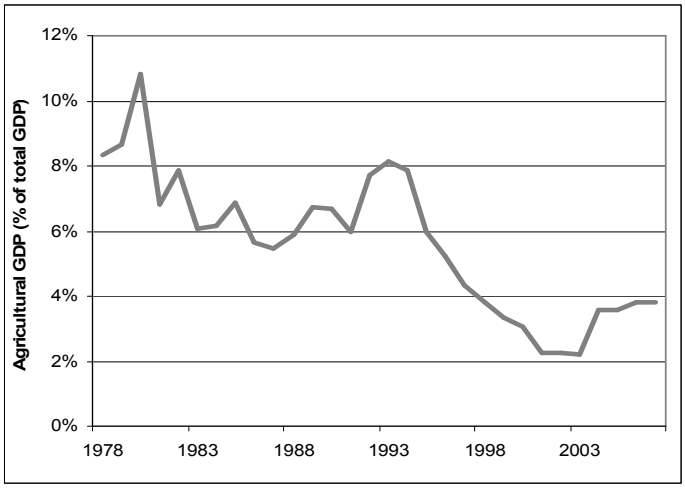
Finally, Jordan has embarked into a process of market liberalization and has signed several free trade agreements including agricultural sections that put further pressure on the sector. The country is facing an increasing regional competition as Syrian, Lebanese and Egyptian products can enter its market and freely circulate in other Arab countries. The major agreements include, the Great Arab Free Trade Agreement (GAFTA) aimed at creating a free trade zone amongst Arab countries (it was enforced in January, 1st 2005): this is the most important agreement for Jordan; an agreement with the European Union (enforced May, 1st 2002) aimed at developing a Euro-Mediterranean free trade zone; another agreement with the USA (ratified in December 2001) and finally the agreement with the World Trade Organization (WTO). Jordan is member of the WTO since April, 11th 2000. Finally, Jordan has also developed several bilateral agreements with its neighbours: Lebanon, Egypt, Syria, and Israel. All these agreements aim at decreasing custom duties on different products (Montigaud et *al.,* 2006).

4.1.3 Importance in the Jordanian Economy

Agricultural direct contribution to the GDP has been continuously decreasing since 1976. Agriculture accounted for 8% of the national GDP in 1976, against 3.8% in 2005 (Figure 4-3). However total contribution of the agriculture sector to the national economy is much higher and actually reaches 29% of the GDP (THKJ and Ministry of Planning, 1999), i.e. US$2.3 billions. The development of a market-oriented agriculture has greatly increased the role of agricultural intermediaries: wholesalers, commission agents, and private-sector engineers. Agriculture, stricto sensus, only contributes 22% of the entire agriculture sector, while agribusiness services (commissioner and agents in central markets, export and import companies, agricultural credit corporations or banks, public and private institutions for agricultural support, research or information) and merchants (mainly inputs, agrochemicals, and irrigation systems) have increased in importance. Finally, agro-industry (activities mainly linked to beverages and food processing) contributes significantly to the Jordanian agricultural economy.

In 2002, the percentage of self-sufficiency in cereals only reached 8.5%, although it was a good year with a production of 79.6 thousands of tons (Medagri, 2003). By 1997-2002, cereals import amounted to US$235,000 (DoS and FAO, 2002), that is, 4% of total Jordanian imports valued US$5.55 millions (Ambassade de France en Jordanie, 2004). These imports are often defined as ‘virtual water’ which designates the water that would be needed to produce essential food imports of a country. If we consider that producing one ton of grain requires 1000 m^3 of water, Jordan's import of cereals corresponds to importing 1.6 Bm^3/yr of ‘virtual water’, i.e. 208% of the 2001 national water use (evaluated at 769 Mm^3 by THKJ 2004 [chapter 4.2]). Import of greenhouses, irrigation systems (pipes, pumps, filters), inputs, seeds and livestock feeds is also very significant.

Figure 4-3: Agricultural GDP: Evolution since 1976 (Source. adapted from Nachbaur 2004)



Agricultural imports account for 19.6% of total Jordanian import, with a quarter of these imports being devoted to cereals. Like in most arid countries, Jordanian arid climate acts as an impediment to cereals production and yields observed are low (1.35 and 1 t/ha for wheat and barley respectively [Medagri, 2003]). Harvested area as well as the percentage of self sufficiency in cereals continuously decreased since the 1960s.

Agricultural exports have a significant importance for the country: they represent 14.6% of total Jordanian exports and fruits and vegetables exports make up 61.4% of these (Central Bank of Jordan, 2004). Due to the climatic conditions and complementarities of the three Jordanian regions (chapter 2), irrigated fruits and vegetables are produced all year long. This production supplies both local markets and an export market to the Gulf countries, Syria, and Lebanon (as most of Jordanian exportations): Arab countries absorb 98% in volume and 90% in value of all Jordanian agricultural exports (Medagri, 2003). The fruit trade balance was beneficiary in value and volume in the early 1990s. From 1995 onwards Jordan became dependant on import for its fruit consumption: exports slightly decreased during the period while importations highly increased. Percentage of self sufficiency in fruit still reached 98% in 2002. Main suppliers are Syria and Lebanon. On another hand, an important surplus of vegetables is produced in Jordan. Jordan is one of the main vegetables suppliers of the region. From 1994 onwards, importation remained almost constant while export increased in volume and value. Percentage of self sufficiency in vegetable reached 129% in 2002, with Gulf countries absorbing nearly 70% of Jordanian vegetables exports (DoS and FAO, 2002).

Box 4-1. Rainfed Agriculture and Livestock Activities

Rainfed agriculture (essentially cereals and olive orchards) is dominant in the mountainous uplands and in the north-western plateaux of Jordan. Rainfed plantations account for 95 and 75% of cereals and olive trees plantation, respectively (DoS, 2005). Herding and breeding remain socially and culturally important activities in Jordan and Bedouins population take up extensive livestock farming (chapter 3 and 5.13). Goat and sheep herds are grazing all over the country on 745,000 hectares of permanent pastures and overgrazing is common (chapter 4.4): food subsidies to owners of small livestock herds had for example to be abandoned to limit the extent of this phenomenon. This has been effective in reducing herd size by 25 to 50% and thus rangeland degradation but the program also reduced revenues and increased poverty (earlier consensus that attendant safety nets would be needed seemed to have been later forgotten [Richards, 1993 and Pitman, 2004). Herds are a living capital: many poor farmers have a livestock activity to improve their livelihoods during bad years (chapter 5.2).

There is also an industrial livestock farming oriented towards dairy and meat production but Jordan heavily imports both products (in 2002, for example, animal products imports accounted for 20 and

5% of agricultural and total Jordanian imports, respectively [DoS, 2007]). Jordan is self-sufficient for poultry meat consumption (with large industrial production, often in the desert plateaux, south of Amman) but poultry farming heavily depends of livestock feeds importation.

4.2 Water Resources in the Early 2000s: Growing Scarcity Problems

4.2.1 Status of Surface Water Resources

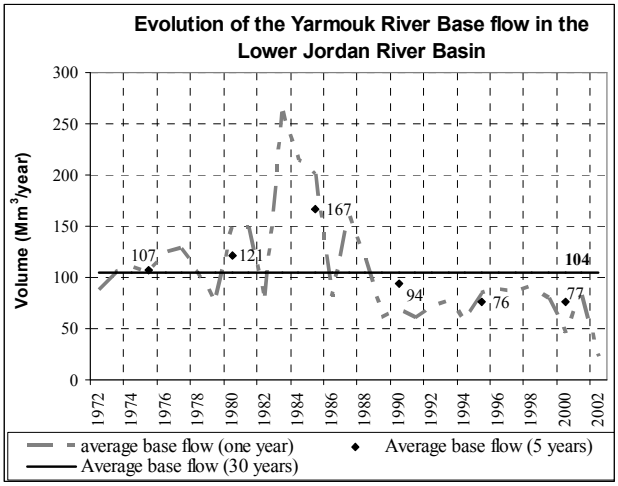
In Jordan, the per capita blue water[30] availability decreased from 3,600 m^3/yr in 1946 to 163 m^3/yr in the early 2000s (THKJ, 2004) and is expected to further decrease to 90 m^3/yr as a result of population growth and improved living standards (Ferragina, 2000; Abu-Sharar and Battikhi, 2002; Batainehet al., 2002)[31]. In the early 2000s, controlled surface water resources in Jordan were evaluated at 575-580 Mm^3/yr (El-Naser and Hagan, 2000; Ferragina, 2001) and an extra 230 Mm^3/yr was still flowing uncontrolled, in the lower Jordan River and in smaller side wadis. Total available surface water resources in the LJRB averaged 550 Mm^3/yr. After exploitation and diversion of the Upper Jordan River water resources by Israel during the previous period (1950-1975), the Yarmouk River became the main source of water of the Lower Jordan River and of Jordan. The main channel of the Yarmouk is fed by spring and intermittent streams arising almost entirely in Syria. The construction of middle size dams on the distributaries in the upper Yarmouk basin and the increasing pumping in the rivers and wells for agricultural and urban purposes led to the decline of the Yarmouk flow entering the LJRB. The Syrian utilization of the Yarmouk has more than doubled within the period (1975-2000) to reach 200 Mm^3/yr (El-Nasser 1998). Once evaluated at 470 Mm^3/yr by Salameh and Bannayan (1993), the Yarmouk discharge into the LJRB dramatically declined to 360 Mm^3/yr in the mid 1990s and to 270 Mm^3/yr over the last ten years (THKJ, 2004). The Yarmouk base-flow is lower than 100 Mm^3/yr (22 Mm^3/yr in 2002) and about 110 Mm^3/yr flow uncontrolled, mainly in winter to the polluted Lower Jordan River (Figure 4-6).

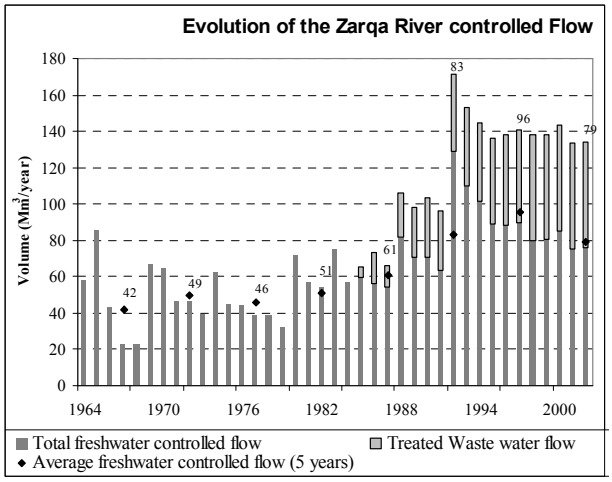
In the same time, the total flow of the Zarqa River, the second biggest tributary of the Lower Jordan, averages 75 to 80 Mm^3/yr (Salameh and Bannayan, 1993; Jayyousi, 2001; THKJ, 2004). It is entirely controlled by the King Talal Dam that stocks both base and flood flows most of the years. Despite intensive underground abstraction in the Upper Basin (Mafraq and Dhuleil Area, chapter 5.3); the total flow of the Zarqa River was higher in the 1990s than in the 1980s as always increasing leakages from water transfers and urban uses drained into the river (Figure 4-4). The Zarqa River also collects, through its main affluent (the Wadi Dulheil), effluents of the treatment plant of Khirbet As-Samra. This treatment plant receives and treats waste water from Amman municipality. Between 1985 and 2002, volume of waste water treated in Khirbet As-Samra increased from 6 to 60 Mm^3/yr.

[30] That is, annual surface runoff and aquifer recharge.

[31] In comparison, the World Bank generally considers that 500 m^3 per capita per year constitute "the poverty threshold" below which it is necessary to mobilize new water resources. Despite all the difficulties in defining and considering relevant thresholds (see Molle and Mollinga 2003), Jordan—with such a level of water availability—will always be at the bottom of the table.

Figure 4-4: Long Term Evolution of the Yarmouk and Zarqa River Flows (Source: database of THKJ, 2004)[32]





Minor *side wadis* (lateral flows) complete the picture of surface water availability in the LJRB. The major ones are controlled by weirs or dams (Wadis Arab, Ziglab, Shueib, Kafrein); the others (Wadis Iabes, Kufreinja, Rajib) still flow uncontrolled to the Jordan Valley. Total flow of north side wadis has been estimated at about 60 Mm^3/yr (in which 30 Mm^3/yr of baseflow) against historical flow of 90 Mm^3/yr [Baker & Harza, 1955; THKJ, 1977]). Total flow of south side wadis still averages its historical value of 30 Mm^3/yr (in which 25 Mm^3/yr of base flow) (Baker & Harza, 1955; THKJ, 1977; THKJ, 2004).

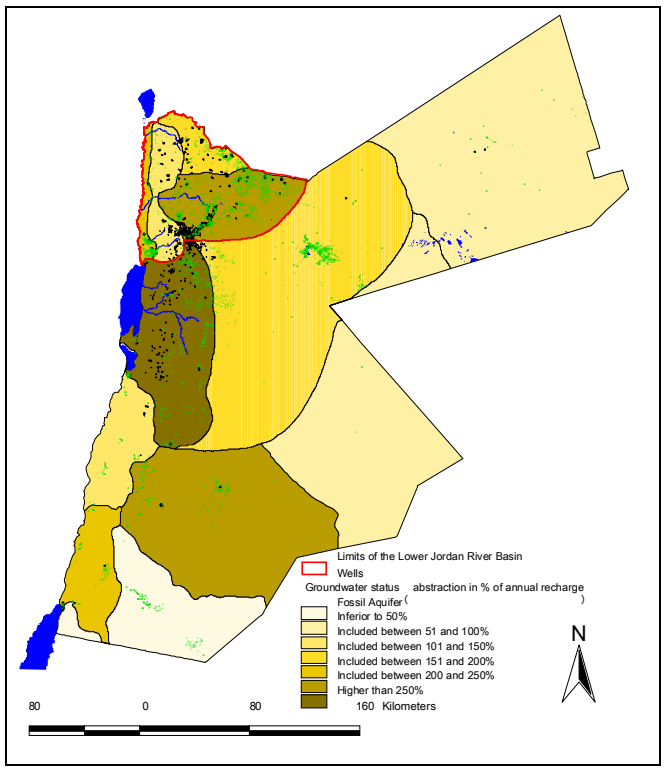
4.2.2 Status of Groundwater Resources

In Jordan, renewable groundwater resources are evaluated at 275 Mm^3/yr (Hussein, 2002; THKJ, 2004) while groundwater abstraction reached 501 Mm^3/yr in 2004 (THKJ, 2004). Seven out of the twelve Jordanian groundwater basins are overexploited. Figure 4-5 gives further indication on the status of groundwater exploitation in Jordan. The Dead Sea basin has the highest rate of over-abstraction (higher than 250% of the annual recharge). Despite low annual recharge due to low rainfall, eastern groundwater basins (Sarhan, Hammad and Azraq) have the lowest rate of exploitation: this is due to low human pressure in these desert areas.

The status of groundwater in the lower Krishna basin differs depending on the groundwater basin considered. The Amman-Zarqa and Jordan Valley basins are heavily overexploited; groundwater abstraction in the Yarmouk basin is close to the annual recharge and abstraction is lower than the annual recharge in the side wadis basin.

[32] The construction of the King Talal Dam in 1977 led to an increase of the controlled flow of the river Zarqa in the early 1980s.

Figure 4-5: Groundwater overexploitation and well's location in Jordan (after MWI-database)



The distribution pattern of wells identifies five main regions of groundwater exploitation in Jordan: (i) the north western uplands nearby large consumption centres and cities (Amman, Zarqa, Irbid, Madaba): abstraction takes place in the Amman-Zarqa and Dead Sea basins; (ii) the south of the Jordan Valley, (iii) the Azraq oasis, (iv) the neighbouring of Maan in Jafr desert in the south of Jordan and finally (v) the Disi fossil aquifer where large cereals and fruit trees farms can be found.

Due to its high quality, groundwater is used for domestic and industrial purposes.

According to the official figures of the MWI, total groundwater abstraction in the lower Jordan River basin reached 248 Mm^3 in 2004 (to which 30 Mm^3/yr of groundwater imports from other basins must be added) e.g. 157% of the annual recharge evaluated at 158 Mm^3/yr (THKJ, 2004).[33] Groundwater use in the LJRB amounted for nearly half the total groundwater abstraction (55, 49 and 23% of agricultural, domestic and industrial abstraction respectively) in Jordan. Nearly half of it (122 Mm^3/yr) was used for irrigated agriculture and the remaining for domestic purposes (119 Mm^3/yr). Industrial groundwater abstraction remained minimal (8 Mm^3/yr). The result is a quick drop of the water table as well as an increase in salt concentration in some of these aquifers. Observations have shown that this increase can be due both to the intrusion of brackish or salty water coming from more saline neighboring aquifers and to salts mobilized by return flows from irrigated areas (JICA, 2004). Chapter 4.4 reviews problems of declining water quality notably in old irrigated areas near urban centres due to overexploitation of the aquifer (ARD and USAID, 2001a and 2001b). Chapter 5.3 gives further information on the nature and extent of groundwater over-exploitation in the Lower Jordan River basin.

4.2.3 Reorientation of Water Management Policies

Between 1975 and 1995, the exploitation of the water resources increased sharply but little change was apparent in the way water resources were managed. In the Jordan Valley, irrigated agriculture was greatly expanded through the construction of several hydraulic facilities (doubling of the length of the KAC, construction of secondary canals for this new section, implementation of a pressurized water

[33] This evaluation underestimates the critical situation of aquifers in the Lower Jordan River Basin and over-abstraction rate is likely to be higher: the annual recharge is exceeded even when accounting for percolation and return flows (chapter 5.3)

distribution network, storage dams on the Zarqa River and other side-wadis). All these investments, mainly financed by international aid during three decades, have been estimated at US$1,500 million (Suleiman, 2003; Nachbaur, 2004). Irrigated agriculture in the Jordan Valley enjoyed a boom in production and economic profitability until the 1980s but is now facing increasing competition (Elmusa, 1994; chapter 3, 4.11 and 5.11). At the same time, in the highlands, private wells have provided "unlimited access" to good-quality groundwater resources. Big and dynamic entrepreneurs have made massive investments allowing the development of an irrigated agriculture, which supplies Jordan and the Gulf countries with fruits and vegetables during summer (chapter 4.1 and 5.11).[34] Until the mid-1990s, water was considered as a "sleeping resource" to be found and mobilized by ever-effective and efficient new techniques. The fuzziness around the sharing of water resources between the riparian countries of the Jordan basin fueled the impression that new resources could become available in the future. However, with more comprehensive hydrological knowledge and the 1994 Peace Treaty that fixed the repartition of water resources between Israel and Jordan, these countries and the donors realized that the situation was more critical than formerly envisioned. The Government of Jordan, supported by international partners strongly involved in the water-sector's investments, has tried to critically reorient its water policy towards more sustainable management of the resource. The main lines of this new policy are summarized here and further developed in chapter 6:

Institutions and Policies

- Official publication of the government priorities and objectives in the Jordan's Water Strategy Policies of 1997 and 1998, where priority is given to potable water, then to industrial use and finally to irrigation water.
- The concentration of the responsibilities for the public management of the entire sector within the MWI (Ministry of Water and Irrigation).

Supply Augmentation

- The planning of a set of new projects aiming at mobilizing the last available resources: dams, transfers, reuse, and desalination.

Actions Aiming at Reducing Agricultural Water Consumption

- Freezing of well-drilling authorizations in 1992.
- Initiation of a control of water pumped from aquifers (installation of water meters in 1994 and groundwater-control by law in 2002, establishing a taxation on the volume pumped [chapter 5.3]).
- Modernization of the irrigation systems in the Jordan Valley (shift from a distribution system by open channel to an underground pressurized network, completed in 1996 [chapter 5.2]).
- Replacement of freshwater used in irrigation with blended treated wastewater coming from the KTR in order to irrigate the middle and the south of the Jordan Valley (chapter 5.2).

[34] The small and middle-size Palestinian-Jordanian entrepreneurs constituted the main driving force of the rapid development of fruit and vegetables production in the Jordan Valley (chapter 3). In the highlands, the development of irrigation was also due to some Palestinian-Jordanian entrepreneurs but investments have been higher (as well as the economic return; see Venot, 2004c and chapter 5.1). To explain this process, it is useful to remember the mainly rural origin of the displaced populations, the Palestinian agricultural knowledge, the technology transfers from Israel, the willingness of the displaced populations to develop their activity of production, the existence of important marketing-networks linked to Palestinian communities settled in the Gulf countries and, finally, the capital investment in the agriculture sector by these communities (chapter 3).

- Since 1998, a reduction of the annual water quotas allocated to farmers in the Jordan Valley has been introduced, according to the quantity of the resources available in the country each year.
- Compensation by the government to farmers for letting their land fallow in order to reduce the demand for and the consumption of irrigation water in the Jordan Valley during dry years (1,000 ha for a value of US$ 0.4 million in 2001).
- Development of applied research and technical assistance to farmers (American, German and French cooperation, among others).

Actions Aiming at a Better Management of Urban Water Supply (chapter 5.4)

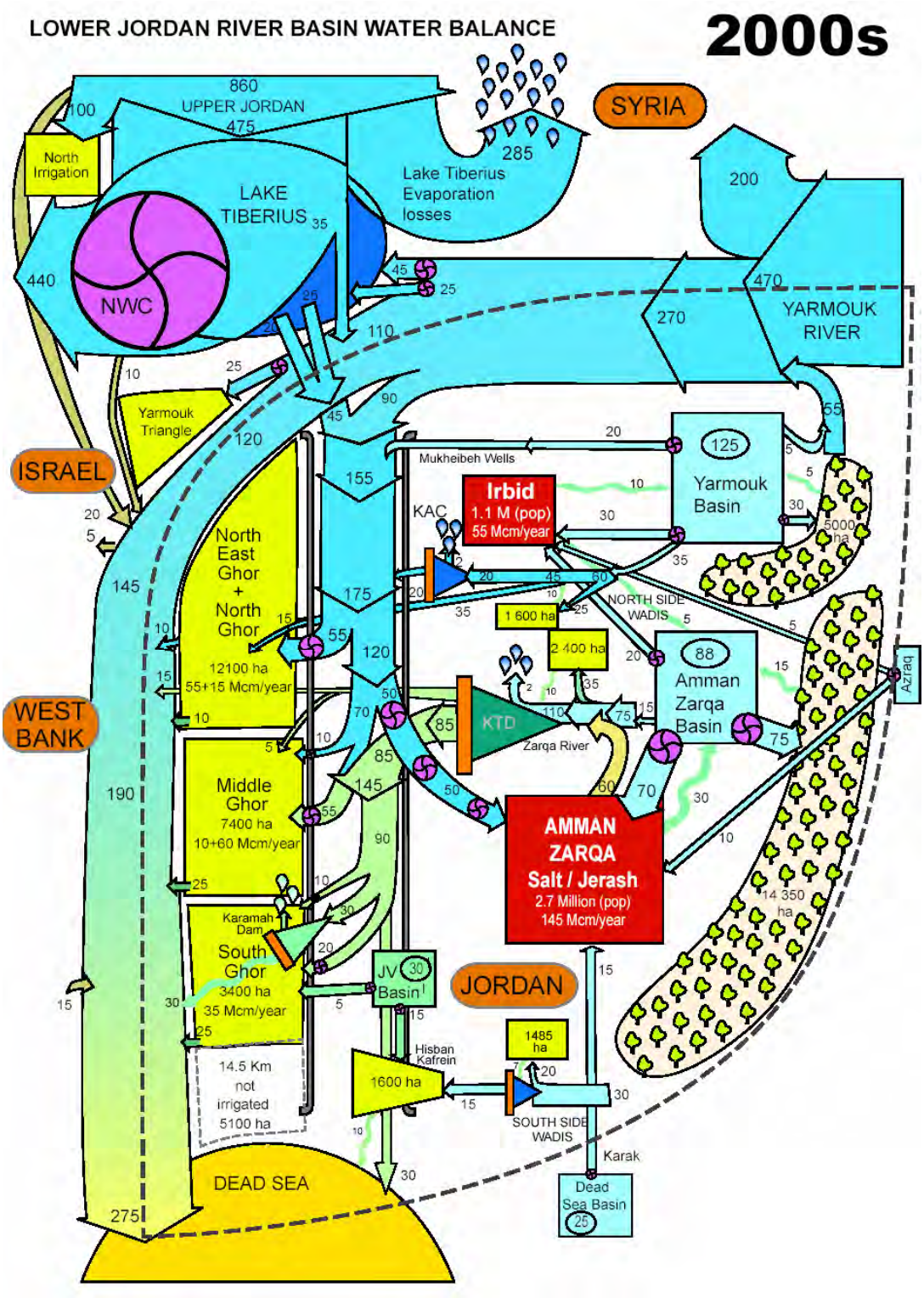
- Rehabilitation of the network of Greater-Amman (investment of US$250 million in the 2003–2006 period) in order to reduce the large leakages which amounted to 30 percent of the water delivered.
- Transfer of the management of urban water supply for Amman city to a private company in an attempt to improve distribution and control over the network, and to increase bill recovery (reduction of unaccounted-for water). The reliability of the distribution has considerably increased as well as the percentage of bill recovery, but losses are still very high because of the dilapidated state of the network.

Political interest groups slow down the implementation of such measures (chapter 5.2 and 5.13) and only a global awareness of the problems faced by the Jordanian water sector could mitigate these difficulties. If demand management is the motto of the last policies; prevailing mid- and long-term solutions are eventually typical capital- and technology-intensive supply augmentation projects, namely large-scale transfers and desalinization (Figure 4-6). This might be seen as the lasting dominance of the engineering based approach to water resources development but may also show that a ceiling has been reached (total water withdrawn in the LJRB amounts to 585 Mm^3/yr e.g. 83% of the renewable surface and groundwater resources of the basin [chapter 5.6] and 98% of the renewable water resources of Jordan are already used [Ferragina, 2000]) and that demand management options may only alleviate the actual situation without providing long term solutions.

4.2.4 Water Development and Water Use in the early 2000s

The main modifications that occurred between the middle of the 1970s and the 2000s are shown in Figure 4-6 and include the following (a precise water accounting is presented in chapter 5.6):

Figure 4-6.Water resources and uses in the LJRB in the 2000s. (Source. Courcier et al., 2005)



Note: See legend in chapter 2

Jordan-Israeli Peace Treaty

In 1994, Jordan and Israel signed a peace treaty, defining the sharing of common water resources. The prevailing utilization of the Yarmouk water by Israel (local use and diversion by pumping to Lake

Tiberius in winter) was recognized and remains unchanged (70 Mm^3/yr) (El-Nasser, 1998; Hof, 1998). Moreover, Israel pumps 25 Mm^3/yr in winter from the Yarmouk and gives back the same amount to the KAC during the year, which allows a certain degree of regulation of the canal inflow.[35] Moreover, according to the treaty, Israel, after desalinating the 20 Mm^3/yr coming from saline springs and presently diverted to the Lower Jordan River, should transfer 10 additional Mm^3/yr to Jordan. Another 50 Mm^3/yr of freshwater should also come from common projects to be defined. These two points have not been implemented yet and in compensation, Israel has been transferring 20 Mm^3/yr (added to the 25 Mm^3/yr returned in summer) of freshwater from Lake Tiberius to Jordan since 1998 (Peace Treaty between Jordan and Israel 1994; Beaumont 1997).

Extension of Irrigation in the South of the Jordan Valley

- In the south of the Jordan Valley, the KAC has been extended by 18 km between 1975 and 1978 and by 14.5 km in 1988. Only an additional area of 3,400 hectares has been newly irrigated, thanks in particular to the use of blended freshwater/wastewater (85 Mm^3/yr of such water was used in the southern Jordan Valley in the early 2000s [JVA-records], i.e., one-third of all water used in the south of the valley, this amount is increasing each year). Due to lack of water, an area of 5,100 hectares, already equipped with an irrigation network, is still not put to use (chapter 5.2)

- Optimization of the efficiency and of the control of the distribution of water to irrigated farms, through the construction of an underground pressurized pipe network (chapter 5.2)

- Building of dams on the Zarqa River and other side-wadis in order to control the surface water and irrigate new schemes. [36] Surface water diversion averaged 310 Mm^3/yr in the early 2000s and little water still reaches the Jordan River in winter. The total capacity of the reservoirs is evaluated at 165 Mm^3 (THKJ, 2004).

Agricultural Groundwater Development

While groundwater use was already significant in the mid-1970s (chapter 5.3 and 5.16), most deep wells (85%) were dug between 1975 and 1992 (BGR-WAJ, 1994 and chapter 5.3). Agricultural groundwater use in the basin would thus reach 109 Mm^3/yr in the early 2000s (records of the MWI-Water Resources Department for the year 2003) to irrigate around 15,000 hectares (refer to chapter 5.3 for more information on this aspect)

In the desert plateaus of the Amman-Zarqa basin, some well owners grow orchards of olive trees, which represent nearly half of the irrigated area in the highlands (6,760 hectares on a total irrigated area of 14,460 hectares [Venot et *al.*, 2007]). These orchards seem to reflect the pursuit of social prestige rather than mere economic profitability (chapter 5.1). These plantations are actually hardly profitable (Venot 2004c; Venot et *al.*, 2007c); nevertheless, they contribute greatly to depletion of the aquifer (by about 26 Mm^3/yr, i.e., 20 and 10% of the agricultural and total groundwater abstraction of

[35] This part of the treaty raised some problems since the water pumped by Israel from the Yarmouk in winter is of very high quality, while the water returned from Lake Tiberius to the KAC in summer is, on the contrary, of poor quality.

[36] The construction of the Karamah dam in the south of the Jordan Valley in the mid-1990s (completed in 1997) has proved to be a failure (US$ 77 millions [Nachbaur 2004]). The reservoir was meant to store excess runoff in the rainy season for further reuse in the valley. Eventually, it is a "sink" (chapter 5.6): the water reaching it is too saline to be used in agriculture, because of both salty groundwater infiltration and neighbouring highly saline soils. The water is thus not kept in the reservoir but released to the Jordan River. A prosecution against "X" is now engaged to try to find the responsible for this failure.

the Lower Jordan River basin, respectively [chapter 5.3]) and to its salinization. The present low-cost-domestic use which, alone, amounts to the usable recharge rate of the aquifer is thus jeopardized (ARD and USAID, 2001b; Chebaane et *al.*, 2004). This water use developed by some entrepreneurs, who do not depend on their agricultural activity, lends itself to criticism in the present situation of extreme scarcity, just like the artificially maintained and very profitable banana production that uses large amounts of good-quality water in the Jordan Valley (chapter 5.1). At the same time, the first abandoned areas irrigated with groundwater from desert aquifers (e.g., in Wadi Dulheil and Azraq) clearly illustrate the problems resulting from an overexploitation of these water resources.

Increasing Domestic Water Use and Use of Treated wastewater for Agriculture

Urban population within the basin has been multiplied roughly by 2.5 in 25 years (1975–2000 [DoS, 1978 and 2003]). Urban groundwater use (domestic and industrial water) has, in parallel, grown fivefold and reached 150 Mm^3/yr in the early 2000s (records of the MWI-Water Resources Department). High demographic growth and the improvement in the living standards of the entire population led, and will continue to lead, to a strong increase in the demand for municipal water, which is now reaching 94 lpc/day (average for the country) (THKJ 2004).[37] Ensuring the supply of potable water to growing cities made it necessary to both multiply the number of wells in the surroundings of the cities (between 1975 and 2000, the number of wells used for domestic purposes in the city of Amman increased from 6 to 12 [see Darmane 2004; chapter 5.4]) and mobilize new resources to be transferred to the cities. Therefore, in the early 2000s, in addition to the 22 Mm^3 pumped every year in the municipality, Amman received 32 Mm^3/yr from other wells, partly tapping aquifers outside the LJRB (Darmane, 2004). Figure 4-6 evaluates at 20 Mm^3/yr the transfers from the Dead Sea and Azraq basins.

These water transfers have participated in the drying of the Azraq oasis (Figure 4-14). Added to this water coming from the highlands, Amman also resorts on an energy-consuming transfer elevating water on 1,200 meters from the KAC, in the Jordan Valley, to the city. This transfer, initiated at the end of the 1980s, was developed after the massive immigration of Jordanian-Palestinians who were working in the Gulf countries and were forced to leave after the first Gulf war of 1991 (chapter 5.4).[38] This transfer (reaching 50 Mm^3/yr. in the early 2000s, JVA Water Resources Department records 2004) makes up one-third of the water supplied to Amman and represents one-third of the water diverted to the KAC. As irrigation in the south of the Jordan Valley was already developed (around 3,000 ha), this transfer was made possible only because of the concomitant gradual development of the treatment of wastewater from Amman (McCornick et al. 2002). Effluents are collected in the King Talal Reservoir (KTR, capacity of 80 Mm^3 [THKJ 2004] and built in 1977) and mixed with freshwater coming from the Zarqa River itself. This blended water has actually replaced the freshwater in part of the middle of the Jordan Valley and the entire south of the valley (see records of JVA-Water Resources Department and chapter 5.2). This transfer is facilitated by a favorable topographical situation, allowing a low-cost transfer of treated wastewater from the cities to irrigated areas. About 60 Mm^3 of waste water are treated every year and conveyed to the Jordan Valley in the early 2000s.

[37] Darmane (2004) presents a figure included between 115 and 150 lpc/day for the capital Amman (chapter 5.4). Projections presented in THKJ (2004) consider a future municipal water consumption of 150 lpc/day. Municipal and industrial water uses reached 249 and 37 Mm^3/yr in 2002 e.g. 31 and 5% of the national water uses.

[38] This transfer of population was due to the particular position of King Hussein of Jordan and the Palestine Liberalisation Organisation (PLO) leader Yasser Arafat, both of whom had expressed their support to Saddam Hussein and to the invasion of Kuwait.

In the early 2000s, the first desalinization plants for supplying drinking purposes have been implemented in Jordan (Scott et al. 2003). The costs (investment, operation and maintenance) of urban water supply have strongly increased during the last 25 years (Abu-Shams 2003; Darmane 2004).

Declining Discharge to the Dead Sea

Only the Yarmouk River and some side-wadis, mainly in the north of the basin, still feed, in winter, the Lower Jordan River. In addition, this latter only receives polluted and salty water (water from saline springs diverted by Israel, drainage waters from the irrigated perimeters and wastewater from Israeli colonies, Palestinian and Jordanian villages or cities). The inflow to the Dead Sea (315 Mm^3/yr) amounted to only 20% of the historical flow of the Jordan River in the early 2000s.

4.3 Socio-Cultural Context of Water Management

4.3.1 Water as Social Interface

"We made of water every living thing" (Surah Al-Anbiyah, Ayah n.30)

Jordan is not a "data-poor" country: an overwhelming literature has focused on water and on agricultural issues since the beginning of the last century. This production of knowledge reveals to be yet more important today in light of the constraints on resources, of the changes in water policies, and of the promotion of water scarcity as one of the political challenges faced in the country. At the same time, this production of knowledge has been characterized by a technical and often technocratic approach whereby the "farmers" have often appeared as mere beneficiaries or passive recipients of external projects, but seldom as active actors with their own experience and knowledge systems in water management.

In the 1950s, the planning of water distribution in the LJRB, and especially in the Jordan Valley, has followed a top-down and centralized approach. Participation of local communities was not deemed important nor necessary due to the urgency of planning. Centralized management has allowed both the large settlement of new regions (chapter 3) and an intensification of agricultural production (chapter 4.1) but it engendered mistrust between farmers and the institutions responsible for water management.

Water management is a social interaction, where different social actors, cultural traditions, agricultural knowledge systems encounter, as it is evident in the confidence gap between farmers and the water bureaucracy, or in the conflicts for water between farmers themselves (chapter 5.2.2). Irrigation cannot be understood as a mere transfer of technology. First of all, it conveys a political and social project, with new concepts of "water", a new organization of the collective management of resources, new hierarchies and roles. Following Long and Villareal (1994), the technical design of an irrigation system contains a number of social and organisational, management assumptions. These assumptions have often been given for granted, but they are indeed historical dynamics characterized by the encounter between heterogeneous ideas of communities and of cultural values linked to water.

Today, we face in the Jordan Valley, and more generally in Jordan, a complex system of water distribution, where the development of irrigation itself has become an arena of struggle among different interest groups (Olivier De Sardan, 1988). We need to understand which social changes have been engendered by the new water distribution in the last decades and how the present situation is locally perceived by farmers. This issue is directly related to the meanings of "community" in the

valley today and to the question of what type of "collective management" could be set up in order to overcome the existing conflicts and lack of institutional confidence.

In contrast to an old prejudice that portrays local inhabitants in the LJRB as lacking agricultural knowledge, water management tradition and patterns of cooperation, we will show how local cooperative patterns have faced radical shifts and adapted to new environments. Indeed, both refugees who found a home in Jordan as much as farmers of Transjordanian origin have often seen their local institutions disrupted by development interventions.

As we saw earlier (chapter 3), water projects have served in the past a multipurpose role: if the main target has been agricultural intensification, they have also allowed the introduction of the bureaucracy in rural areas, they have fostered a border on a frontier area, they have shaped a new relationship between the state and citizens, between tribes and the state, between farmers and engineers. In fact, "hydraulic projects reveal the struggle where the meaning of state is at stake" (Hannoyer, 1985:35, translation of the authors). In other words, the Jordanian state has been built also through water planning, through the land reform, through the new water distribution, all aspects that are crucial in practice as much as in symbolical terms. Even if the Jordan Valley is a relatively small region, it has been amplified in the past into a 'large-scale project' because of its strategic, military and symbolic importance, because of critical regional water disputes and of past and present confrontation between conflicting parties, like Israel, Syria, Lebanon and the Palestinians.

In order to shed light on this complex situation, we will deal with irrigation through an interface analysis (Long, 1989, 1992) where different lifeworlds intersect around water. Multiple social actors have intervened in irrigation, from ministries to engineers and experts, from Stage Offices down to the Farm Turnout Assembly at the farmers' units of land, from public employees to private farm investors. Different perspectives and practices of water are at stake, also in the form of local manipulations and systems of mediation in the access to this scarce resource. If here we will deal with general issues of the LJRB, a. more detailed analysis of the different but interrelated contexts of the Jordan Valley (chapter 5.2.2) and the Highlands will be presented later (chapter 5.3.2).

Water remains one of the major critical points of the encounter and struggle between planners, administrators and local farmers: far from bureaucratic control, farmers daily invent illegal ways to get access to this scarce resource and to adapt its timing to personal needs. These manipulations cause permanent problems for the water distribution apparatus. Besides, the local ways of using water acquire sense in the wider non-agricultural context and in relation to ideas of belonging other than that of 'farmer'.

Water conveys multifaceted dimensions in its every day use and the scarcity of water contains surely ecological attributes determining water availability and temporal and cyclical dimensions of water scarcity. Notwithstanding the importance of these two aspects, we will focus also on the "anthropogenic dimension" (Mehta, 2000) of water scarcity that is linked to the cultural, social and political relations set up in connection to water. Scarcity is a dynamic that often is relegated to a naturalised dimension but we analyse the manufactured dimension of water scarcity in the Jordanian context. Water refers inevitably to power relations, to distribution policies and redistributive mechanisms, to over-consumption by powerful actors and difficulties in access by marginal groups.

As Lancaster has argued (1999), local management of resources in Jordan has always been linked to the knowledge of quantity, quality and scarcity of water in seasonal periods through the year and flexible strategies have always been put in place to re-act in case of severe water shortage or in case of

any change in this fragile context. In contrast to other cases (see Mehta, 2001), there is today, in the LJRB, a high awareness among farmers that scarcity is not just a natural fact, but a political one: in other words, farmers are aware of the anthropogenic dimension of water scarcity, although they will not often recognize their own impact. Water is not perceived just as natural event, but it is politicised in local perceptions, linked, for example, to the urban bias of water policies, to the Israeli conflict, to the hierarchical structure between farmers and in the Jordanian society.

4.3.2 The Social Construction of the Farmer in Jordan: from Fellahin to Muzare (the 'farmer')'

In Jordan, farmers in irrigated agriculture are a main issues at stake today since they use most of the renewable sources of national water (chapter 4.2. and 5.11). But the category of "farmer" refers inevitably to a symbolic struggle, in which 'global' labels supported by international and national agencies have the power to define 'others', while various local actors perceive themselves and act through other terms of belonging.

The concept of the 'farmer', as the client label that has legitimised planned intervention[39] over the last 50 years, has become a major analytical site where different, even contrasting, collective representations of the community are negotiated. In the Jordan Valley, the farmer label has led to neutralizing a tense political context of refugees presence on a border, but in the Highlands it has allowed to put forward the settlement policies, although the agricultural investments has been mainly private (chapter 5.3). The category of farmer is not a neutral term in Jordan but it has introduced new ideas of farming, it has substituted the category of *fellahin*, and its meanings are intimately related to the present agribusiness.

The *fellah* (peasant) identity is traditionally perceived as opposed to the Bedouin way of life and customs: a settled and agricultural culture, still present in daily life and belonging dynamics, in contrast to transhumant and pastoral society; a dichotomy which follows an ancient and conventional delimitation between nomads and settled population that goes back to the Arab historian Ibn Khaldun (XIV century). This dichotomous representation is at the root of the contemporary development belief, which claims that agricultural settlement would have inevitably engendered a detribalisation of the Bedouin groups; a concern that was dismissed, in many other regions of the Middle East as well as in Jordan, since the ties of tribal solidarity have often reproduced in the settled context (chapter 3 and 5.12).

Out of an idea of a homogenous "farmer community", the LJRB rural population is characterized by social heterogeneity and by multiple and diversified economy (chapter 5.1). Indeed, the "farmer" has been a social construction that has started in the Jordan Valley: it has unified in one common category communities who perceive themselves as different. It strongly differs from the local term for "peasant" (fellah), since this last term refers to a specific village tradition, to a moral community, and more in general in the case of the refugees, to villages of origin in Israel or in the West Bank. Besides, the term of fellah refers to a specific rural knowledge and savoir-faire that differs from the agronomic paradigm imported in the last half-century.

[39]I use here the notion of 'planned intervention' (Long, 1989) since it embraces both development agencies and humanitarian aid, and focuses on the pattern of transformation that different actors and diverse policies introduced.

Therefore, fellah identity is recognised as a social marker linked to the '*adat* (customs and traditions): '*hua mn' baladna'* ('he is from our village'), an exclamation often heard, refers to a lost village in Palestine but at the same time to a very present and effective solidarity term linked to fellah belonging in Jordan. Fellah identity is perceived also as an icon of authenticity and becomes therefore crucial in social memory in opposing the Israeli master discourse of 'a land without people for a people without land' that legitimised the non-recognition of indigenous population in Palestine. The peasant identity is both a claim of a past community as much as a term that has acquired strong political meanings (chapter 5.2.2.).

On the other hand, "farmer" is a category, which can be understood only within the new agribusiness developed in the valley and later in the highlands of the LJRB: it is detached from the land or from a specific territory, but refers more to an occupational category within the new economic segmentation. Being farmer is linked to the process of decision-making, management and supervision on the farm. It is often connected to the greenhouses as productive, but also symbolic, place of decision and management. In fact, what makes up a farmer's identity and role from local perceptions is the availability of capital rather than land, the management rather than the execution of farming work, which confers the authority and power of decision-making. It is here interesting to quote a dialogue reported in Shryock's book devoted to Bedouin identity and history in Jordan in Wadi Zarqa of the Jordan Valley:

Shryock: 'Nowadays everyone is a peasant. In an economic sense. What do you think?'

Muhammed: 'Peasant by occupation, Bedouin by blood. It's close to that. It's close. But don't use the word peasant- fellahin- around the 'Adwan. It's like a curse. Say 'farmer' (muzar'e). It's nobler.'

Further, as an old peasant told me in the valley: *"Everybody cultivates now: the King, the Members of Parliament, the engineers, everybody is muzar'e now, before we were just fellah!"*

The term fellahin is perceived as deprecatory from a Bedu perspective, while the new concept of farmer is accepted, but not as identity marker but only as occupation definition. While 'fellah' is traditionally opposed to pastoralism, nomadism and beduinity, Bedu identity is expressed in terms of customs that emphasise hospitality and generosity: the *mensaf* (a traditional dish), the coffee, the main tokens of hospitality offered to the guest in the *bayt-shahr* (the goat-wool tent)[40].

In contrast to fellah, Bedu identity is idealised in Jordan into an ancient way of life linked to pastoralism, although it has lost its material basis with the shift from a pastoral economy to an intensive agriculture system. Nevertheless, it has reproduced as a main value and term of belonging. Moreover, Jordan is presented as a Bedu country, where a stereotypical lifestyle has become an icon for the nation.

In fact, the category of muzar'e is attached to the 'nobler' modernisation process and refers to a technical role detached from the peasant culture. It has become also a key notion in defining a farming position without alluding to collective identity markers that have become so problematic in Jordan. Indeed, muzar'e refers to a status position in the new agricultural management in a vertical structure rather than a collective belonging. The category of farmer is thus intimately linked with the

[40] In this frame, we should not forget that Palestinian refugees were both fellah and Bedu, as well as from urban origin.

introduction of bureaucratic apparatus and centralized management of water in the Jordan Valley. It is not defined by a sense of rootedness to land but more by the capital of investment or expert knowledge

The external representation of the population in the Jordan Valley as a homogenous group of "Jordanian farmers" has definitely depoliticized a tense region and it has been part of a wider process of the construction of the nation. The label of farmer is indeed a stereotyped definition, as many development labels inevitably are, which was linked to the model of social integration that the JVA and Jordan have put forward. But this label, as a neutral and technical category, has often silenced other idioms of identity, which are not just social expression, but are also social networks, linkages of solidarity and cooperation that directly affects management of resources and water. Further, thinking in terms of "farmer community" has hidden the structural presence of large migrant groups of wage labours as much has the feminization of agriculture (see below). The development of farmer has imposed an external category connected to pre-defined needs without any local participation in determining local priorities where "stereotyped identities are transformed into bureaucratically assumed needs" (Zetter, 1991).

A widespread and unproblematic consensus and legitimacy among donors and planning actors has arisen around categorising the local population as 'farmers': 'local farmers', 'Jordanian farmers', 'farmer-operators', are all exogenous categories that stress the homogeneity and neutrality of local community in a progressive definition. Indeed, 'farmer' is a matter of becoming, since it is presented as a process of accommodating local inhabitants to an external model. This categorisation of 'farmer' is even more significant in the context of the "fragmentation of peasantry" (Harris, 1980), and consequent de-peasantisation led by the displacement and dispossession of Palestinians that has disrupted both an agricultural tradition and the cycle of farming knowledge.

The new notion of farmer is linked to the idea of development, '*tatawor'*, which is locally perceived as linked to chemical supplies, hormones, drippers or greenhouses as major markers of modernisation. Tatawor is perceived as a question of degree and intensity, through which people and places are interpreted on a scale of evolution. Besides, tatawor is generally linked with education: acquiring new knowledge that confers authority, roles in bureaucracies, and power in decision making. Furthermore, tatawor is conceived of as something which comes from outside and engenders changes inside: a deterministic metaphor where the input of change can only be exogenous. While the technical language and symbols have been assimilated locally, it is widely believed that, although there has been a lot of tatawor, "nothing has changed in the Jordan Valley", since often privileges have merely increased and benefits have been unequally distributed.

Secondly, the introduction of the role of "farmer" is linked to the introduction of the agricultural engineers, as new authority roles, with new power and new knowledge. The antagonism which is often present between farmers and engineers is due to the asymmetrical relationship that development bureaucracies or private companies have put in place, reinforced by a top-down development. Often embedded in an evolutionary model, engineers have viewed local population as implicitly primitive, backward, ignorant, or unable to cope with rural modernization. This has impeded them to acknowledge often the present reality of local knowledge and to understand the major social changes led by the many technical and political innovations. Therefore, even discussing about water management is perceived as a political question, since it raises the issue of this antagonism but also relation of dependence. We should recall here that Jordan has one of the highest levels of education in the Middle East, engineers have been pivotal in the national construction and even in the political life of the country.

4.3.3 Agricultural Labour Market

Employment in agriculture has continuously decreased since the 1970s. Agriculture employed 25% of the working population in 1970; 6.8% in 1995; 5.5% in 2000 and 3.6 % in 2005 (Salman, 2001b and DoS, 2005). In 1998, two thirds of agricultural workers were wage earning workers (Salman, 2001b). The characteristics of hired labour in agriculture are summarized below (figures are drawn from Salman, 2001b; DoS, 2003 and 2005):

- Two thirds of agricultural hired workers are non-Jordanian. They are mostly Egyptian, Syrian and Pakistani (chapter 3 and below). This official figure is certainly an underestimation since informal networks, black market, and precarious work are unaccounted for. Non-Jordanian female workers is less frequent, but present with Syrian and Pakistani women, although often unaccounted.

- Officially, men constitute 87% of hired agricultural labour force. By non considering informal pattern of work, official figures certainly underestimate women participation in agricultural work (Chapter 3 and below)

- Permanent and casual labours are the two main forms of hired labour in agriculture. They respectively represent 50 and 46 % of total hired work. Seasonal labour remains very limited but is certainly under-estimated in these statistics.

- Men are principally permanently (on a monthly basis) and casually (on a daily basis) employed. Permanent employees and casual employees respectively represent 56 and 40% of total male agricultural labour force. Women are generally employed for casual labour (87% of female labour force), on a daily basis, for certain tasks: weeding, harvesting, etc.

- Non-Jordanians represent 82% of permanent hired workers in agriculture. Permanent work is mainly done under greenhouses where Jordanian generally do not work (chapter 3 and below)

- Official figures show that there are no agricultural workers below the age of 16. This does not reflect reality since young unmarried women working in the fields are common.

- Agricultural households are larger than the Jordanian average and their average income (US$ 7,420 per year) is similar to incomes of non-agricultural households (DoS, 2003). However, the agriculture sector is characterised by a high proportion of workers earning low wages: 29% of agricultural workers earn less than US$140 per month compared to 9.4% if the total hired working force is considered. Moreover, only 25.2% of agricultural workers earn more than US$ 280 per month against 42.5% for the entire labour force (DoS, 2006).

4.3.3.1 Immigrants and Agriculture

Since 1970, Egyptian migrants, side by side minor groups of Syrian and Bangladeshi men and Pakistani families (see chapter 5.2.2), have fitted perfectly, in terms of cheap labour, into this growing agricultural system characterised by high labour costs (chapter 4.1 and 5.11). From that moment, the LJRB has become both an importer of labour engaged in agriculture and in construction, as much as an exporter of labour due to mobility of the local inhabitants (of both Palestinian and Jordanian origin) out of the Jordan Valley and out of farm activities following the rise in oil prices in 1973 and 1979.

Since the 1960s, Jordan has applied a dichotomised policy towards immigrants, distinguishing and favouring Arabs to non-Arabs nationals. Egyptians found in Jordan an open-door policy for Arabs and

the number of Egyptians in the Jordan Valley and later in the Highlands highly increased. Egyptian labourers constitute today most of the male labourers in agriculture in the Basin. The rotational migration from Egypt became instrumental in the agribusiness "success": the uncertain status, docility, and exploitation of Egyptian have been in fact crucial in decreasing the cost of wage labour, which requested quantity has enormously augmented in intensive fruit and vegetable agriculture that developed in the LJRB.

Linked to that, immigration has been linked in Jordan to a sectorialization of the economy: agriculture has remained one of the most vulnerable sectors in terms of work relations, side by side domestic and construction sectors, and where migrant employment (legal or illegal) has been implicitly encouraged since the 1970s: 37% of foreign workers in Jordan, mostly Egyptians, were working in agriculture (Humphey, 1993). Interestingly, these three sectors are all labour-intensive, they were all excluded from labour regulation, while foreigners were not allowed to become member of trade unions.

Foreign workers were banned in Jordan from specific professions in 1995.[41] In 1996, Egyptians were obliged to get a work permit for Jordan from the embassy in Cairo, a measure that opened the way to the *kafil* system. This pattern of labour absorption identifies the role of the guarantee (*kafil*) with the one of the employer in Jordan: this inevitably changed the trajectories of migrants and the previously easy circulation between Egypt and Jordan. Intensive agriculture has increased the yield-productivity and gains in the last decades, but it has enormously augmented the costs of farming: greenhouses are labour-intensive, above all in the harvest period. Flexible labour has become thus a fundamental part of farming, and cheap manpower has represented the only way to contain the high farm expenses.

Further, Egyptians have well adapted, in social and ecological terms, to this new environment. They live on the farm itself, which means that they also protect the costly on-farm investments from theft. In addition, as temporary migrants, they are 'free' of family ties, which allows flexible hours, long turns of work, possibly at night, according to irrigation schedules or market strategies. Therefore, they are preferred to local labourers who are generally more costly, less flexible and adaptable to long or hard working conditions in the heat. Besides, Jordanians labourers are not always available, they often ask for leave for marriages, visits, or for other ritual events that are crucial to community building in Jordan.

Besides, Egyptians who live on farm have become, as farmers say, very clever (*shattir*) in circumventing regulations and stealing water. In some cases, irrigation, as symbol of the control and supervision of farm management, has remained in the hands of farmer who avoid delegating it to labourers, but in many other contexts, who manages water at the field level are migrants, who may often lack the adapted knowledge linked to micro-irrigation.

This migration process has had direct impact on farm and water management. First, labour availability and costs are major concerns for farmers and have an impact on their agricultural strategies. Labour, indeed, represents a much higher expense than water and constitutes, with the market, one of the main local problems. As a farmer in Wadi Rayan in the Jordan Valley, stated:

> "This year (i.e.2004) the Ministry of Labour forbids new visas for Egyptians for the new season, so we do not find enough labourers. Today for example, I had 31 labourers, of whom 16 were Jordanians; they take 3 JD for 6 hours, breakfast included. At mid day, they were too tired and so

[41] Doctors, engineer, administrative, retail, mechanics and education were some of the major professions that were banned to migrants.

they did not work well. So, now Egyptians who are here gain more than before since they are highly requested".

The control of family labour is crucial in farm management and in the broader economic strategy adopted at the household level; the main challenge in farm management is balancing the needs of each year against the changing pool of household labour.

Finally, new displacement has occurred in 2002 with the expulsion of Egyptian illegal workers which made their presence even more precarious and vulnerable). This, of course, strongly contrasts with the open-door policy activated in the past in the name of Arab unity: the Arab labourer welcomed and privileged in the 1970s, has become the "illegal worker" subject to expulsion after 2003, the obvious scapegoat of local economic problems and a main competitor for marginal Jordanian communities.

The decrease in availability of cheap Egyptians migrants due to restrictions and expulsions of illegal migrants of the last 4 years is leading to an increase of the already present process of feminisation of agriculture, mainly women and girls of low-income Jordanian families and an increase in wages for legal Egyptian migrants.

4.3.3.2 Feminization of Agriculture

Male Jordanian wage labour in agriculture has nearly disappeared in recent decades. Men seek employment outside the agriculture sector for better wages and better timings of work, although control and responsibility in agriculture have remained symbolically male affairs. Notwithstanding the high number of women working as labourers today, the responsibility on irrigation has remained in the hands of men since it symbolizes the control over the production process and the product (Shami, 1990), as much as over the marketing, and the control of labour and any relationship with water bureaucracy or administrations.

The participation of women in agriculture is underestimated in official statistics and nearly 58% of women female labourers are under 25 years old and 62.7% are unmarried (GTZ, 1997), data which show the status of these workers: married women will try to avoid going to work as labourers since it socially represents a low reputation and entails promiscuity with foreign men on the farms. Significantly, 46.7% of wage women labourers are from landless families (GTZ, 1997). The main farming activities of wage women labourers are: harvesting, planting, weeding and packing (GTZ, 1997). Further, women farmers are predominately small-scale or subsistence farmers, they compose less than 2% of land holders and generally lack control over resources (GTZ, 1997). Moreover, although women should legally inherit land, they often do not for a woman is reputed not responsible for her own living; therefore women give up often the inheritance rights to their brothers.

The Jordan Valley has the highest percentage of women labourers (43%) in any sector in Jordan, mainly absorbed in agriculture (GTZ, 1997). The "invisibility" of female labourers is yet dramatically striking since women compose 80% of Jordanian labour in agriculture in the Jordan Valley. This is all the more striking that, since its inception, the planning process in the Jordan Valley was intended to target an implicitly masculine "farmer operator".

If on one hand the profitability –and attractiveness- of agriculture have decreased in the past two decades, the new segmentation of work in agribusiness has also led to a decrease of the social value of some agricultural activities. In fact, agricultural tasks that only some decades ago were performed by men are now performed by women. An important distinction is that the "contribution of women to

vegetable production seems to be higher in the irrigated areas and in the Jordan Valley in almost all activities except marketing in contrast with rainfed areas and the Highlands" (GTZ, 1997: 64). Only in fruit production does women's contribution appear to be higher in the Highlands, as compared to Jordan Valley.

The recruitment of women labourers is informal, not registered and therefore it is often not statistically visible. It is based on networking by the oldest female labourers who manage to find the amount of women needed for the next days and for different employers. As is often stated, *"they are all looking for us today, then we'll sit (ga'din) for three months!"* This illustrates the flexible and intensive reality of seasonal labourers. Indeed, some girls, generally unmarried, may work up to 18 hours a day for some weeks, at an average price of 500-600 fils per hour (70 to 80 cent/hour), while from May to October it will be difficult to find a day of work.[42]

Within the new social and moral segmentation of work, the wage condition is avoided by young Jordanian men since this working status is perceived as dishonourable. Female labourers share often the labour activity with Egyptian men, a promiscuity that has engendered a negative perception of these agricultural environments as much of agricultural work itself. This notwithstanding the fact that women's earnings from farm labour are often crucial for the income of poor households affected by high male unemployment and it represents also a new burden on top of domestic workload.

Water and agriculture have to be related to this new regime of values of work in the farms: cultural ideas of "reputable" work and of social segmentation have changed and the main consequence has been to redefine gender roles in the workplace. Working in a greenhouse is perceived today as shameful (*haram*) for Jordanian men, while it is acceptable for women of reputed low status. In practice, while even young men of low-income families will not work on farms because they do not perceive it as "work", their sisters will and they will contribute financially to the household income. Furthermore, the social stigma attached to labour condition is linked to the meanings associated with female work vis-à-vis male work and to the household's reputation: what is at stake here is the role of honour protection in the gender mixed context of the farms. The fact of working on farms is a public statement of the low status of the household itself, since higher status families will not allow their women to endanger their honour and visibility Therefore, women may often assert that their are not "working", in the sense that they do not have a fix employment (*shughl*) but also in order to hide their low-status labour condition.

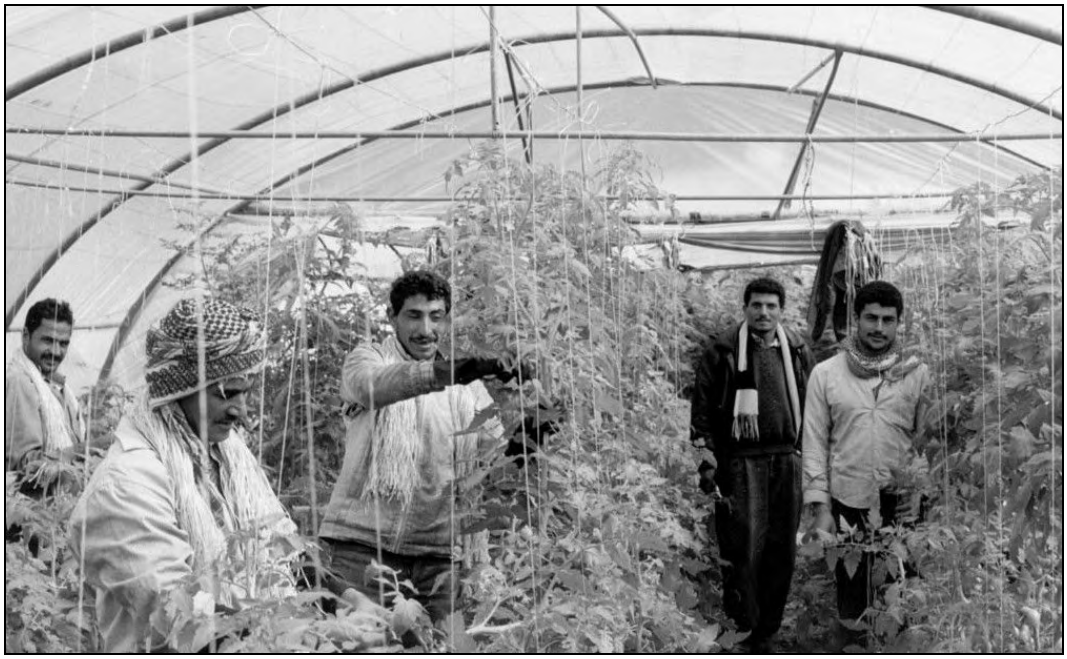
4.3.3.3 The Changing Values of Farming: the Greenhouse

One major factor that shapes the meaning of farming today is the devaluation of many farming labour activities that has taken place in the last decades. A crucial social site that has reshaped the social relations of agriculture is definitely the greenhouse, symbol of local agribusiness and of high capital investment. In the LJRB it is called *bayt al-plastic*, "house of plastic", similar to the traditional Bedouin bayt sha'r, "house of goat-wool". It has in fact been the symbol of local agribusiness since its arrival in the middle of the Jordan Valley in 1968, but also a place of intense socialisation. Indoor agriculture is perceived as the opposite of open-field agriculture (*makshuf*) in terms of investment, productivity, and work environment (chapter 5.1).

[42] In addition to low market prices, a major problem in the current high indebtedness of many farmers, are the payments, which are often delayed. Cases of labour going unpaid are not rare, and female labourers try to select the work opportunities according to the respectability and the knowledge of the employer.

In and around the greenhouse, identities are negotiated, status is redefined and a new discipline is set up in an agricultural context. Greenhouses are not just productive sites but symbolical development markers, icon of technology transfer and intensive farming. Greenhouses are labour-intensive and require continuous care of fast-growing plants and, most of all, a large number of seasonal labourers, especially during the harvest period [43]. Greenhouse cultivation is also capital-intensive. It requires a high level of inputs and is 6 to 8 times more costly per unit of land than open-field cultivation (Qasem, 1995: 19). Superior hybrid seeds, chemical fertilisers, intensive pest control due to the increased likelihood of plant diseases in the humid environment are the main causes for the high capital input. In addition to the initial investment for setting up greenhouses ($25,000/ha for the greenhouse only), the necessary drip irrigation system (plastic pipes, plastic mulch and plastic sheets and their yearly maintenance) constitute a very expensive capital input at the beginning of every season (chapter 5.1).

Figure 4-7. Egyptians labourers working in a greenhouse, the farm manager behind (Van Aken 2003)



Added to the intense humid environment, going inside greenhouses is like entering a different social place demarcated today by the low status of wage labourers. This closed environment is characterised by oppressive heat,[44] heavy working conditions, relations of dependence and gender promiscuity. Secondly, only wage labourers work in greenhouses, a position identified with "Egyptians"[45] as an ethnic definition of work: this reproduces on one side the social stigma previously attached to the *harratheen* and to the 'abid (chapter 3) as dependent conditions in the new context of international

[43] Labour expenditures in greenhouses and plasticulture are 40 % to 50 % higher per unit of area than in open fields (Steitieh, 1980 and chapter 5.1). As early as 1980, 97% of workers in greenhouses were non-Jordanian, a figure that highlights the status demarcation of these places of production.

[44] During the long summer, from May to September, external temperature gets up to 45 degree (chapter 2), even more inside the greenhouse where the environment is humid.

[45] As early as 1980, 97% of workers in greenhouses were non-Jordanian, a figure that highlights the status demarcation of these places of production.

migration. In fact in local knowledge, there is a fixed proportion of Egyptians required: one Egyptian labourer for every four greenhouses[46], or four for every 30 dunums of open cultivation.

Plastic, in the form of new and old pipes, mulch, plastic rolls and dripper lines, has become constitutive of the local material culture and a symbol of the scenery of the farms (see pictures in chapter 2 and 5.11). Even the huts on the farm where Egyptian labourers often live, are often fabricated out of the remains of old plastic from greenhouses.

The devaluation of specific agricultural tasks by the Jordanian population in the last decades is linked to the growing economic segmentation transversal to the different communities in the LJRB. While other wage labour activities, such as mechanics, car washing, construction or painting, are accepted by local *shabâb* (young men) of poor families, the farm has developed a social stigma due to the presence of Egyptians labourers, while some on farm activities have become a woman affaire. Wage labour in greenhouses is in fact an activity increasingly identified with "Egyptians" in terms of an ethnic definition of work. Who works *al-ajjar* (literally, "at rent"), as a wage labour, is perceived as lacking autonomy and reputation, in contrast to a free (*hurr*) and independent work condition. This agricultural work falls within a new regime of value: ethnic, gender, and class demarcations are overlapping in terms of new criteria linked to the organisation of labour. Further, with the expansion of public administrations, the role of the employee (*muaddhaf*) conferred a new status brought about by privileges and social network.

4.3.4 Kinship and the Network of Solidarity

Solidarity and a sense of community are expressed through kinship terms, which used to address and legitimise solidarity based on blood relationship. In practical relations of solidarity, of which visiting is one of the main manifestations, different types of relationship are sometimes absorbed in the intimate language of kinship. Often the distinction between effective family relations and other kind of ties is not clear, since any close relation is presented generally as family relations: in other words, kinship is the model of the local representation of affinity or solidarity as a form of interpretation of relationships, which may be not linked by effective genealogical ties or marriage. On the other hand, close relations or peers may often become relatives through marriage, reinforcing in this way pre-existing ties.

Larger units of solidarity based on the patronymic clan, the hamula or 'ashira, have fragmented as a result, not only of displacement, but also due to the change in resource management and to the development process, which has targeted nuclear families and thus contributed to the splitting up of wider social units. In this way, displacement and modernisation quickened a process of fragmentation that already was under way during the British Mandate in Palestine, when the tribes started losing their territorial and economic base, economic segmentation becoming the major defining factor (Cohen, 1965).

The village is still an important framework for social life, but its material base has often been transformed and, in areas like the Jordan Valley, village schemes and new settlements of refugees have completely changed the village identity. For Transjordanian communities, the village still remains an anchor of identity and fellahin tradition, while for refugees the imagined village lost in 1948 or 1967 remains the reference of belonging, even after four generations in Jordan.

[46] According to the intensity of production and cropping patterns, one Egyptian labour could work up to ten greenhouses.

The '*aila* (family), and not the village, has therefore become the main cultural frame in defining solidarity and decision-making, the main fixed value within shifting and flexible identity criteria. If the nuclearisation process has had a strong impact, the 'aila refers to a concept of extended family, a frame which is extended in a continuous reinvention of 'family' ties'. The family has often lost its material base represented by the tribal land and management of resources, but it embodies today the socio-political unit of organization: within its frame, decisions are taken, help is exchanged and disputes are solved. As Mundy writes, "the household is a residential unit and a unit of consumption but it is not necessarily the unit which operates a single budget, two or more households may operate a joint budget" (Mundy and Smith, 1990:20). Thus, the economic unit is often wider than, and not restricted to, the household and even in farm management the larger extended family should be taken into account as the frame of decisions and economic strategy. If the household in terms of conjugal family is the residential unit and unit of consumption, the economic unit represented by the extended family is wider, often based on the joint ownership of land or animal or through which "people access to national and even international labour markets (Mundy and, Smith, 1990:172).

An 'aila is composed thus by different dar (houses), where conjugal families live. The frame 'aila (extended family) comprise different related families, where relations are extended both through patrilineal ties and through persons related matrilineally or through marriage. Its boundaries are not static or impermeable, but are being continuously redefined. In the case of low income groups, the kin relations that legitimise a social bond or loyalty are often remote or even forgotten, but they are described as close (*qarib*) or related through marriage ties (*nasib*). Asking if someone is 'qarib' means in fact defining his or her kin relationship, which at the same time is an expression of potential solidarity, loyalty, and mutual obligation. Thus, what is at stake in defining closeness is a potential of solidarity that may be mobilised since, following Eickelmann (1981:134), "kinship relations should be treated as something which people make and with which they accomplish things". Any close relationship is therefore expressed in terms of kinship ties and "shared blood", whatever type of relationship it may be, a 'shared place', as a common neighbourhood, village and nearby place of work. In the same way, unequal relations or patronage ties are absorbed in this frame, in the continuous attempt to express closeness and represent equality, although in a rhetorical frame. It is a major offence to call someone '*ghalbanin'*, which means 'poor' but also 'without kin support', thus lacking any fundamental network of solidarity.

More generally, water planning in the Jordan Valley has been a "reconstruction of landless refugee peasants under conditions of intense irrigated farming" (Tamari, 1989). Tamari argues that this process has consisted in "weakening kinship-based solidarity and re-establishing it at the base of a diversified occupational class basis" (Tamari, 1989:310). In fact, capital, techniques and labour intensive market-oriented agriculture have engendered a "commodification" of agriculture: whereas beforehand patronage relations represented the model of local management of farms, following the introduction of agribusiness a new class structure has been imposed, paralleled by a decline of family farms. In this context, class relations have overlapped with previous patronage relations that have today acquired a new shape. What Tamari argues above, can be applied also to Jordan, since larger collective identities such as the tribe have fragmented and have overlapped with class segmentation.

Solidarity within the extended family is crucial in managing resources, exchanging information and mutual assistance, even more in the management of water. The 'aila is the main frame of solidarity, and maintaining autonomy and a space of manoeuvre from relations of dependence is a main cultural value and criteria of reputation. The family thus constitutes a "complex web of patrilineal, affinal and matrilateral ties, neighbourliness and sustained cooperation in political, economic and ceremonial

activities" (Fafo, 2001). Within the family, a high level of resources is shared and services are exchanged as a form of support, a reality which contrasts with the exogenous critic of lack of cooperation in the Jordan Valley. On the contrary, these patterns of cooperation have persisted and reproduced in time and difficulties, they have overlapped with the administrative structure of water, where forms of mediation often take the language of tribal solidarity and kinship.

Farming and irrigation in this frame have to be understood within the context of the extended family and its social network, included the off-farm employment and the diversified economy: "the entire cycle of farming system strategy and household development is intimately bond in with patterns of employment outside agriculture" (Mundy and Smith, 1990). Indeed, according to Mundy in a study of Wadi Zarqa, the diversification of economic activities is a crucial and diffused strategy that is based on some main elements:

- The significant contribution of women in the agricultural calendar;
- The secondary occupation besides farming is central among those who are wage earners;
- The majority of non-agricultural labour force is occasionally involved in farming activities;
- The age should be taken into account in relation to household economic strategy: generally, the older men have farming as their primary occupation, while younger seek non-agricultural employment;
- The size of the family is crucial and "the benefits of owning land, or of retaining land in one's possession do not seem to be considered as great as those of continuing to possess a large family" (Mundy and Smith, 1990:25).

Thus, while often the older men in the family will be farming, the younger men will look for out-farm employment, preferably in the army and the "strategy of the household in diversifying its economic resources is influenced by its size and composition and to its development cycle" (Mundy and Smith, 1990:25). Farming and the use of water are thus linked to mobility: in term of migrant labourers, but also in relation to Jordanian emigration. Jordanian migrants maintain a strong symbolic tie with the village, land of origin and the landownership itself remains the icon of the social status of the kin group, and therefore many resistances are developed against selling the family's land (chapter 5.2.2).

4.3.5 Hospitality as a Political Institution

> "Before there was one common community and the lineages of the tribe decided together. Now everybody has its own diwan, there is no common space of decision. Also the solidarity between lineages has changed; everybody goes back at his home after work and does not see the other." (Farmer in south Jordan Valley)

People in the LJRB recognize the process of fragmentation of tribal solidarity by the decrease of importance of the common diwan, the place of hospitality representative of the tribal unity. These are indeed important sites where the social network is reproduced. In a context of disappearance and lack of public spaces and sites of common adherence and belonging, much of public life has been brought inside the house and within the visiting network and pattern of socialisation, a process even stronger in the Jordan Valley where planning transformations have been more intense.

In historical Palestine, the *madafah* (house of the guests*)* was class based, due to the high cost of maintaining an open system and hospitable space: hosting a high number of guests was a performance of generosity but also of political status through a ritualized performance of the hierarchy and of the capital at disposal. For Palestinians, the madafah represented "a place of common ancestry and shared kinship" (Slyomovics, 1998: 125) that has been reproduced in displacement in Jordan as the icon of the lost land and kin relation to land. Madafah was the guest-house for the household of the tribe (hamula), while diwan was the common place of the Bedouin tribe or lineage qabīla. The terms hamula and madafah have often disappeared in today's Jordan but those institutions remain central. The madafah, called in Jordan diwan, is today the main place of cohesion, of encounter, of conflict resolution and of political and economic relations. [47] Generally, the diwan is the room for the guests, and represents the conjugal family although it is actively used and lived in by the extended family.

Following the waves of Palestinian displacement the Jordanian authorities have always encouraged the setting up of madafahs in Jordan, since it has constituted "a mechanism by which the government easily controls communal and tribal activities" (Slyomovics, 1998). In fact, madafah have to be registered at the Ministry of Interior to be recognized, in a dynamic of cooptation by the regime of these patterns of public and political relations. In this way, the state has also delegated the control of violence to these institutions, as much as it has used madafah in the reproduction of consent and in the election process. The Jordanian state favoured the reconstitution of these tribal institutions in order to control local politics in a process of tribalisation of the state itself and in order to promote group cohesion. Due to the strong social heterogeneity, in the Jordan Valley hospitality constitutes a crucial political institution that involves high investment of time and of capital in daily life, but larger tribal diwan have disappeared and have been assimilated within the family house in a more intimate context.

The incorporation of the diwan inside the house has certainly been part of a process of social nuclearisation and of privatization: it does not stand any longer for tribal identity, but rather for the honour and hospitality of the family, 'aila. This is the case of low-income families, since the higher the status, the higher will be the investment in a setting for guests and building a separated diwan. A lot of capital is invested in hosting, as a crucial value and resources, even by low income families that may get indebted in order to be able to host family members. Visiting takes time and involves a specific cultural dimension of time. Hospitality is a reproduction of traditional values and practices that cannot be understood as mere conservatism or only in terms of social pressure. In fact, hospitality is a guarantee of social encounters since it is the common language and meeting space of different social groups, even during periods of tension and confrontation as in the past and in the context of latent forms of exclusions, as in the present. The daily exchange of offers, demonstrations of generosity, commensality, presents and even water in case of scarcity, expresses the social relevance of hospitality in local relations.

As such, hospitality constitutes a political relationship and the diwan is indeed a political institution: community is shaped through these social encounters, status is exhibited, and power relations are defined and negotiated. What strikes any external visitor is the routine repetition of acts of visiting: from verbal utterances to acts, postures, gestures, respect for timing, all acts that are appropriate to the visit, setting the sphere of ritual. This is a 'mise en scène' (Hannoyer, 1989), a set of performative actions that emphasises the value and priority of hospitality.

[47] The *diwan* is a common institution in other regions in the Middle East. It has several names, but performs a similar political role: *qaa', iwan', diwaniyya, majlis, mafraj, mudhif, madhafa*, are some major examples.

The diwan is a sacred place; traditionally shoes are taken off before one enters, and the space should be *naddhaf* (clean or pure). The importance of creating a pure and sacred space for hospitality is indeed a major aspect that may be reproduced in any context, even in agricultural fields. Relations of hospitality are in fact enclosed within a religious frame: it may seem strange and inappropriate to thank the host for his generosity, respect, or offerings, but it is obligatory, a sign of respect and of moral conduct, to emphasise the gifts of Allah for the visit.

Hospitality settings are reproduced as a virtual place on the front door, in the street, in a shop, in a field of tomatoes. By setting out some mattresses, some clean plastic bags on the ground, or some plastic chairs in a circle, and issuing invitations to tea, the hospitality setting is composed by the effective relationship of hospitality.

A '*bait-al-dhiuf*', a house for the guests, is thus relevant even within a farm (Figure 4-8), where social interaction and visits are indeed frequent: development extension agents, chemical suppliers and water employees, JVA employees and other experts engaged in the continuous surveys and questionnaires on agriculture, all are involved in their daily work in this social and ritualised setting, in this form of investing time and in these patterns of social exchange. Indeed, it represents a space of domestic relations inside the agribusiness farm.

Figure 4-8. On the left, a diwan in a farm, build with recycled material of greenhouses (Van Aken 2003)

Development agents have been assimilated into guest relations within the farms, but administrations are also organised along these lines: To borrow a description of Depaule, "the diwan has entered in the administrations, in the ministries, by introducing its ritual" (Depaule, 1997:22, translation of the authors). Settings of conviviality and host-guest relations are reproduced in all of the development offices, and so the use of time and space in an administrative context followed the needs of ritualised encounters of visits. The office (*maktab*) has often become a reproduction of a personal diwan, with the initial offering, the greetings, relations of reciprocity, many guests just hanging about on the chairs and sofa, the exchange of information and reputation. This setting of interaction is explicit in the Stage Offices in the Jordan Valley, one of the most intense places where turns of water are changed, discussed and manipulated (Chapter 5.2.2).

Through the space of hospitality and its solidarity network, local resources for daily use are mobilised and, in the same way, global resources introduced through development agents or sources linked to national institutions are mediated. Thus, the places of hospitality are inevitably also places of productivity and of water management. The hospitality settings make visible the complex web of

relations of solidarity that are so important in building up a community and in exchanging resources out of the formal channels. Mutual exchange, such as reciprocity in favours and time, is evident in household activities and still important in farming work. With sharecroppers or in family farms, it is indeed important to reduce labour expenses as far as possible. Besides, great attention is devoted by low-income families to the allocation of labour force, as an important strategy of the household in order to preserve labour power within the family (chapter 5.1). Generally, time can be exchanged, as in the construction of a house, in domestic repairs, or in agricultural work.

The social network can be mobilised and, the higher the status, the greater the resources that can be circulated. In all these cases of resource distribution, the exchange takes place within the social ties, reinforcing them and at the same time being legitimised by them. Men's networks are very much linked to the resources that are publicly related to administrations, to vertical networks and to upward mobility, and to their cultural role in the protection of the autonomy of the household. Thus, men's networks are tied to the ideology of the male breadwinner, in which men are presented as the providers of resources and sources of social mobility, while women's visiting activities are indeed crucial as a horizontal network, where the circulation of information is one of the main resources.

4.3.6 Values of Water and Contemporary Adaptations

> "We do not drink the water from here [i.e. Wadi Yabi], I always bring the water to drink from home in Ajloun! It is much better, it comes from the rain. This morning I have already drunk at least 12 tees, all with water from the highland, never from the Ghor!"

This sentence of an old man of Hashemia tribe in the Jordan Valley is illustrative of the values that water may entail in daily life. The notions of purity and impurity of water, in relation to domestic but also ritual use, reveal the changes in the perception of water for many farmers in the Jordan Valley. Water has indeed a morality, since in the past it was linked to a moral community that used to manage this scarce resource and to moral and ritual values. Further, religious sentiments and symbols are deeply linked to water.

The word *ma'* (water) comes 63 times in the Quran, where it is intimately connected to ideas and norms of cleanliness and ritual purity but also to ideas of social orders linked to water: "water of the thirsty, knowledge for the ignorant"(Quran). Further, the Quran often refers to water in general (ma'), to the sea (*bahr*), rivers (*anhar*), sources of water (*'uyùn*), and of rain (*matar*).

The concept of purity is crucial since it is linked in many perceptions of water. In ritual ablution before prayer it is compelled a personal purification through water; in the case of a minor ablution (*wudu'*) and the major ablution (*ghusl*). Purification is a way of avoiding minor impurities (*hadath*) or major impurities (*gianàba*) before the prayer. In Islam, all water is sacred and sent as gift from Allah and therefore derives its ideal gratuity and prohibition of personal appropriation.

Interestingly, in case of water scarcity, a fact not rare in arid and semi-arid areas, it is possible according to the Quran to wash and perform the ablution with sand, as an icon of the culture of the desert and adaptation to the shortage of water. Water is at the origin of the creation and of the state of purity but it can be also a punishment for the unfaithful. Being a gift to all humanity, according to the sacred text, water should not be wasted for blameable uses (*makruh*) even in case of abundance or unequally distributed. Strong moral values are thus attached so to water use, distribution and exchange.

Islam recognizes two religious rights related to water:

- *Shafa*, the rights of thirst, as universal right for human to quench all their thirst and that of their animals;

- *Shirb*, the right of irrigation, which gives all users the rights to water their crops in case of need.

These rights are sometimes called upon at present time, more in order to legitimize some practices (for example stealing water) and general values than to put them at the base of local management. Indeed, the religious dimension of water as a universal justification is intermixed with local cultures, with customary rules that were so diversified in this area and with the national new rules of the last decades.

Islamic teachings contain many references to water conservation, to priority of distribution, to equity of allocation of water: "Do not withhold the surplus water of a well from people" (Al-Muwatta, v.36, n.30). The Islamic Law, Shari'ah concerns water to ensure the fair and equitable distribution of water within the community. The word Shari'ah itself originally meant "the place from which one descends to water". Before the advent of Islam in Arabia, the shari'ah represented a series of rules about water use: in fact, the *shuraat al-maa* were permits that gave right to drinking water.

The introduction of non-conventional types of water, as wastewater and desalinized water has engendered an intense debate in the Islamic world on the purity of these new waters and a special fatwa has been proclaimed in 1978 in Saudi Arabia:

> "Impure water can be considered as pure water and similar to the original pure water, if its treatment, using advanced technical procedures, is capable to remove its impurities with regards to taste, colour and smell, as witnessed by honest, specialized experts. Then it can be used to remove body impurities and for purifying, even for drinking" (Fatwa issued in 1978).

Thus, waste water can also be considered pure in this interpretation of the Islamic law, although in common perceptions this kind of water is deemed impure and it is it is therefore avoided for religious or ritual purposes. In the present day's debate between pure and clean water, only 'pure' water can be used to wash away minor or major impurities with minor or major ablution (*wudu'* and *ghusl*), while purified water, as treated wastewater is often reputed clean but not pure.

Besides, there is an internal debate on pricing water: for Islam teaching, water should be free for all as a gift from Allah. But, in front of the process of commodization and secularization of water some interpretations retain that pricing water is justified to cover Operation and Maintenance costs of its distribution if it is contained in a recipient or in an irrigation canal; or within positions critical to water privatization or to pricing of water the ideal equal distribution as a gift from Allah is recalled..

Lastly, collective prayers for rain (*istisqa*) are often called upon in case of scarcity during the winter period and the water problems are so assimilated within the mosques network.

4.3.6.1 Traditional Water Rights

In the study of water management worldwide, a new attention has been devoted to traditional rights, local knowledge systems, and patterns of commons' management in irrigation. These perspectives have followed a main dichotomy between the exogenous intervention and the "local", "traditional"

ways of managing water: a polarity that often does not help in understanding a more complex and embedded reality.

Irrigation systems are indeed technical but also social constructs: they entail social relationships, authority roles and ideas and projects of communities. Besides, management systems of resources are dynamic, although in Jordan local 'traditional' patterns are often portrayed as a timeless system, an ethnocentric prejudice which is often at the core of the resentment of local populations. The historical cases of musha' (chapter 3), of tribal management of resources, of fellahin knowledge have often been left aside as implicitly non-progressive, in a censure of local agency and participation. Today, local knowledge on water and irrigation in the basin has been hybridized: pre-development practices and knowledge about water have overlap with a new reality in a mixing of words, conceptions of land ownership and contested claims on water.

In this context, the so called traditional rights around water refer to an intermixture of Islamic law, customary rights linked to the tribal structure, and influences from Ottoman codifications. First of all, as Trottier well remarked on the opposite bank of the Jordan River, "studying Muslim Water law shows that it does not correspond to the law that is in force, which is in fact a local customary law from village to village" (Trottier, 1999:117). Also in Transjordan, we face many varied traditional rights around water, which differ starkly with the centralized system introduced after the 1950s. As Lancaster argues, "the Balga tribes share with other Arab tribal communities an elaborate body of customary law ('*awayid*) which recognizes and protects individual ownership of land and water as against collective rights to pasture, stubble in harvest fields, seasonal flows of water in stream beds, natural springs and flood pools" (1999:43). One important aspect is that traditional rights are often orally transmitted and codified and this leads to reluctance, on the part of farmers, to talk about it, or to difficulties in translating them into written form. This is because the oral tradition also allowed an easier and more flexible interpretation and manipulation of these rules, according to the political and social context, while written rules are inevitably more rigid and static. Therefore, these rights, which many consultants and planners encounter on the fields, are often not taken into account. What we face thus is an overlapping of formal and informal water property right systems and claims.

Of course, this water knowledge and rights were intimately related to the resources available at that time, to side-wadi's management, to the tribal pattern of distribution, and the new water realities, in terms of available water, infrastructure, quality and quantities of water have inevitably radically transformed the context of this resource. GTZ (2003) shows that turns of waters were distributed according to the size of the holdings in consensual agreement of the village, and often coincide with a lineage of a tribe as one common community. There was often a water mediator, frequently the head of a tribe or sheikh, who solved disputes around water. Shares of water could be sold or exchanged in order to adapt the time-share system to local needs in a flexible ways (although the sell of water right was strictly linked to land). Even today, "although trading and/or selling of water rights is illegal, it is widely practiced" (Regner, 2002:229). Patterns of traditional systems are still activated in the Jordan Valley, as in Wadi Shayb or Hudjaydjeh in the south of the Jordan Valley, where local communities share water on a temporal schedule without the intervention of the JVA. Patterns of water distribution were thus connected to social relations and units of solidarity:

> "Before, if I needed water I could ask to some neighbours, in a form of exchange of hours of water. Now I have to go to the JVA: now instead of sticking together, we fight against each other."

What we face thus is a context of legal pluralism, with an overlapping of formal and informal water property right systems and claims. The main dynamic that took place in the valley in the encounter

between exogenous and local knowledge and practices of water has been the overlapping of the two modes of managements: in the lack of any local participation, local communities have managed to overlap into the new bureaucracies in order to manipulate and change it from within (see below and chapter 5.2.2).

4.3.6.2 The Main Changes and Adaptations in Relation to Water

We will synthesize some main changes that generally took place in the LJRB in order to show the encounter of different knowledge systems and authority roles around water and their overlapping. Later, we will deal more separately with the specificities of the water use in the Jordan Valley and in the Highland, although some aspects already witnessed in the Jordan Valley are important to understand the changes that could take place in the Highland in terms of introduction of new waters in agriculture and new management.

The shift from surface to micro-irrigation linked to pressurized pipelines dates back to the 1980s and has radically changed, in a very short time, the ways of thinking and practicing water, more so than any other technical innovations in the past. A first major change has been the transition from a concept of water allocation based on the household heads and representatives in the past, towards a water allocation according to the crops in the fields (and non-allocation to illegal or unlicensed crops): the idea is that the amount of water to be allocated is calculated according to what is planted and not according to 'who' plants it; in other words, it is depersonalized through bureaucratic mediation.

A second general change is the shift from a distribution of water according to a tribal pattern, where water refers inevitably to local tribal alliances, to a tribal territory (*dirah*), to hierarchy and ideas of equality, to its centralization under a water administration with new authority roles and mediation patterns. Thus, different ideas of place are at stake. This is linked to a third main issue: the changed idea of time and of the calendar of the year. The turn of water was traditionally connected to an idea of time, and even more, a personalized time related to the local social context and tribal arrangements. The agricultural calendar was based on a local notions of timings determined by temperature change and rain: Marba'nia (40 days, the beginning of cold weather in the winter), Sa'd al dhab (12 days and a half, gradually colder period), Sa'd bala (12 days and a half, increasing colder period), Sa'd bala (12 days and a half, increasing colder period), Sa'd sa'ud (12 days and half, increasing temperatures), Sa'd Nus (mild temperatures), and finally Sa'd Alakabai (starting of the warmer season and of lack of rain). With water planning, the turn of water has become a measurable and quantified object with a connected price, where the time of allocation is just one variable, but even more important are the indicators of volume (cubic meters), pressure, and quality, and type of unconventional water used (chapter 5.2), which are not often used by farmers. Water has become a quantifiable object in a new system of thought and ideally, the network functions efficiently when farmers, *ganawati*, and pumping stations are able to control these "new" variables of water (in the case of the Jordan Valley). But in fact, talking in terms of cubic meters or pressure indicators does not always have the same meaning for farmers and JVA employees since water is embedded in a multiple frame of significance.

A fourth main aspect is the political reality of water scarcity: in relation to basin closure, the current high competition between urban and agricultural water needs leads to a closer interconnection and interdependence of the water systems (see, for example, Figure 4-6), in a social context, which is often characterized, on the contrary, by a fragmentation of social connections and by the disruption of local patterns of cooperation.

Finally, water is becoming a valuable and economic good in a global process of commoditisation: ideas of water price and water market are introduced today in Jordan (chapter 6) and represent a new shift in the conception of water that conflicts with other moral and religious justifications in water use. From a link within a tribal network in an integrated system, the water "user" has become a "client", a "consumer", an inhabitant, all new administrative categories that reveal the importance of the water bureaucracy.

4.3.6.3 Wasta and the Manipulation of Resources

In this new administrative framework, social circuits are a way of redistributing resources through informal networks that find in the diwan its symbolic place. Indeed, social ties become a necessary medium for accessing development resources, whether employment in administrations, credit opportunities, or a turn of water in agriculture.

Patronage in this context has been defined as a "merchant form of hospitality" (Hannoyer, 1994): indeed, the guest-host relation shapes and mediates the circulation of resources, whereas hospitality is extended and adapted to the new environments and actors of planned interventions. To 'know someone' means to be able to get access to important jobs, resources and thus even water; so, the larger the family reputation and the wider the social network, the more resources can potentially be mobilised. Conversely, the lower the perceived status of the family and the fewer the influential relations available, the fewer the resources are available. This shows the symbolic importance of hospitality performance, since it constitutes a way to foster relations of loyalty and partnership as much as relations of exclusion. It constitutes a way of personalising formal ties, by assimilating any relationship within the web and idiom of kinship.

Local relations of mutual respect and obligation overlap administrative practices and rules: 'putting a *wasta'* or 'having a '*alāqa* (having a relationship) are the local expressions for having connections and access to favoured treatment in obtaining a resource. Wasta is the term used for the act of mediation as much as for the person who intercedes. These connections represent the opportunity to rely on social ties and common belonging in order to circumvent administrative rigidity or to cope with problems and needs. In other words, wasta is a local system of pragmatic mutual assistance and is used daily in contacts with the bureaucracy, in water management in the Jordan Valley, to obtain a visa for migrant labour or avoid paying new fees in the Highlands, etc. Wasta relations do not coincide, but often overlap, with family networks and are often expressed through the kinship idiom. Locally people often ask if 'you have a relation' ('*alāqa*), or if someone is 'close to you' (*hua qaribak*?) in order to get access to a service or resource. Wasta may be '*qawīyya'*, strong, or weak, in terms of the closeness and status of the relationship mobilised: "the stronger the wasta, the greater one's chances of success" where strong wasta stands for the political influence of the intermediary. Wasta "facilitates access where one has a legitimate claim and yet is denied service by agency officials" (Kilani, Sakijha, 2002: 33), as it happens in irrigation context

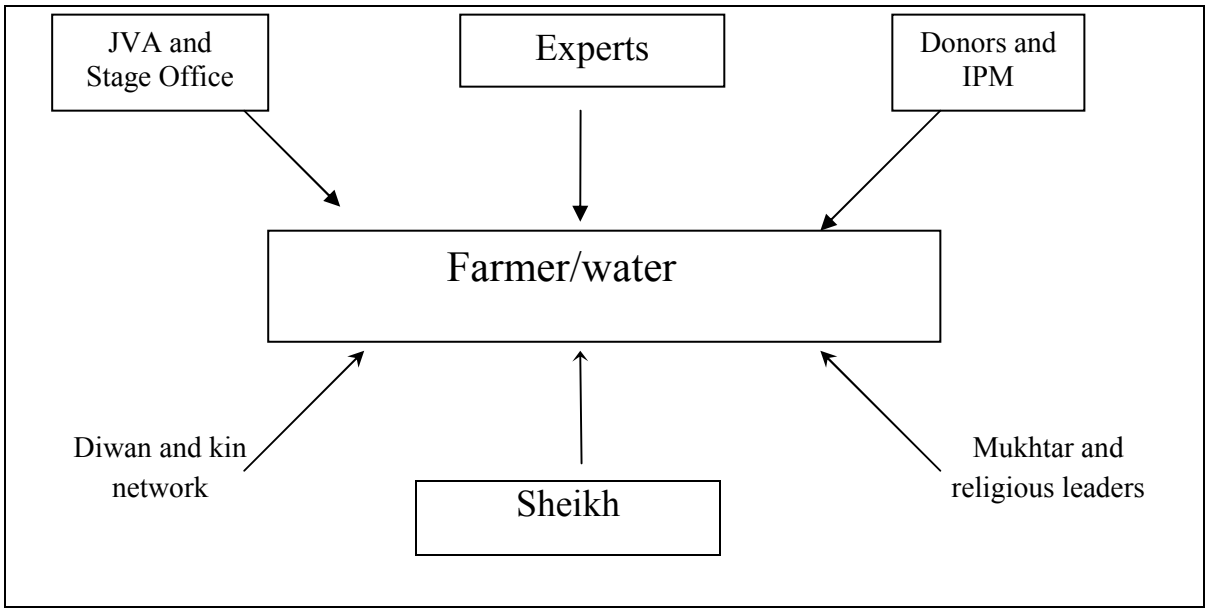
These vertical networks of wasta often coincide also with a personal linkage between a patron and a client that overlaps in the context of administration and development: ties that are locally represented by the egalitarian idiom of kinship but constitute, in practice, unequal relations of dependence. This client network constitutes mainly a masculine network and a male practice, related to what are perceived as masculine roles, mobility, and vertical networks.

In practice, wasta represents the main pattern of local power distribution and of the maintenance of inequalities through an egalitarian idiom of exchange. Within this frame, wasta relations also lead to

the idea of being able to manipulate the state and the market constraints at different levels of the power hierarchy. It is perceived as the capacity to find a space for manoeuvre in a rigidly controlled environment, where "people see themselves governed from above but still able to manipulate" (Rabo, 1986:168). Therefore, wasta is part of the dynamic of accommodation in water management that is described in chapter 5.2.2, and justified locally as a form of cooperation, selective appropriation, co-optation, and compliance.

Local patterns of exchange, linked to the concept and exhibition of honour and hospitality, represent a 'buffer area' that personalise development, assimilating it within 'personal' and local social ties in order to be able to cope with external constraints. Parallel to the formal institutions responsible for water management, we should therefore take into account the informal institutions such as the solidarity network, the sites of hospitality, the idiom of kinship that are so relevant in day to day irrigation. Rather than being neatly opposed, formal and informal arrangements, just like the state and local institutions, overlap and the frontier between them is blurred. The lack of confidence often expressed by farmers, is linked in fact to this gap that has formed in farmer-state relationships and to the overlapping of different actors in the effective use and negotiations on water.

Box 4-2. Formal and informal institutions at stake in water management



4.3.6.4 From Surface to Micro Irrigation

Water represents the encounter between different types of agricultural knowledge and particularly different 'savoir-faire'. Local irrigation management, as in the case of traditional furrow irrigation with or without technological investment such as concrete ditches-canals, was based on accurate knowledge of the different water flows of surface irrigation[48], of the types and varying qualities of water in different periods of the year and on the ability in performing a very time-consuming activity. Knowledge of water was related to an understanding of water quality, of the type of sub-canal constructed, of the correct levelling of each basin, of the position of each canal and drain, of the

[48] Although pressure was not a variable as important as it is in today's irrigation, the flow of incoming water in the fields was manually regulated according to the kind of crop, the presence of seeds, and according to the stage of growth of the plant.

awareness of the absorptive capacity of different types of land units in relation to the crop cultivated, and finally of the water flow (always referred to furrow irrigation) in different periods of the year. Dulab', tellim (furrow) and irrigation by submersion have been the main types of traditional canal irrigation that with variations, were, and still are, applied in agriculture (even if at a lesser extent in intensive irrigated farming; chapter 5.1).

Besides, not every technological input has been adapted to the local conditions: in the 1950s, the sprinkler irrigation system was introduced and subsidized but it was refused when it was found to be non-adapted to citrus, banana and vegetables, since farmers discovered that wet leaves developed fungus disease. The shift to micro-irrigation has been a complete change in the way of using water, as this farmer explains:

> "In the 1970s, I was working for a private company at that time and the JVA saw us as competitors, it was difficult work, and the farmers were laughing at us. Many farmers were making larger holes in drippers in order to have bigger water flow, which of course is the opposite concept of drip irrigation. Or others were saying: 'how can I irrigate with those tubes in order to water all the fields, as in tellim and dullab'? Or very often they were over irrigating, thinking their crop were not watered enough".

In the past, one of the main beliefs of technology transfer has been that with the introduction of micro-irrigation, water delivery would inevitably decrease, while, in the Jordan Valley as in many other contexts in the world, this technological shift has generally not resulted in reductions in water diversions and consumption (Molle and Turral, 2004:4-5).

Box 4-3: Micro-Irrigation: a Historical Perspective

Micro-irrigation is an ancient technique, known also to the Arabs from the X century with the Arabic translation of the "Greek agriculture" of Costus (*Kitab al filaha ar-rumiyya*), manuscript of the IV century. This document described the technique of using papyrus and white clay in order to absorb and release slowly water to plants on the grafted parts. This method was developed later by the Andalous agronomist Ibn al-Awwam in the XII century.

One of the main shifts encountered with the adoption of drip irrigation is that water is not anymore more visible as it was before, when fields were covered of it. The shift from visible to "invisible" water has increased definitely with the introduction during the 1990s of pressurized system in the Jordan Valley: except for the KAC, water has gone underground, it is not directly available, nor physically visible and it became apparently more difficult to steal water out of the turn (chapter 5.2) The issue of visibility of water should not be understated, since water has been in the past a public activity, linked to ideas of common resources and collective distribution. The fact that it is not possible anymore to see where and how much water is flowing, in case of stealing, or what is the level in the secondary canals, has transformed the "public" meaning of, and the common control on, this resource (by "public" we refer to its communal and open meaning and availability, in other words to its "publicness" for the community (Mosse, 1997).

One case in the south of the Jordan Valley is illustrative of a similar process: farmers in one of the Hisban Kafrein areas have requested the GTZ to rehabilitate the pipe network leaving it visible, shifting from underground pipes to an on-the ground pipes, or sometimes, above-the-ground pipes, to make more visible and "public" any illegal connection and allow wider control. As one farmer put it:

> "Before, water was always available in the open canals and we did not have to pay. So I take water from three sources on my turn: the official one from the normal water valve, and from two other valves underground in the field that we have opened to get more water in a short time, but the Sulta (JVA) does not know about it. In case we need more water, everybody has the key to open the valve; they get it through some cousins in the Sulta, for example. The Sulta tries to stop illegal openings with fines, but after midnight there are fewer controls, so you see farmers going out at that time without having their turn and going to their fields!"

Thus, water becomes the main term of the encounter with the administrative practice, and stealing water is a normal practice to cope promptly with the need for it.

The farmers' lack of participation in water management corresponds at the same time to a different perception of agricultural work, of efficiency and of good irrigation. Local practices adopt different strategies in relation to their land tenure and manage to circumvent rigid administrative rules that are remote from local needs, in the attempt to adjust water management through personal ties: local solidarity networks become therefore the medium and context in managing water, as with other resources.

Moreover, microirrigation has introduced all of a sudden a wider technical apparatus in terms of pumps, filters, fertilizers as well as new expert and hydraulic knowledge that have indeed transformed the farm environment and the water use. For example, microirrigation made on-farm design necessary, while in most cases this knowledge and expertise was not transmitted to farmers with consequently poorly designed infrastructure. This has shaped the general process of delegation of authority away from local representatives to technical experts and has led to competing knowledge claims and competing authority roles between experts and engineers and farmers. Further, what becomes crucial in irrigation is the control of water pressure, which becomes a basic information and knowledge of water. Finally, micro-irrigation has changed the "timings" of water: in furrow-irrigation, large amounts of water are supplied less frequently; on the contrary, microirrigation requires smaller volumes, more frequently, with less labour involved.[49] This need of frequent and reliable turns and quantity of water, notably during sensitive periods in spring and autumn when supply is constrained, often collides with the rigid irrigation schedule of the JVA in the Jordan Valley and is often the reason that pushes some farmers to steal out of their turn (chapter 5.2.1).

4.4 Water Quality, Health and Environmental Impacts

Water development in the basin has been and will be severely affecting the environment. It may have negative socio-economic impacts as well as possibly uncontrolled consequences on public health. This chapter aims at giving a first overview of current environmental impacts of recent water development in the basin but does not address possible medium and long term environmental effects. Environmental problems and their possible resolution are well known by the national authorities. However, even if the latter pursue environmental objectives notably when creating a new Ministry of Environment in 2003, they are still far from being able to implement the necessary measures (radical decrease of groundwater abstraction, severe control of industrial and agricultural waste and pollutions,

[49] Although microirrigation makes irrigation practices easier, it requires a lot of work for the control, the maintenance and the cleaning of the networks.

etc) that would preserve a dramatically impacted environment. Only a strong popular awareness and a public debate on these problems and on the necessary solutions could be a basis for changes.

4.4.1 Surface Water Quality Problems

Surface water quality depends on the severity of pollution. Only water coming from basins with low population and limited industrial activities are sufficiently protected from pollution and then can be treated and used for domestic purposes. This section lists the main issues regarding drinking water supplies for the main sources of surface water in the lower Jordan River basin:

- The northern half of the King Abdullah canal is the main source of fresh surface water for domestic supply in Amman (Figure 4-6). It receives water from the Yarmouk River, the Lake Tiberius, some side wadis and the Mukheibeh wells (chapter 4.2 and 5.12). These sources are not polluted (concentrations of nitrate, pathogens, heavy metals, toxic substances and salinity are low ….) even if some concern exists with algae development inside the canal. A serious water quality problem appeared in Amman in 1998 due to an eutrophication problem but the Chlorophyll A content is now regularly monitored.

- Water from side wadis and springs is increasingly diverted either to the KAC or to urban areas (in the case of the Mujib and Wala). Originating in low-densely populated watersheds in the mountains, this water is of good quality and can be used for domestic purposes.

- The quality of the Zarqa waters increases along the flow of the river. It is higher downstream (in the King Talal Reservoir) than upstream where effluents of the As-Samra treatment plant joins the river in Wadi-Dulheil and severely affect its quality that is not meeting Jordanian Standards for drinking water.

    - Finally, the Jordan River is highly polluted and saline. It receives around 20 Mm^3/yr of brackish water from saline springs coming from Israel (Klein, 1998); return flows from irrigated areas and untreated or insufficiently treated wastewater from Jordanian or Palestinian villages and cities as well as from Israeli settlements.

Figure 4-9. Treated wastewater used in a reserved area around the As-Samra treatment plan

In these very densely populated areas, surface run-offs collect many pollutants during winter: waste water collection is not complete and treatment plants are often overloaded. Water from the Zarqa River is exclusively used for irrigation purposes along the valley or in the south of the Jordan Valley (chapter 5.1). .

4.4.2 Groundwater Quality Problems

Generally, due to very efficient natural filtration during the transfer to the aquifers, no pathogens are found in groundwater (except when a well or a spring is directly polluted but it is rare and can be easily solved by local measures). Therefore, the main problem concerning ground water quality is the concentration of dissolved compounds (principally nitrates and salts in general). Jordan is facing a national problem of increasing groundwater salinity that has been addressed by several studies (IAEA [1995-1998]; JICA [2000]; ARD and USAID [2001a]) yet it is still not completely understood. Two different processes have been identified as possible responsible for a groundwater salinity increase:

- Pollution through infiltration of dissolved elements linked to human activities at the surface.
- Contamination from more saline neighbouring aquifers that may flow to the exploited aquifer when its level decreases. The water table drops also participates to the concentration of salts within the aquifer. This has been observed in the Azraq basin. In other cases, the nature and extent of this phenomenon has still not been evaluated.

JICA (2000) studied the evolution of groundwater quality in the region south of Amman. It suggests that the pollution coming from surface sources could be responsible for most of the salt concentration phenomenon. The pattern of nitrate concentration increase mimics the distribution of salinity increase (with some exceptions of nitrate pollution in some localized points). Waste water is an important source of nitrate pollution but is not really saline; saline neighbouring aquifers do not have high nitrate concentration: they are not responsible for the observed interconnectedness between nitrates and salinity. The fact that common salts and nitrates increases are principally located down the areas where irrigated agriculture has been especially developed tends to prove that irrigated agriculture may be the main source of combined salts and nitrate pollution in the groundwater.[50] It is not possible, without specifics studies, to extend this conclusion to other aquifers.

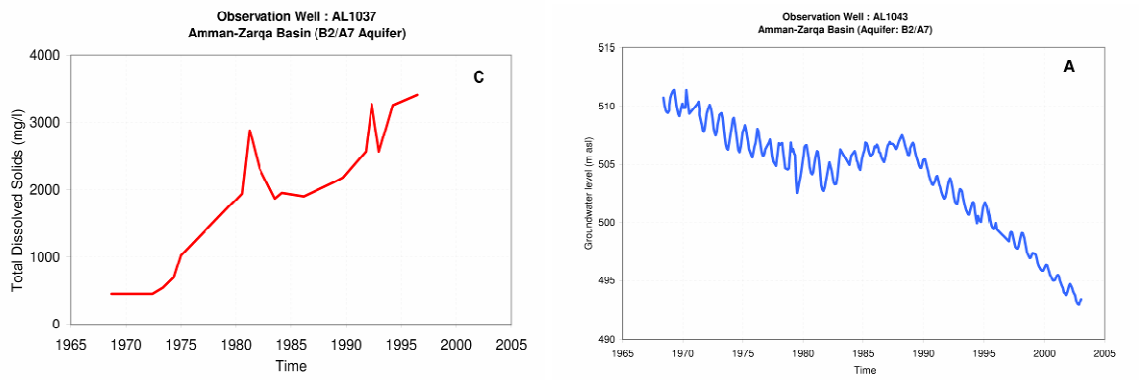
Box 4-4: A case study of groundwater quality degradation in Wadi Dulheil (North east of Amman)

During the 1970s, a groundwater irrigation project has been implemented in the area of Wadi Dhuleil, Eastern Jordan. Ever since irrigation started, water quality in the aquifer has been deteriorating with an increase in salinity and nitrate contents (Figure 4-10). There are three main reasons for this quality degradation. One is groundwater over-abstraction as a result of irrigated area increase and water use development by people other than local farmers. The other is poor irrigation practices, along with a lack of adequate supply that led to poor salinity control. The last reason is the discharge from the As-Samra Waste Water Treatment Plant in the Wadi Dhuleil (the plant is now being upgraded but its capacity has long been too low and effluents from Amman-Zarqa were thus not properly treated and directly discharged in the river): due to its low quality, aquifers have been contaminated. In the Jordan Valley basin also, groundwater over abstraction by farmers leads to an aquifer salinization while

[50] For the Amman-Zarqa basin, the JICA (2000) study suggested that without reduction of present irrigation, average salinity could increase from the situation in 2000 when TDS concentration was at 500-600 mg/l (or an EC of 900 µS/cm) to a situation in 2020 when TDS would equal 1,100 mg/l (EC=1,500 µS/cm). In 2040, salinity is expected to further increase to reach 1,300 mg/l (EC of 1,900 µS/cm). Moreover, the study suggests that from a present concentration of 30 to 40 mg/l, nitrate contents of well's water could reach 90 mg/l in 2020 and 100 mg/l in 2040. In comparison, allowable concentrations for drinking water in Jordanian standards are 500 mg/l for total dissolved solids (TDS-a measure of total salinity) and 50 mg/l for nitrate concentration.

intensive use of pesticides and fertilizers with high nitrate concentration causes severe pollution to the shallow aquifer, highly pervious and located about 10 meters deep.

Figure 4-10. Water table drop (right panel) and salinity increase in north eastern aquifers of Jordan (THKJ, 2004)



If we assume that the current practices of agriculture are the main responsible for groundwater quality degradation, a quantitative decrease of groundwater abstraction will not be sufficient to stop aquifer contamination and substantial adjustments of farming practices are needed. The WAJ is suggesting protecting areas around wells that are used for domestic supplies to preserve the aquifer from further degradation but this has not been done by the mid 2000s. A decrease of irrigated agriculture is difficult to envisage for social and economic reasons (chapters 5.11 and VI). Moreover, promoting and enforcing new agricultural practices like organic agriculture to try limiting salts and fertilizers transfers to layers down irrigated areas will be technically very difficult. Drainage networks should be placed down irrigated areas in order to collect and eliminate as much as possible of the agricultural return while amount of fertilizers should be decreased. For the farmers, the exact amount of fertilizer to apply is difficult to ascertain: applying more fertilizer than necessary is actually perceived as safer and if the crops do not use it all, it is not a main concern (chapter 5.2). Moreover, there is no way to completely stop the soil leaching mechanism: the remaining salts and fertilizers transfers will anyway occur during winter. Finally, general enforcement of regulations and farm's control will be very difficult. The same can be said for industrial waste but controlling hundreds of industries may be easier than that controlling thousands of farms spread all over the basin. Finally, it is not sure whether such localized measure might have a beneficial effect on a larger scale: groundwater contamination is indeed not limited to very small areas around wells and springs, but spreads over the entire aquifer. To be used for domestic supply, there is a risk that the groundwater resources of the LJRB should be treated or blended with more pure water. This could be done by bringing water from other less polluted basins (Disi aquifer in the south of the country) or to use desalinated water (Jordan Valley, Red Dead canal…). However, in the long run, the sustainability of such practices for exporting basins might be questioned; major pollution processes would not been controlled and costs of maintaining water quality will continue to increase (chapters VI).

4.4.3 Decreasing Water Quality: Risks for Human Health

Due to its importance for public health, quality of domestic supply is the main priority and is highly controlled in Jordan. Many control points for surface water exist and more than 1,000 wells and 700 springs are regularly controlled since the 1970s.

4.4.3.1 Risks Linked to Drinking Water Consumption

Surface water resources can be affected by pathogens (bacteria, viruses and worm eggs) and other toxic elements (heavy metals, Boron, antibiotics, hormones), which may appear in polluted water. The main difficulty with these toxic compounds is their possible accumulation in human, animal and plants tissues, as well as in soils and water bodies and their strong effects even at very limited concentrations. But as the only surface water used for domestic purposes comes from small unpolluted streams and is consumed after treatment; this remains a marginal problem. High nitrate content has negative impacts on haemoglobin of blood cells; provokes *Methemoglobinemia* (also called the 'blue baby syndrome') and favours algae development as high phosphate contents do. Groundwater quality does not always meet the standards (JICA 2000, Box 4-4).

4.4.3.2 Risks Linked to Irrigation Water Use

Due to risks of contamination for farmers and workers who can ingest irrigation water (physical contact and drinking purposes), and due to the possible effects on consumers who could ingest contaminated fruits or vegetables, irrigation water has initially the same kind of requirements than drinking water, i.e. low concentrations of pathogens and toxic elements. However requirements may be looser since quantities involved in such possible contaminations are smaller. Moreover, it would create an economic problem if only drinking water could be used for irrigation. Finally, different standards are used for different crops due to different risks of contamination. For example, fodders only given to animals, fruits that are not picked in the ground, industrial crops and crops eaten only cooked do not create health problems as vegetables eaten raw do. Irrigation system characteristics and sensibility of each crop to salt contents are also considered in some standards.

Water salinity is also a main concern for irrigation but its impact depends on each crop's sensitivity. Some plants, like strawberries or beans, are very sensitive and require a very low salinity; other plants like eggplant, alfalfa, tomatoes, date palms tolerate much higher salinity (FAO 29, 1985 and FAO 48, 1993). Generally, groundwater and water in the north of the Jordan Valley are not saline. In the middle and in the south of the Jordan Valley, ground water is almost always brackish, while surface water blended with treated wastewater (TWW) is more saline than fresh water. Soils are sometimes very saline and some local springs are saline.

High suspended solids (TDS) content may not be an important problem for domestic supply because it is relatively easy and cheap to control in water treatment plants but for farmers its effect on drip irrigation systems is a real concern. Another particular problem is the high content in calcium carbonate (especially for some springs near the Dead Sea) that precipitate, decreasing pipe section and increasing friction losses, blocking the filters and clogging the emitters inducing therefore production losses because of an inefficient irrigation system. For example, emitter sealing by 10% is very common after three years of open field vegetables cropping in the Jordan Valley and can decrease the production by one third (MREA, 2006).

Other emerging problems linked to the use of TWW have been identified (notably in Israel where TWW is extensively used for fodder and fruit trees cultivation). Boron, for example, accumulates first in the soil, is then absorbed by plants and accumulates in the leaves: it appeared to be very damaging to citrus farmers. Jordan has banned Boron based detergents but it is still used for cleaning metals. Because its effect is cumulative, mid to long term risk remains. There are also evidences of fertility problems for cattle, goats and sheep eating alfalfa irrigated with TWW (Shore, 1999). The high content of estrogens and phyoestrogens in the TWW and Alfalfa, respectively have been presented as

the causes of this problem. In Jordan many dairy farms buy alfalfa irrigated with effluents from As Samra wastewater treatment plant (chapter 5.1) and this question should be carefully studied.

Box 4-5: Waste Water Use in Irrigated Agriculture

Waste water reuse appears to be one of the most suitable solutions to take up the challenge of water scarcity in arid areas. Waste water reuse provides additional water resources, ensures the balance of the natural water cycle and protects the environment. Among all the different ways of using wastewater, agricultural irrigation is the largest consumer. Waste water reuse in irrigation is often considered not only as a creation of a new resource but also certainly as a complementary treatment that allows avoiding direct dump into nature (Massena, 2001).

In Jordan, treated wastewater use in irrigation is likely to be generalized. From 60 Mm^3/yr in the early 2000s, it has reached nearly 75 Mm^3/yr in 2005 and it is planned that 240 Mm^3/yr of treated wastewater will be used in agriculture by the year 2025 (THKJ, 2004; chapter 4.2 and 5.12). Quality of this resource is thus of primary importance. Two different aspects have to be considered: the microbiological quality and the physico-chemical quality.

(i) Microbiological quality can be evaluated thanks to the quantity of intestinal nematodes and faecal coliforms. It is of prime importance for public health protection. Treatment plants are built to control this microbiological quality. In Jordan, the main treatment plant (located in As Samra)[51] receives waste water from the municipalities of Amman and Zarqa as well as from other villages in the same area (chapter 4.2 and 5.14). It is being rehabilitated and its capacity extended to face increasing water supply and insure good quality water.

(ii) The physico-chemical quality is important if treated wastewater is reused in agriculture. The quantity of fertilizing elements and the salinity impact crops and soils. They have to be carefully considered. A high concentration in fertilizing elements improves the agronomic value of wastewater, however these nutrients could also be a restrictive factor in the case of extreme input. This can be notably the case in the Jordan Valley where farmers do not adapt their fertigation to the water they receive (chapter 5.1 and 5.12). Salinity of the treated wastewater leads to a soil salinity increase as well as to an enrichment of sodium, chloride and sulphate ions implying a change in the soil solution composition. Finally, increase of electric conductivity and accumulation of heavy metals in the TWW could lead to the restriction of certain crops, especially those which are sensitive to salt.

4.4.3.3 Risks of Industrial and Urban Pollution

Due to the limited development of industries, concentration of toxic elements is far below the Jordanian standards in both groundwater and most surface water out of the Zarqa River. However, in the Amman Zarqa basin where 450 industries are concentrated in 400 km^2, dumping of highly concentrated wastewater and of municipal sewers in limited surface flow is worrying.[52] In absence of facilities for proper disposal of hazardous waste, most industries are forced to store on site, which is a potential threat to ground and surface water quality.

[51] There are 19 treatment plants within the country.

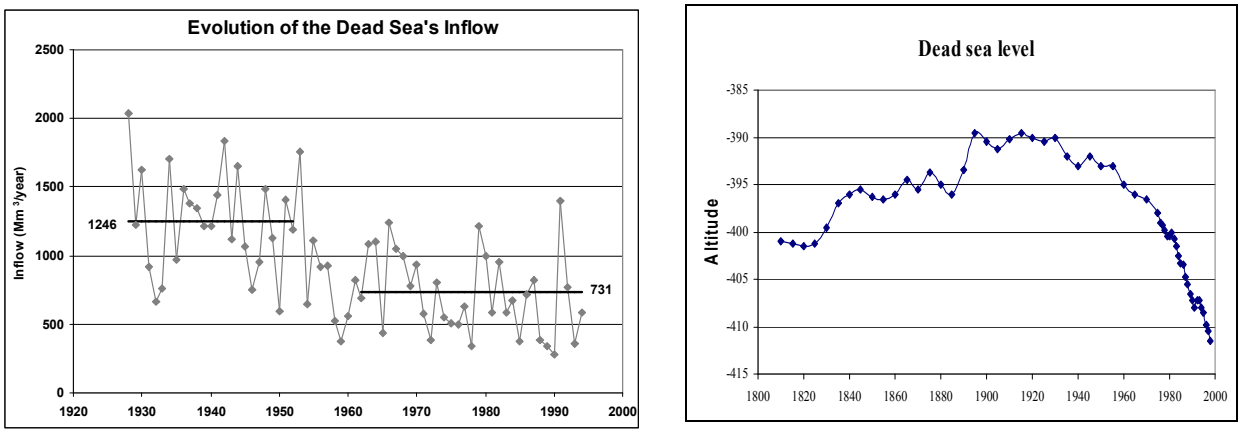
[52] The index of toxic discharge per unit of water availability calculated by the World Bank "Industrial pollution Project system" is for example 1,392 in Jordan when it is only 100 for Egypt.

In Jordanian cities, and especially in Amman, solid waste is regularly collected and dumped in landfills constructed by the Municipalities. But until now, there isn't any protective lining and no inspection on entry when solid waste is disposed in the landfills. This creates potential for serious contamination of ground water aquifers by leaching (heavy metals, salts …). After achieving -during the 1970s and the 1980s- the main priority goal of distributing good quality domestic water to the whole population, a lot has been done in the last 20 years to develop collection network and treatment plants to treat urban waste water. Donors have strongly participated in these two phases (chapter 4.5). Today waste water quality is about to be controlled and groundwater to be protected from the main threats. However, examples of severe degradation of water resources quality due to human exploitation have been observed in some areas in Jordan and this problem is expanding. Public authorities have been generally able to control all the appearing problems especially for domestic supply but existing solutions appear to be very expensive (water purification processes, nitrate removal through ion exchange, ultra filtration, and desalination through reverse osmosis ...) and thus difficult to develop for all the situations in the country.

4.4.4 Exploitation of the Dead Sea Resources

The Dead Sea is an inland water body that is the terminus of the Jordan River, collecting all the water non-committed to any particular use within the basin. Due to water exploitation, this inflow has continuously decreased since the 1950s and will continue to do so. The inflow to the Dead Sea at the beginning of the 1950s has been evaluated at 1,285 Mm^3/yr. It now only reaches 315 Mm^3/yr and it is expected to further decrease to only 200 Mm^3/yr at the 2020 horizon (chapter 4.2 and VI). This decreasing inflow has led to a decline in the Dead Sea water level from about 392 m below mean sea level in 1958 to about 411 below sea level in 1998 (Figure 4-11 and Figure 4-12).

Figure 4-11: Historical evolution of the annual water and level of and inflow to the Dead Sea.



Source. Left panel from Arab Potash Company (personal communication) and right panel from Harza JRV group (1998)

Surface and groundwater resources within the Dead Sea basin catchment area (excluding the Jordan River) have also been overexploited, severely compounding the decline of the Dead Sea water level. The Dead Sea groundwater basin has been exploited at 365% of its annual recharge in 2004 (abstraction of 92 Mm^3 for an annual recharge of about 25 Mm^3/yr -MWI-database; chapter 4.2). Extraction of potash and other valuable salts on the two banks of the Dead Sea is done in evaporation ponds depleting 200 to 300 Mm^3/yr: this is responsible for nearly one third of the Dead Sea level decline (Orthofer, 2001a). Extraction companies contributing to the current drop in sea level are also

affected by it mainly because of related land collapse and percolation losses (Harza JRV Group, 1998). Surrounding groundwater aquifers have higher levels than the Dead Sea. Further drop of the Dead Sea level will thus increase the existing hydraulic gradient.

The Red-Dead project (chapter 6) is expected to have major positive environmental impacts. It includes the restoration of the Dead Sea level to its natural, pre-1960s level, thereby enhancing the potential for tourism. This will also enhance the habitats of the unique flora and fauna that inhabit the pockets of freshwater between the springs and the Dead Sea. The most ecologically important of these species are threatened birds such as the Griffin vulture, lesser kestrel, as well as vertebrates such as leopards, hyenas, the Nubian ibex, rock hyrax and jungle cat (GCEP, 1998). According to Salameh and El-Naser (2000) raising the level of the Dead Sea will result in refilling groundwater aquifers along the coastline, which is another anticipated positive impact. However some environmental NGO that are supporting the project have questioned the environmental benefits of such transfer and call for an extensive assessment (FOEME, 2007).

Figure 4-12. Terraces on the Dead Sea Shore show a receding Sea level (Source. Remy Courcier, 2004)

It will result in an increased drainage of groundwater into the Dead Sea, and in an increased salinization of the upper aquifers (Salameh and Naser, 2000). Dead Sea level decline has also resulted in expanses of barren, hyper saline mudflats, which have led to a reduction of tourist landscape values in the surrounding areas. The tourism sector has therefore been negatively affected, as the Dead Sea shore constantly recedes further away from the hotels surrounding it.

4.4.5 Degradation of the Aquifers

As seen in chapter 4.2; overexploitation of water resources is affecting the nation resource base and future sustainable uses are jeopardized. This is clearly the case for “non renewable” or fossil aquifers (the Disi aquifer in the south of the country) but it also holds for the disappearance of accumulated stock of water in renewable aquifers..

Figure 4-13: Sinking Hole in Mazra on the Sea Shore of the Dead Sea (Source. Remy Courcier, 2004)

A spectacular case of these phenomena are the 'sinking holes' affecting many areas around the Dead Sea (Figure 4-13). The aquifer is highly brackish yet used for agricultural purposes after desalinization but there are no plans to rehabilitate such reservoirs. hese unpredictable land collapses have strongly affected agricultural plantations, irrigation networks, and tourist facilities, especially on the Israeli side of the Dead Sea. They are one of the more intense environmental problems due to water resources over exploitation.

Beside the degradation of groundwater quality, the aquifer itself is degrading. In many cases, when an underground reservoir is emptied, vacuum is created and the soil may subside, affecting the storage capacity of the aquifer in the future. It is highly difficult to evaluate such degradation and to precisely forecast how it will evolve if the aquifer is to be refilled.

4.4.6 Use of Water Resources in the Azraq Oasis: an Environmental Disaster

In 1977, the Azraq oasis has been included in the Ramsar list of wetlands of international importance for its role in bird migration patterns. It is also a protected area under the mandate of the Royal Society for Conservation of Nature. There are no local laws protecting this site from development projects, but some international regulations as the Ramsar Convention and the Convention on Biological Diversity should, in principle, regulate any intervention in the Oasis.

Abstraction of groundwater from the Azraq basin started in 1982, when the Amman Water Sewerage Authority (AWSA) drilled fifteen wells within the northern parts of the Azraq Oasis in order to meet Amman and Zarqa domestic water needs. In the area surrounding the oasis, water is also pumped for local irrigation. Annual groundwater recharge has been evaluated at 40 to 45 Mm^3/yr (THKJ, 2004) on which 25 Mm^3/yr occurs in the Azraq oasis area (Fariz and Hatough-Bouran, 1998). Total abstraction exceeds the annual recharge since the early 1990s when the four springs of the oasis dried up (1993).

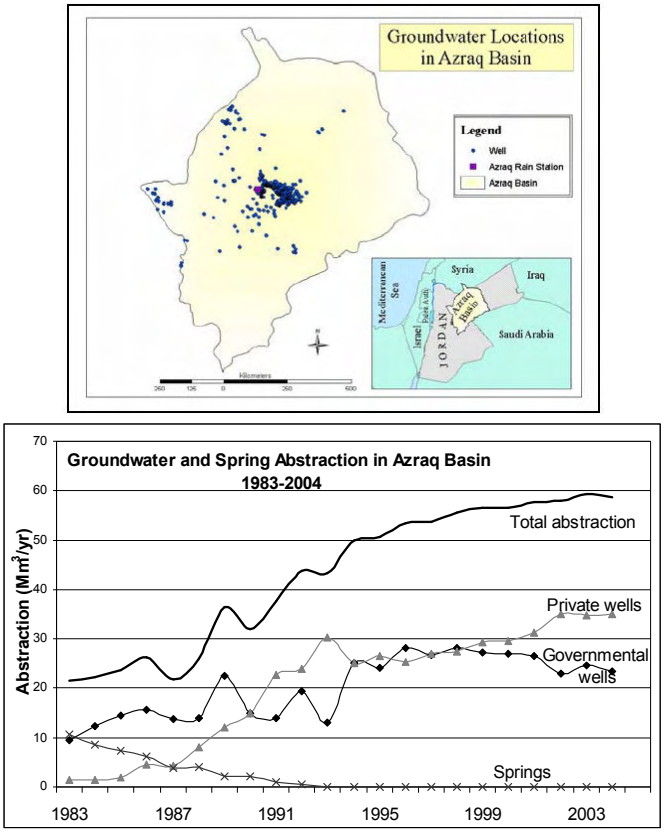
Before the drying up of springs, the reserve contained water birds and more than twenty species, which could be found in important numbers according to international standards (Ramsar Bureau, 1998). Endemic fish and plant species such as the Azraq Killifish (*Aphanius sirhani*) could also be found. In order to protect this remarkable ecosystem, the Ramsar Bureau visited the site in 1990 and recommended the following water-related measures to be implemented after a proper environmental impact assessment study: (i) a reduction of groundwater exploitation: total annual exploitation should not exceed the 'safe yield' of the oasis; (ii) a control of private wells extraction; (iii) a pumping of small volumes of water from middle aquifer to supplement spring flow into the wetland; (iv) further research on the hydrology and the geology of the oasis; (v) an increase in water distribution efficiency; (vi) the construction of storage reservoirs to promote groundwater recharge (Ramsar Bureau, 1990).

Following these recommendations, a plan for the rehabilitation of the wetland was initiated in 1994: the government started supplying the oasis with 1.5 Mm^3/yr pumped in the north of the site, in the middle aquifer. Nevertheless, this amount is not sufficient to offset the impact of the ongoing over-

abstraction. This rehabilitation program also aimed at protecting the wetland by fencing and guarding it; at promoting research, monitoring activities, local participation and public awareness and at developing the tourist industry in a culturally and naturally rich region (the Azraq fortress and the Shaumari natural reserve where Arabian oryx, ostrich, gazelles and onagers can be observed are attracting many tourists and this benefits local livelihoods)

Figure 4-14 shows the location of wells and history of water use in the Azraq basin since 1983. Total abstraction in the basin almost tripled in 20 years: it increased from 21.6 Mm^3/yr in 1983 to 58.5 Mm^3/yr in 2004. This over-exploitation led to a drop in the water table by 0.3 to 0.8 meter per year (HCST, 1999); to a dramatic salinization of the aquifer (Ramsar bureau, 1998) and to the drying up of the wetlands. Most wells are surrounding the oasis; governmental wells are used for domestic supplies while most private wells are used by settled Bedouins to irrigate small plots of vegetables and olive trees (chapter 5.1). The number of wells did not evolve since the mid 1990s.

Figure 4-14: Location and volumes of groundwater and spring abstraction in Azraq basin (Source for left panel: Bajjali & Al-Haddidi, 2005; source for right panel: MWI-database)



Due to increasing awareness of environmental degradation, governmental abstraction has decreased since the mid 1990s (Figure 4-14). Transfers to Amman and the cities of northern Jordan still exist but are expected to be discontinued in 2025 (chapter 4.2 and VI). However, despite several governmental decisions to limit agricultural groundwater abstraction (chapter 5.3); private exploitation is still increasing, even if at a slower pace. In the Azraq region, many farmers do not have licenses to abstract groundwater: the implementation of the By-Law No.85 of 2002 considering lower quotas in the Azraq basin than in other regions of Jordan (100,000 against 150,000 m^3/yr; chapter 5.3) could strongly affect local agriculture and significantly decrease ground water over-abstraction.

4.4.7 Soils Degradation

4.4.7.1 Soils Salinization

Soils in the mountains, plateaux and valleys of Jordan generally have a good drainage capacity; therefore soils salinization is not a major environmental problem. In some areas of the Jordan Valley, high content of clay has forced the JVA to install drainage network. This has never been necessary in the Highlands. Generally, in order to reduce the risk of lacking water and fertilizers in any part of their fields (low uniformity of the system), and to irrigate too late or too little, farmers apply 30 to 50% more water than the effective consumption of crops. Rains also contribute to soil leaching. Therefore, the leaching fraction is generally much higher than needed and the transfer of salts to deeper layers used to be effective to keep upper layers free from salinization processes. Problems of groundwater salinization are however recurrent in small overexploited aquifers in desert areas and in the south of the Jordan Valley. Moreover, increasing use of TWW and decreasing freshwater allocation, notably during dry years or dry periods, increase the risks of soil salinization that are also contaminated due to excess use of fertilizers (chapter 5.2).

4.4.7.2 Concentration of Heavy Metals

Using TWW for irrigation may concentrate heavy metals and toxic elements in the soil. However pH of soils in the Jordan Valley is high (generally more than 8.0) and risks are much less than in acid soils. Even if some farmers already complained about heavy metals concentrations in their soils and plants, all concentrations of heavy metals in irrigation water and in soils are far below EPA[53] and Jordanian standards. Some local studies have been done (Shatanawi, 1994 and 1996) but need to be completed. The recent GTZ-JVA project on reclaimed water use in the Jordan Valley (2000-2003) has already made technical proposals for farmers using waste water and may produce additional information on of the status of heavy metals concentration in soils and crops.

4.4.7.3 Soil Erosion

If soil salinization is not a major environmental problem in Jordan; soils are highly eroded, notably in the mountains area. This impacts water management by increasing the concentration of suspended solids in surface water and the sediment-loads in reservoirs. Many existing dams have been raised in order to increase their capacity but also to compensate the storage capacity lost because of their rapid filling with sediments. Solutions given to this problem are mainly based on reforestation. During the 1980s, diverse projects have been implemented but their results are not convincing and protection of soils continues to be almost zero.

4.4.8 Threats on Flora and Fauna

4.4.8.1 Landscape Changes and Deforestation

In the past, most of the basin area was covered by forests and rainfed vegetation (chapter 3 and 5.16). Only very dry areas in the east may not have had a complete vegetal cover. But, during the last fifty years, almost all the trees have been cut and replaced by range land or rainfed agriculture except for a few thousands hectares of pine and oaks forests (the Dibin forest) in the highest and wettest areas of

[53] US Environmental Protection Agency

the basin (around the cities of Jerash and Ajloun; chapter 2). On another hand, fruit trees plantation in the north of the Jordan Valley and on the plateaux in the Highlands participate to a recent 'human induced' landscape that could also be affected if policies to reduce agriculture water use are implemented (chapter 5.3 and VI). In the Jordan Valley for example, date palm trees may progressively replace citrus and banana plantations (chapter 6).As the basin landscapes have a growing importance due to their tourist value, notably near the Dead Sea and the Azraq oasis, their degradation has negative economic impacts. Hyper-saline mudflats that appeared due to the drawdown of the Dead Sea and the progressive drying up of the Azraq oasis have negatively affected the local biodiversity and are threatening the still high profitability of the local tourism industry. This might motivate high investment from tourist entrepreneurs to bring additional water to these areas (chapter 6).

4.4.8.2 Overgrazing

Not only tree cover is impacted by industrial and agriculture development. Rangelands in semi-arid areas have also dramatically disappeared due to recurrent ploughing and sowing of barley to produce fodder for livestock. In the 1980s and 1990s, programs to support herders thanks to subsidized imported fodder (Pitman, 2004) led to an increase of the Jordanian flock size from 1 to 3 million. This put further pressure on rangelands increasingly grazed and the government stopped this program..

Figure 4-15: Overgrazing in the South of Jordan (Source: Adrien Peyre, 2005)

Flock size has dropped back to 1.4 million but overgrazing is still recurrent in Jordan (Figure 4-15). It is only in some military controlled areas, notably nearby Mafraq and close to boarders that rangelands are preserved from overgrazing. The road in Figure 4-15 delineates two zones: on the left a military zone protected by fences where vegetation still remains; on the right a free-grazed area where bare lands have replaced the natural vegetation.

4.4.8.3 Wild life

Building dams has already significantly damaged various ecosystems, especially around the Dead Sea as in the case of the Mujib dam. Some natural reserves (Dana, Mujib, Eastern desert, Ajloun…) have been created and are managed by the Royal Society for Conservation of Nature (RSCN). Some new "protected areas" may still be established but their extension is very limited and most of the wildlife has been drastically reduced by deforestation, overgrazing, extension of rainfed mechanized crops and hunting.

4.5 Institutions for Water Management

The different institutions involved in water management in Jordan are briefly described here. Despite the existence of institutional and legal instruments, many laws and By-laws remain not implemented. This partially explains the water over-commitment in the basin.

4.5.1 Government Agencies

Until the irrigation boom in the 1960s, no public state institutions were requested to manage the use of water resources in Jordan. Human settlements have always been developed close to permanent drinking water sources (generally springs and sometimes wells) and agricultural use of water resources only appeared where large quantities of water were available. Volumes of water used basically depended on the population of the area and on the investments made (weirs to divert a part of the existing flow and canals to transport it to the fields). Whoever was able to peacefully reclaim an area and to build the necessary infrastructures received the right to do so (chapter 3). Traditional "Islamic laws", mixed with customary laws, were used to solve conflicts between users and were sufficient until the pressure on water dramatically increased with the development of new techniques, which allowed easy transfers of large quantities of water over long distances (pumps and pipes, trucks with water tanks, deep boreholes, etc.; chapter 3 and 4.12).

The need for a public administration managing water appeared first with the development of collective networks for the distribution of drinking water in the cities, and later with wastewater collection. Initially, only the municipalities had to organize services to control the distribution of drinking water (control of water quality, leakages, fee collection, etc.). With growing development and the need to mobilize new water resources, the scope of the administration exceeded the limits of the municipalities. The biggest cities had to transport and use water resources from neighbouring areas and a national service had to be created to administrate possible conflicts and competition.

The "Central Water Board Authority" was created in 1960 and the "Water Supply Corporation" in 1973 in order to regulate water services in the whole country. Only in Amman, and until 1983, did the municipality remain in charge of water services (AWSA law 977). Finally, in 1983, all water services have been transferred to the Water Authority of Jordan (WAJ). From the 1960s onwards, a distinct administration was set up for water distribution and other services in the Jordan Valley. Many of these services have now been transferred to national institutions (Ministry of Agriculture, Ministry of Planning) but the Jordan Valley Authority (JVA) is still responsible for the management of surface water in its area. The administration of water resources in Jordan is thus divided between the JVA and the WAJ.

4.5.1.1 The Jordan Valley Authority (JVA)

This institution created in 1977 succeeded to the Jordan Valley Commission (JVC) and was initially in charge of the development and operation of many public infrastructures in the Jordan Valley area: roads, schools, health centres, domestic water supply, telecommunication and electricity networks, tourist facilities, marketing centres for agricultural products (chapter 3). In 1988, a law modified the status of the JVA and during the 1990s almost all these services were gradually transferred to other national agencies (THKJ and JVA, 1988a). The JVA remains now in charge of the collection and distribution of surface water to farmers and cities, of the development of tourism and of land use planning in the area. It controls water delivery to almost half of the total irrigated area in the LJRB and a third of the drinking water used in Amman.

4.5.1.2 The Water Authority of Jordan (WAJ)

It was created in 1988 (THKJ and WAJ, 1988; a preliminary law in 1983 was enacted and constitutes a milestone in the formation of this public agency). It is the national government agency in charge of providing water supply and sewage services in the whole country; of regulating groundwater use, the

production and distribution of drinking water; and of collecting and treating all wastewater in the country.

4.5.1.3 The Ministry of Water and Irrigation (MWI)

It was created in 1992. It is covering the two institutions presented above and assumes the coordination of the management of all national water services. Its mandate includes: formulating policy and strategy; planning water resources development; procuring financial resources; carrying out research and development; conducting socio-economic and environmental studies; monitoring water and wastewater projects; implementing human resource development and public awareness programs and finally, establishing information systems. The MWI centralised planning and policy making and highly reduced the existing overlapping of responsibilities. This authoritarian centralization allowed resolving differences of water resources development between JVA (irrigation oriented) and WAJ (urban water supply oriented) by creating a common culture of management. Both institutions however continue to face various problems to operate and maintain the systems they have to manage:

- **Low services for water:** For the JVA, irrigation water supply revenues cover about two thirds of Operation and Maintenance costs. Ultimately, if we consider total expenses (operation, maintenance and depreciation costs), cost recovery from tariffs has been estimated at 50% for the whole water sector (including JVA Irrigation water supply and WAJ waste water collection and municipal water supply; THKJ, 2004). Public subsidies to the water sector (to the two operators WAJ and JVA) amount to US$ 85 million per year (THKJ, 2004). Such subsidy has to be compared with the total deficit of the national budget (US$ 280 to 420 million per year in the last 3 years).

- **Overstaffed Agency:** too many unskilled personnel have been employed and the number of employees for 1,000 farmers, or 1,000 house connections, is far above standards. At the same time there is a clear lack of skilled personal for technical support and management, notably at the highest level of management.

- **Inadequate and inefficient Operation and Maintenance:** inadequate pressure in networks creates uneven deliveries, inadequate water quality and too frequent high water losses due to leakages and breakages in the networks, intermittent and irregular water deliveries etc. Illegal connections are also common and negatively affect the functioning of the networks (chapter 5.2 and 5.14)

- **Poor billing and collection services:** problems are diverse: customers (household or farmers) do not receive bills on time and it delays their payments. Non-paying customers are rarely disconnected (especially for irrigation) from the service and public services avoid going to court to recover their bills (chapter 5.2 and 5.14)

- **High operating costs**: water coming from long distances needs high elevation and that leads to high costs (chapter 4.2 and VI)

It has been recently suggested that, in order to improve the quality of service, administration should be transferred whenever possible to local or private bodies. The two public institutions could keep, when possible, the task of regulating and coordinating these services. This institutional disengagement was mainly considered for urban water supply: the transfer of the management of the Greater Amman water facilities to a private company (LEMA) in 1999 was the first step in this direction but in 2007

the management of Amman drinking supply returned to WAJ. In the agriculture sector, privatization is less attractive but some responsibilities in the management of irrigation facilities in the Jordan Valley have also been transferred to farmer's organizations and water associations (chapter 5.2). This has not yielded the expected results.

Various new proposals for a transfer of responsibilities to the private sector have been recently developed or envisaged but a lot still needs to be done to develop this process. We can mention: (i) the creation in 2004 of a public company for the distribution of water in the city and industrial zone of Aqaba (ASEZA), (ii) the preparation of the participation of the private sector in the management of urban water utilities in the main cities of the North (2002-2004), (iii) the preparation of an eventual management transfer for irrigation services in the Jordan Valley (this transfer envisaged until 2003 has been now abandoned), (iv) a BOT investment for As-Samra sewage treatment plant, (v) a private participation to the DISI aquifer exploitation for drinking purposes in Amman, etc.

4.5.1.4 The Ministry of Environment

Several environmental problems are related to water management (chapter 4.4). The Ministry of Environment has been newly created (2003) but will probably acquire growing importance in the management of water resources.

4.5.2 Cooperation and Funding Agencies

Two thirds of Jordan investments in the water sector are financed by foreign loans. Foreign aid, through "soft loans" and grants (especially for technical assistance and studies) has been of utmost importance for the Jordanian government to develop and maintain its water services until now (Nachbaur 2004). This support was seen as a mean to stabilize the region and has been principally politically justified. Due to the need to support resettlement of large displaced populations and to guarantee a stable country in the region, Jordan has received and is still receiving important financial and cooperation support from many donors (chapter 3). These are International agencies (World Bank, European Commission; European Investment Bank –EIB-, Arab institutions…); developed countries (Arab and Western supporting countries) and private companies signing "Build Operate and Transfer" (BOT) contracts.

Through soft loans and grants, American public support to the Jordanian water sector is by far the largest of all, (50 to 80 millions dollars a year)[54]. It has supported many large projects, including in the past the Jordan Valley dams, canals and irrigation system and, more recently, almost all present and future development projects. American aid is also directed towards many technical assistance projects in association with related institutions (JVA, WAJ, MWI) on all the main issues faced by Jordan: water resources management, information networks, training of technicians, public awareness, reuse of treated wastewater, extension services, private sector participation (Appendix 4).

German aid is second bilateral aid in importance. Like the American government, the German government supports several investment projects (through its funding agency KFW) and many technical assistance projects (through its cooperation agency GTZ in close relation with the Jordanian administration). Japanese aid (through its agency JICA) is also very important and Japanese funding has many times been associated to American or World Bank projects. Other countries such as France

[54] Until 2002, the cumulative aid reaches nearly US$ 390 million.

(through the AFD [French Agency for the Development] and the MREA, notably), Italy and Canada (through the IDRC) fund diverse development projects.

The World Bank (WB) was one of the major investors in the first irrigation projects in the Jordan Valley. It has later financed many infrastructures in the country and has recently concentrated its efforts on management projects (regional development projects, transfer of Amman water utilities management to a private company, horticultural Export Promotion Project, etc.). The World Bank is one of the main partners financing the rehabilitation of the drinking water network in Amman (Appendix 4). It is also supporting the main new projects like the "Disi-Amman" project and the feasibility studies of the "Red-Dead" project (chapter 6). In 2002, Jordan did not accept a loan prepared by the WB for the Jordan Rift Valley Improvement Project studied with JICA funds, arguing that the cost of the funding was too high and the economic returns not guaranteed. The European Aid is relatively recent but it is already important (an aid package of US$250 million was signed in 2000, of which 61 millions or Euros are lent by the EIB). The largest European funding is the EIB participation to the Greater Amman Water sector improvement project. Moreover, European programs fund many technical training and scientific researches in Jordan and in the region. A Euro-Mediterranean Water information system (EMWIS) has also been implemented. Finally, most recent investment projects in the water sector have been funded by important loans at reduced prices obtained from Arab banks with the support of their governments. It is said that it is the case of the construction of the "Wehdah dam" and the "Disi-Amman" project. But in contrast with Western aid, very few of this support is publicized, although the amounts may be even larger.

4.5.3 Non Governmental Organizations (NGO)

With such centralized bureaucratic planning in the water sector, there has always been little room for manoeuvre from private or non governmental initiatives. Jordanian NGOs are very few and undeveloped. Most of them are working with the main social issues in the country (refugees, poverty areas, social difficulties…) and the NGOs specialized in the water sector are virtually nonexistent. For example, there is hardly any association representing water users in the cities or in the irrigated areas. Some attempts to develop cooperatives and committees representing the farmers using irrigation facilities in some areas of the Jordan Valley are very recent and experimental (chapter 5.2). A new (2004) NGO named "Jordanian association for the conservation of water", apparently focused on the Jordan Valley, is an example.

Several Jordanian NGOs exist in the environment sector: The "Royal Scientific Society" (RSS) is the most famous "independent" organisation, with efficient laboratories and technical staff. It has its own research interests and is often contracted by public institutions for environmental monitoring programs like, for example, the monitoring of water quality in the KAC for JVA. The Royal Society for Conservation of Nature – RSCN is another efficient institution focusing on wildlife conservation and ecological projects. Another important Jordanian NGO in the sector is JES (Jordanian Environment Society), which has executed several public awareness projects on water. International NGOs are very few in number. FOEME (Friends of the Earth Middle East) is very active in the Palestinian Territories and in Jordan and has notably made an important study for IDRC (International Development Research Centre –Canadian Cooperation) on the possible local impacts of the "Red Dead Project" (FOEME, 2007). This allowed an important meeting between the stake holders (MWI-JVA, Palestinian Water Authorities, Israeli Ministry of Public Works, World Bank, other donors).

4.5.4 Legal Framework

Current legal responsibilities with regard to water resources monitoring and planning have been defined through specific laws for JVA, WAJ and MWI (THKJ and JVA 1977 and 1988; THKJ and WAJ, 1988; THKJ and MWI, 1992). The Jordanian Institute for Standards and Metrology, in cooperation with representatives of the Ministries of Health, Water, and now Environment is charged with the duty of issuing standard specifications for the water sector (drinking water quality, treated wastewater qualities…).Recently a new JVA-by-law authorized a private sector participation in the management of water resources in the Valley (farmers' organisations or companies…) and authorized the transfer of properties of irrigated farms when they allow the creation of larger farms (THKJ et al., 2004). Another new WAJ-by-law was issued in 2002 fixing fees to be paid for excessive ground water abstractions (THKJ et al. 2002; chapter 4.3).

The lack of legal instruments is not the main problem. Many laws and regulations exist and are adapted but they are not implemented as they should due to social resistances, technical difficulties, or very high cost of enforcement (chapter 6). This is illustrated by the following examples:

4.5.4.1 Difficulties to Implement Limits on Groundwater Exploitation

Control and ban of drilling new boreholes or wells (since 1992) have not been implemented in some areas where the water is relatively shallow and sometimes of poor quality (south of the Jordan Valley, Azraq and other desert areas). Limits of groundwater abstraction defined in the licenses have generally been very much exceeded. Moreover, some well owners sell water from their wells to neighbouring farmers even if it can officially only irrigate the licensed area (chapter 5.1 and 5.13). Others sell water from agricultural wells to tankers, who sell it for domestic uses without permission and without paying the proper taxes.

4.5.4.2 Difficulties faced by the JVA

Even if the law authorizes JVA to suspend the delivery of water to a farmer who is not paying his bill, repeatedly stealing water, or damaging the JVA equipment, farmers generally can resort to courts in order to obtain the water delivery back based on the traditional "law of thirst" (Stephan, 2001). In these cases, the JVA has lost many local legal processes and this has severely undermined its authority and management capacity.

4.5.4.3 Difficulties to Transfer Responsibilities: Decentralisation and Privatization

The recent development of private sector participation in the water sector and the different kinds of management transfers to local decentralised public institutions or to water users' organisations may soon require an additional by law in order to better define these transfers of responsibilities.