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THE ROLE OF WOMEN IN IRRIGATION MANAGEMENT AND WATER RESOURCES DEVELOPMENT IN JORDAN

S. Al-Naber* and M. Shatanawi**
* Research in irrigated agriculture, Faculty of Agriculture, Amman University of Jordan
** Professor in water resources and irrigation, UNESCO Chair, Amman University of Jordan

ABSTRACT – Jordan is a middle-income country with a per capita income of $ 1.666 and a population of approximately 5.5 million. In Jordan, water is the single most critical natural resources where the per capita share of water is less than 175 cubic meter per year. The water scarcity is exacerbated by rapid population increases, the growing industrial and services sectors, inefficient irrigation practices and inefficient water management and use. The renewable water resources that can be developed are approximated at 800 MCM from surface and groundwater. The actual water demand of 1150 MCM is being met by over pumping (160 MCM), exploiting fossil water (80 MCM) treated wastewater (80 MCM) and desalinated brackish water (30 MCM). With an irrigated area of about 76,000 hectors, agriculture consumes about 65% of the available water. Therefore, efficient management of irrigation water is the key solution to the water crises.

In addition to limited natural resources and water scarcity, about 25% of the population live below poverty line and the unemployment is high of more than 20%. People are Jordan's main resources where most of them are concentrated in urban areas. In spite of this, the well being of the Jordanian women has improved significantly over the past two decades as reflected by their increase participation in the labor force, higher life expectancy, improved educational attainment and decline in fertility rate. Women represented about 16% of the total labor force in 2002, where their employment has shifted from teaching, nursing and financial activities to social services, agriculture and water management. About 40% of the working women are employed by the government. The general umbrella for women movement is the Jordanian National Committee for Women (JNCW) and Jordan National Forum for Women (JNFW) headed by Princess Basma. Focus of the women movement concentrates in three areas: poverty alleviation, better integration of women into economy, and strengthening of women's political participation and legal rights.

The role of women in the management of water resources is very important in countries of extreme water scarcity like Jordan. The involvement of women in managing small scale irrigation projects has improved the efficiency of water use. They are also involved in other activities like; water harvesting, soil and water conservation and rehabilitation of spring in order to raise productivity and produce cash crops.

The formal structure of addressing women involvement in irrigated agriculture consists of a number of aspects. The ministry of Agriculture has established a gender unit to increase the role of women in the agricultural development. International organizations such as IFAD and GEF/SGP have implemented several projects in water and irrigation aiming at poverty alleviation and women participation. On the other hand the number of NGOs working with women in agricultural and rural development has increased significantly. The ultimate goal of the NGOs is to transform income generating project into sustainable enterprise development. This paper describes the activities carried out by a number of NGOs.

Women as decision makers, extension engineers and researchers can play an important role in improving irrigation management at the farm level. Women in the public sector (Ministry of Water and irrigation and Ministry of Agriculture) have demonstrated high level of performance on irrigation project management and extension services. Examples of women involvement in irrigation and the management of the scare water resources are presented. They range from using harvested water, gray water and spring water for irrigation of income generating farming.

This paper also discusses different practices (technical and behavioral) where the family can do at the home or in the farm in water conservation. These include using water saving devices, gray water reuse, landscape irrigation, and on farm irrigation management. The paper present few successful

case studies from Jordan concerning water education for water conservation. Examples from different parts of the world will be presented that shows how the family efforts affect the water use more efficiently.

INTRODUCTION

Jordan is one of the Middle East countries that is located to the east of the Mediterranean sea. It is bordered by Syria to the north, Iraq to the east, Saudi Arabia to the east and south, and Palestine and Israel to the west. The Gulf of Aqaba on the Red sea is the only access for Jordan to the open waters. Jordan lies between latitudes 29 N and 32 N and longitudes 25 E to 39 E. The total land area of Jordan is about 89,400 square kilometers with a population of about 5.48 million (2003). The topographic features of the country are variable with approximately 80% of the total area is steep mountainous or steppe arid land (Badia).

Jordan can be divided into three distinct regions from west to east: the Jordan Rift Valley (JRV), the Plateau, and the semi-desert or the badia region. Being a part of the Great Rift Valley, JRV runs from lake Taberia in the North to the Gulf of Aqapa to the south. Officially the area bounded by elevations of 400 m below sea level and 300 m above sea level is called the JRV, which contains the Jordan Valley north of the Dead Sea (DS), the DS area, the southern Ghors south of DS and Wadi Araba (running from the upper point of the southern Ghors to the Gulf of Aqapa). The Jordan Valley and the southern Ghors are the major irrigated area of about 33,000 ha with a potential of 43,000 ha. The plateau is situated immediately to the east of JRV where its elevation varies from 300 m to about 1200 m. The plateau comprise of a narrow strip running north to south and varying in width from 25 to 40 km. The remaining part of Jordan (about 90% of the country) is low rainfall semi desert area which is called locally "the Badia Region". Rainfall in the Badia region is sparse and erratic ranging from less than 50 mm to 200 mm and is sufficient to give a thin and occasional vegetative cover useful for short periods of grazing.

Rainfed agriculture is practiced on the arable lands in the plateau with average annual precipitation of more than 300 mm. Irrigated agriculture can be found in limited areas where irrigation water is supplied from the base flow of the side wadis, springs or local wells. State and private forests can be found on the mountains and steep rocky land but they comprise only 1% of the total area of the country. The range land area, of annual rainfall between 200 mm and 300mm, represents about 5% of the total area of Jordan.

In general, only 4% of the total area of Jordan can be put into cultivation through rainfed agriculture in years of sufficient rainfall. The actual cropped area was 306,000 ha in 2000 compared to 380,000 ha in 1970. Areas developed for irrigated agriculture amounts to approximately 76,000 ha. Of this total, 33,000 ha are in the Jordan Valley and the southern Ghors which are primary developed by the Government. The rest of the irrigated area of about 43,000 ha has been developed by the private sector in the plateau and the Badia regions depending mainly on groundwater.

The population of Jordan has reached 5.48 million by the end of 2003. This is over ten times the population in 1952. The total fertility rate has declines from 7.3 children per family in 1976 to 3.6 in 2002 and the current natural rate increase is 2.3 percent, with total population growth rate of 2.8 percent. This will lead to a doubling of the population by about the year 2030. The population momentum poses sever demands on Jordan’s limited water resources and is a key factor in the current high rates of unemployment and under-employment. The per capita income is $ 1.666 per year and the Human Development Index (HDI) ranked Jordan at 88 in 2001 with a score of 0.714. The population is well educated with a literacy percentage of 90% and life expectancy stands at 71 years.

WATER SITUATION IN JORDAN

With an annual per capita share of 175 cubic metes, Jordan is one of the most water scarce countries in the world. Consequently, water is the single most critical natural resource since virtually all aspects of sustainable economic, social, and political development in the country depend on the availability of an adequate water supply.

Water resources consist primarily of surface and ground water sources. In recent years wastewater has increasingly been used for irrigation. Surface water resources in Jordan vary considerably from year to year. The long-term average surface water flow is estimated at 710 MCM/year, comprising of 454 MCM/year base flow, and 256 MCM/year flood flow. Of these only an estimated 480 MCM/year is usable or can be economically developed.

Groundwater resources amount to about 54% of the water resources of Jordan with an annual safe yield of the renewable groundwater supply estimated at 277 MCM. However, the actual withdrawal rate from these aquifers has reached 440 MCM. The over-draft has reached about 160 MCM in six basins. Consequently, the water level in these basins is declining and some aquifers are showing some deterioration of their water quality due to increased salinity. An additional 143 MCM per year are considered available from non-renewable fossil aquifers that are sustainable for a period between 50 and 100 years.

In a water-short country such as Jordan, wastewater is an important component of the country water resources. Generally, fully treated wastewater is suitable for unrestricted use in agriculture and for aquifer recharge. About 80 MCM/year of wastewater is treated (secondary treatment) and discharges into various water courses or used directly for irrigation, mostly in the Jordan Valley. Currently, approximately 55% of the urban population is provided with sewerage services.

The water use among different sectors is shown in Table 1. Demand is far exceeding the supply implying a growing deficit. The deficit is being met by over pumping from renewable aquifers, exploiting fossil water, and curbing use by rationing of the municipal water supply. The water scarcity is exacerbated by rapid population increases, the growing industrial and services (including tourism) sectors, inefficient irrigation practices, inadequate wastewater treatment capacity, and inefficient water management and use. Over the short term, the best and most cost-effective options for reducing the gap between demand and supply are improving the management of existing water resources and improving the quality and availability of treated wastewater for reuse.

Table 1. Water uses in Jordan in 2002 (MCM/year)

Resources Uses	Surface Water	Ground Water	Wastewater	Total
Municipal	60	220	-	280
Irrigation	290	250	60	600
Industrial	20	40	5	65
Others	10	10	5	25
Total	380	520	70	960

The Ministry of Water and irrigation is in charge of managing and controlling water resources. The ministry comprise of three entities: (1): The ministry secretariat responsible of planning and management, policy formulation and implementation, water allocation among sector, water master plan, human resources development, public awareness and international cooperation; (2) The Water Authority of Jordan (WAJ) which is in charge of water resources, management, water supply and distribution, and wastewater collection and treatment; (3) The Jordan valley Authority which is responsible of irrigation systems management in the Jordan Rift valley area and controlling of water resources within that area. The Ministry of Agriculture by its mandate is responsible for on-farm irrigation management and irrigated agriculture.

Efforts in community-based water management are always a major priority in Jordanian water policy. Experiences at the community level for the optimal use of water resources are spreading all over the country based on successful demonstrations. Now, the family particularly women are getting more involved in water conservation at home or in the farm.

Jordan needs to do whatever it can to effectively and efficiently use water resources it has. The Jordanian rural communities suffer most from lack of water, and they are being challenged on daily basis with the task of securing clean water and sanitation for households, farms and small businesses. Women are always responsible to carry there tedious job.

Farmers need to receive information about the latest technology in agricultural water conservation and crop selection. Decision makers need information about policies supportive of best practices and public support of these policies. Furthermore, the public needs to understand agricultural water conservation issues in Jordan, the water needs of farmers, and quality of food produced. A strategic and multi-dimensional education and communication campaign that addresses these key stakeholders and reinforces extension through broadcast and print media, internet access to information, and community mobilization techniques will help reduce the gap between water demand and supply. This is a role where women can do very well.

THE GENDER ISSUE IN ARAB REGION

Gender issues refer to any aspect governing the lives of women and men as well as the relations between them. In the second half of the eighties, after a several development programs, it was realized that the lack of participation of women in planning, maintenance and management has negative impacts on the quality of the services and on the overall position of women and their participation in development. As a result many projects began to take special measures to involve women in decision making and management of services. This greater focus of the participation of women is not without risk either from the above review of historical development and cases it is evident that neither an exclusive focus on men nor on women will work. Both approaches have led to ineffective and unsustainable services and behavior changes and have had undesirable effects on wider irrigated agriculture development (Karam and Stephan, 2002).

Gender issues must be integrated into all national policies to achieve equitable development for women and men. In developing countries, the gender issues mean more involvement of women in development and other economical activities. The region of Arab countries has witness social changes for the last three decades with respect to women. These changes are driven by social and economical reform as well as evolution of education. The status of women in the region is improving in many aspects such as education, participation in planning, execution, and evaluation of different development projects. They are also increasing in numbers as professional engineers, medical doctors, service providers as well as decision makers in different governmental and non-governmental organizations. Although their presence in the cabinet of ministers, parliament, advisory political councils, administrative local councils is still very low, nevertheless they managed to increase their acceptance by the people at the communities level in the different countries of the region. Women's power in controlling the family decisions should not be neglected although men in the region may not admit this role. Women are playing a very strong and dependable role in case of natural emergencies as well as their daily life chores.

The priority in gender issues in the Arab countries as described by ESCWA (2001) could be categorized under four main headings as:

Economic Life

- Unfavorable labor market conditions due to low economic activity and cultural stereotypes that preference males
- Limited opportunities for career promotions
- Wage discrimination
- Division of labor within the home and market place (women segregation and job feminization)
- Prevalence of women working in the informal sector and extent of under-counting of women's work by conventional measures

Education

- Socio-cultural heritage that reinforces gender discrimination within the home
- Female drop-out rate from the educational system and its augmentation among women
- Priority for men in training and acquiring experience

Law

- Prevalence of discriminatory legislation concerned with inheritance, marriage divorce and pension collection

- Inadequate implementation of existing legislation due to lack of enforcement mechanisms or bureaucratic inefficiencies
- Absence of measures and procedures conferring financial benefits or social security for the least fortunate groups in society, often girls and women
- Absence of measures curtailing child labor
- Existence of legislation inhibiting men/children to acquire the nationality of the wife/mother

Media Representation

Limited participation of women in radio and TV productions, possibly leading to biased messages being transmitted to the public

THE STATUS OF WOMEN IN JORDAN

The well-being of Jordanian women has improved significantly over the past two decades, as reflected by their increased (though low) participation in the labor force, higher life expectancy, improved educational attainment, and decline in the fertility rate. Nevertheless, important gaps remain, particularly in women's low participation in the labor force and in political life. Women represented just 16% of the labor force in 2002 and were employed primarily as community personal, and social services including activities such as teaching, nursing, and financial activities. About 37% of the working women are employed by the government. In 2002, the unemployment rate among women in Jordan has reached 21.0% (UNIFEM 2003). Low levels of formal economic participation may imply greater participation in the informal sector, although few data are available to substantiate these hypotheses. Still, it is an issue that deserves investigation

As shown in Table 2, the well-being of Jordanian women had improved significantly since 1980. This is reflected in the key indicators such as the drop in the total fertility rate and the increase in women's labor force and improved life expectancy.

Table 2. Jordan key Indicator, 1980, 1995, 2002*

Indicator	1980	1995	2002
Total fertility rate	6.8	4.8	3.7
Labor force participation (%)	20	25	27
Female percent of labor force	10	12	16
Primary school GER (%)	102	95	96
Maternal mortality (per 100.000 live births)	n/a	32	27
Infant mortality (per 100.000 live births)	82	36	22.1
Illiteracy (%)	n/a	21	10.3
Life expectancy (average years)	58	70	71

* Department of Statistics (2003)

The women's movement in Jordan is at an important crossroads that provides opportunities for strategic support to women and development. In the national program for Women, Jordan has outlined an agenda for advancing the status of women. An organizational structure consisting of the Jordanian National Committee for Women (JNCW) and the Jordan National Forum for Women (JNFW) is in lace under the leadership of Her Royal Highness Princess Basma. It is designed to provide leadership and coordination of a development program for women including the work of NGO's. The structure and program provide a broad framework for undertaking future activities.

WOMEN CONTRIBUTION IN AGRICULTURE

With an area of Jordan of 8.94 million hectares, the total area that can be put into cultivation through rainfed or irrigation is approximated at 0.38 million hectare representing about 4% of the area of the country. The actual cultivated rainfed area varies from year to year depending on rainfall but has reached 0.26 million hectare in 2002 while the irrigated area is about 76,000 hectare distributed in the Jordan Valley and Southern Ghors (33,000 ha) and the upland and the desert (43,000 ha). The importance of the agricultural sector in Jordan lies on its social and environmental impact rather than the economical contribution. Although agriculture is modest contributor to the GDP, it remains

important to about 15-20% of the population who rely on it as a major source of income. The share of agriculture in GDP at current prices was 3.7% in 2002 compared to 8.1% in 1990. The decline share of agriculture is a result of structural changes in the Jordanian economy. However, the contribution of the agricultural related activities in the GDP is estimated at 29% which include agribusiness services, inputs and agro industry.

The number of Jordanian working in agriculture has reached about 64,000 person in 2002 which represent about 6.3% of the total labor force. Labor is considered as an important factor in the production process of the agriculture sector. Traditionally the participation of women in the agricultural production has been very significant. They were involved in all activities related to the agricultural productions; namely seeding, weeding, harvesting and post harvest. At present, the role has been extended from family farmers to work as hired labors. Table 3 shows that the percentage of women in the agricultural labor force is about 10%, because most of them are casual labors where they work in irrigated agriculture in land preparation, seeding, fruit picking and irrigation technology.

Women work as casual labor in the irrigated agriculture in the Jordan valley where rural women play a key role in on- and off-farm activities in Jordan. This is particularly true in the case of the ecologically fragile areas, where women are becoming increasingly responsible for the day-to-day survival of the family.

Table 3. Distribution of Hired labor by type of labor, sex, nationality and age group in Jordan, 2002

Sex and age group		Permanent Labor		Seasonal Labor		Casual Labor	
		Jordanian	Non-Jordanian	Jordanian	Non-Jordanian	Jordanian	Non-Jordanian
Male	12-16 year	0	2	0	0	521	0
	Above 16 year	4592	10680	117	580	6772	34449
Female	12-16 year	0	0	0	0	0	0
	Above 16 year	189	106	100	10	5554	379
Total		4781	10788	217	590	12847	34828

The ownership of land by women is still at very small rate of 10.4% according to the Department of Land and Survey. Most of these ownership is a result of heritage rather than trade in real estate and are less than 5 hectares each. A study done by FAO (2003) has shown that 20% of the Agricultural loans were given to women representing about 12% of the total value which were directed for the support of small size projects. For training and extension, about 48% of the women has received training in agriculture especially in the low income area where most of development projects exist. About 60% of the extension services are provided by the Ministry of Agriculture. The female extension agents represent 20% of the extension services of the Ministry. About 38.5% of these services are executed by women.

WOMEN AND WATER RESOURCES MANAGEMENT

Women, who make up half of the world population, needs to participate more in defining policies and programs for sustainable development. The rapid socioeconomic and political changes that are taking place at the global level are producing many challenges and problems. It is very important to ensure that the gender prospective is well integrated into policy relating to all sectors of the economy and society.

Women play an important role in water management. They are most often the collectors, users and managers of water in the household as well as farmers of irrigated and rainfed crops. Because of these roles, women have considerable knowledge about water resources, including quality and reliability, restrictions and acceptable storage methods and are keys to the success of water resources development and irrigation policies and programs.

In many cases, water resource policies and programs have proven detrimental to women's water rights and, therefore, to their sustainable management and use. Interventions such as traditional irrigation fail to take into consideration the existing imbalance between men and women's ownership rights, division of labor and incomes. By raising the value of the land, irrigation brings about social change which usually favors men.

Women's agricultural practices must usually be adapted to soil moisture conditions that depend on the changes of the climate and the conditions of their soils. When women's survival strategies lead to erosion, their farming practices can be major sources of watershed instability (www.fao.org/focus/e/women).

Women and children provide nearly all the water for the household in rural areas. Domestic water is used for processing and preparing food, for drinking, bathing and washing, for irrigating home gardens and watering livestock. Women know the location, reliability and quality of local water resources. They collect water, store it and control its use and sanitation. They recycle water, using gray water for irrigation, and runoff water for livestock.

Women make multiple and maximum use of water sources and attempt to assure that these sources do not become polluted. Given their multiple and often competing needs, such as water for livestock and for human consumption, as well as time and resource constraints, women often cannot avoid contaminating water supplies (www.FAO.org/focus/e/women).

It is now recognized that the exclusion of women from the planning of water supply and sanitation schemes is a major cause of their high rate of failure. International initiatives, such as the International Drinking Water Supply and Sanitation Decade and the United Nations Conference on Environment and Development (UNCED), have been instrumental in promoting the role of women in water management. Yet, the incorporation of gender issues in the planning, design and implementation of irrigation programs has been far more limited despite the number of studies documenting the failure of irrigation schemes due to mistaken assumptions regarding the intra-household division of labor and organization of production.

Gender analysis can help irrigation planners and policy-makers to improve the performance of irrigation schemes. There are three broad areas in irrigated agricultural production systems that require particular attention, and where a more thorough, gender-based analysis of local situations will help to create more effective, equitable and sustainable irrigation policies and programs.

Ensuring women's use and control of land - and irrigation water - is fundamental. Studies have shown a direct correlation between independent land and irrigation rights for women and a higher productivity of land and labor. Thus, land allocation under irrigation schemes should be to individual farmers rather than to households.

In regards to Water Users' Associations, all farmers who own or rent irrigated plots as well as all adult family members who work on irrigated plots, including women and young adult children of plot holders, should be members. Women should also be guaranteed leadership positions based on the proportion of women as members or as participants in the scheme.

Water delivery schedules should be devised in such a way as to accommodate both men's and women's needs with respect to quantity, timing and quality of water. Also, training in water control and management, cropping calendars and system maintenance should be extended to women as well as men.

Given that women's incomes are considerably lower than men's and that the capital requirements to invest in irrigated crops can be quite high, access to credit systems should be made available to women irrigators. Access to credit will also facilitate women irrigators' access to technology.

WOMEN IN THE PUBLIC WATER AGENCIES

The number of female engineers working in the public agencies dealing with water has increased significantly; their role in water management is clear in the Ministry of Water and irrigation, Ministry of Agriculture and NCARTT. This is due to the evolution of number of graduates from the Faculties of Agriculture and Engineering from Jordan Universities and other institute. Table 4 shows the percentage of female students enrolled at the Faculty of Agriculture at the University of Jordan. It is

evident that the percentage of female students exceeds 60% of the students bodies. The following is a brief description of these institutes dealing with water management.

Table 4. The number of accepted, enrollment and graduate students in the Faculty of Agriculture at the University of Jordan.

Year	Accepted		Graduates		Enrolled	
	Total	Female	Total	Female	Total	Female
1990/1991	294	146	225	104	1229	560
1991/1992	331	172	245	116	1317	611
1992/1993	315	176	260	120	1314	644
1993/1994	256	179	283	130	1250	671
1994/1995	276	170	312	158	1217	692
1995/1996	254	170	233	124	1182	712
1996/1997	270	167	263	175	1171	722
1997/1998	310	223	224	148	1179	747
1998/1999	339	239	259	174	1285	820
1999/2000	250	170	232	145	1230	810
2000/2001	250	162	248	142	1160	760
2001/2002	228	156	315	156	1200	721
2002/2003	275	165	249	158	1071	675

Source: Higher Educational Council, Yearly statistical report for higher education in Jordan (2003).

Ministry of Water and Irrigation (MWI)

The MWI was created in 1988 bringing the WAJ and JVA under one umbrella. Under the Water Authority law of 1988, the MWI was given full responsibility for all water and sewerage systems and related projects, as well as strategic planning and resource development programs, formulating water allocation options, monitoring and controlling water quality and analyzing and drafting water policy. The number of female engineers and policy makers represents about 20% of the work force in the Ministry. Among about 20 engineers and high ranking decisions makers, there are 5 engineers who are responsible for strategic planning and development of water resources. They work in all different aspects in water management and development.

Water Authority of Jordan

Law No. 34 of 1983 brought together various water sector services providers under a single entity called Water Authority of Jordan (WAJ) as an independent body. WAJ is now under the umbrella of the MWI and is responsible for municipal and industrial water supplies and wastewater. WAJ is also responsible for planning water and wastewater projects, implementing and operating all water supply and wastewater facilities in Jordan, exploring existing water resources and developing potential resources plus allocation of water for various municipal uses. Female engineers in WAJ are working in the planning and design, implementation of water works and supervision of projects.

Jordan Valley Authority

The Jordan Valley Authority (JVA) was established in 1972 and operates under Law No. 19 of the Jordan Valley Development Law of 1988. JVA is responsible for social and economic development of the Jordan Rift Valley (JRV). JVA is also responsible for developing the water resources of the JRV, planning, and implementing and operating irrigation project, and dam projects.

JVA law was recently amended reliving it of many of its social development duties. JVA is also under the umbrella of MWI. In JVA, the number of female engineers has exceeded 15. They are working in the division of studies and design, research and development, and operation and management. Some are involved in soil-water management and some have an extension role in the irrigation advisory services.

Ministry of Agriculture

The MOA is responsible for setting and implementing the country's agricultural policy including livestock and forest resources. Furthermore, Agriculture Law No. 20 of 1973 authorizes the Ministry of Agriculture to exploit surface water resources through construction and operation of small dams and other facilities for production of livestock feeding crops. The female engineers in MOA have a major role in rural development in the irrigated areas in the Jordan valley. The ministry has established a gender unit with a main task in enhancing the role of women in development. Accordingly, the policies of the MOA have a profound effect on the water resources of the country since they affect water policies as well as the planning and management of water resources.

Affiliated with the MOA is the national Center for Agricultural research and Technology Transfer (NCARTT), which was established in 1986 as a result of the reorganization of the Departments of Agricultural Research and Extension within the MOA. The center is an autonomous public institution governed by council chaired by the Minster of Agriculture. NCARTT's mandate is coordinating all agricultural research and technology transfer activates within the Kingdom of Jordan. Programs implemented by the Center include but not only rain-fed agricultural, irrigated agriculture and water management. In addition to main headquarter near Amman, NCARTT has six regional centers located throughout the country. Each regional center has a large experimental farm. The center has established major programs in land, water and environment, which has an ambitions goal in the management of irrigation in the Jordan Valley and the highland. There are 6 female engineers among 22 engineers working in this program. Female researchers have a leading role in the Irrigation Information System and Irrigation Advisory Service. They also conduct research on integrated watershed management.

Agricultural Credit Corporation (ACC)

The ACC plays a great role in agricultural development. Since 1994, the corporation focused on rural families through the activation of women role. Total number of granted loans was 162000 with a total amount of 287 million JD. The number of female working in ACC is about 20%. Some of them are supervising loans which are intended to install new irrigation system, while others have a big administrative role.

PRIVATE SECTOR AND NGO'S

Rural women in Jordan spend long hours every day performing tedious and mostly unpaid labor-intensive and time-consuming agricultural and domestic work. Consequently, there is a real need to develop appropriate technologies for women to reduce their workload in unpaid activities, as well as to increase and improve the quality of their income-generating work. Many foundations in Jordan recognized the importance of women development and began to direct their attentions to women projects. Below is a brief description of some foundations and their activities.

The Jordan National Committee for Women (JNCW)

The JNCW was established in 1992 by a decree of the prime Minister as the official coordinating organization for women's affairs, both governmental and nongovernmental. The Board is headed by Princess Basma. The JNCW is the policy-making body for the advancement of women in Jordan. As such, it was instrumental in developing in 1993 a National Strategy for Women, which was later adopted by the government. After the Fourth World Conference on Women in Beijing, the JNCW initiated the development of a National Program of Action for the Advancement of Jordanian Women 1997-2005, which was written in partnership with the official and NGO coordinating committees. Although the JNCW is a coordinating and policy-making agency, it is not an umbrella organization. Thus, NGOs represented at the JNCW act independently, submitting proposals to donors and obtaining funds from them directly. In fact, smaller NGOs, if they do not themselves have the capacity, can approach the NGO subcommittee of the Coordinating Committee to help them write proposal. The JNCW has a legal Committee that studies legislation and its impacts on women. When discriminatory legislation is identified, the JNCW recommends amendments to help the appropriate authorities.

The Jordan National Forum for Women (JNFW)

Founded in December 1995, as an initiative from Princess Basma, the Jordanian National Forum for women is the JNCW's link with the grassroots and implementing agency. The Forum's objective is to work through local NGOs throughout Jordan, particularly in rural areas, to raise awareness among women and increase their participation in local and national policies.

The Princess Basma Women's Resource Center (PBWRC)

The Center was established in March 1996 as a support for women's organizations and policymakers. It has four functional areas, social policy and population; women in development; advocacy and decision making; and research and development, which includes a media unit. It also has a meeting place (Al Multaqa), where women can hold informal meeting and where lectures, seminars and workshops are also held. The idea is to make the Center accessible to women especially to youth. Other activities of the Center are as follows: training of trainers on enterprise development, funded by DFID; media services for women running for election, funded by the EU; and a policy project training trainers on women's political participation, funded by USAID.

The Office for Women's Affairs

This office was established to coordinating the activities of all the organization described above and the NGOs. It is also involved in planning, international liaison, and the coordination of funding.

In addition to this relatively new official structure addressing women's issues are two large established and well-known organizations affiliated with the royal family that support projects for women as part of their overall strategy. They are the Queen Alia Fund for Social Development (QAF) and the Noor Al Hussein Foundation (NHF).

The Queen Alia Fund for Social Development (QAF)

The QAF was established in 1978 by royal decree that gave the Fund its own legal status. The Fund is headed by HRH Princess Basma. The objectives of the Fund are to have direct presence at the grassroots, provide skill and knowledge for people to improve their lives, to promote sustainable development using local resources, and to provide training. Women and children have been a key focus since inception. The QAF has the largest outreach of any community-based organization, with 50 community centers nationwide. The centers house kindergarten classes, training rooms, and places for crafts training. They are run by local NGOs training and supervision being provided by the QAF.

Queen Noor Foundation

Established in 1985 and its strategy focused on ensuring sustainable development through improving the character of life for the local community. The foundation has many projects, among these are the agricultural projects, which aim to train women on different productive skills and techniques to benefit from the local resources available in rural areas and improve the income of women working in agriculture. The activities are distributed in 21 villages, 1639 family benefit from different projects, total amount of granted loans was 555,293 JD. Women contribute in two programs to 40% and 65% of the total number of granted persons.

Jordan River Foundation

Established in 1995, headed by her Majesty Queen Rania Al Abdullah. It is a national, non-profit foundation working on improving the level of life of the community members, minimizing poverty and improving the social, economical, health and scientific conditions. It has a great experience in productive projects, which aims to improve the income of poor families in different areas in Jordan. Projects mainly concentrate on traditional crafts, which can provide labor opportunities and source of income for women who have little fortune in the local community. The foundation encourages women to optimize the limited water resources in producing cash crops, medicinal plants and water conservation projects.

The Hashmite Jordan Fund for Human Development

The fund concentrates on the participation of the local communities in the development through its net work, which consists of 50 centers distributed in rural areas and Jordan Badia. It aims to create positive changes in the life of women in social, economical, health and other life aspects. A total of 57 training courses were carried out for 1183 women participants in many productive projects and focusing on agricultural projects.

International Fund for Agricultural Development (IFAD)

IFAD has been supporting the Government of Jordan to improve the management of the agricultural resources in the country for the last four decades. Two projects are of an integrated nature that involves watershed management. In these projects, the role of women has been identified as a key stockholder. The main objectives of these projects are to increase agricultural production, increase income of neglected rural areas and diversities income resources.

Rehabilitation of spring in Kark

Within the Agricultural Research Management Projects (ARMP), springs are the major water resource for many villages and provide domestic water, drinking water for animals and supplementary irrigation for crops, particularly perennial tree crops (such as olives, grapes and figs) and vegetables. The Spring Rehabilitation program seeks to protect springs against falling debris and contamination from livestock and other sources, while the main channels are lined to reduce water losses. A lower limit of 2 dunums was placed on involvement in this activity. The project had achieved 43% of its spring rehabilitation program and 141% of the canal rehabilitation target, with most spring rehabilitation works appearing to be well-constructed. The evaluation committee considered that the project efforts in spring rehabilitation were sustainable and concluded that these activities would increase the amount of water available in the field by about 25-33%, which would ultimately lead to a sustained productivity increases

The Al-Hashimiya spring in Al Aina in Al Mazar, has been rehabilitated under ARMP. The families of the farmers have relied on the spring for centuries for irrigating their farms. Water rights are linked with land rights and each family has a well defined water share which is based on its land holding in the spring command. Each family contributes to the maintenance of springs on the basis of its water share. However, Bedouin families enjoy free use rights to water for drinking and feeding their livestock, even though they have nothing to do with the development and maintenance of these springs.

Cistern construction and rehabilitation was an important mechanism for achieving project objectives. In addition, they facilitate savings on the purchase of (domestic) water, which can range from JOD 0.4 to JOD 5 per m^3. So far 1,770 cisterns have been completed, covering about 70% of the number of farms included in the Soil Water Conservation (SWC) program. This number represents about 37% of the targeted number of cisterns. There has been a continuing high demand by farmers for cisterns, however substantial under-costing at appraisal has resulted in expenditure of almost 64% of the budget. Management proposals for the second half of the project are to increase in the volume of water stored in cisterns by nearly 20% above present plans, and to rehabilitate old 100 cisterns.

Soil and water conservation project

Other IFAD projects in Jordan to save water and create sustainable agricultural practices are on-going and often surprisingly simple: These include building stone terraces on sloping land to retain both soil and water; re-using drainage water and treated waste water from towns and industry, for agricultural purposes; and replacing cereal crops with olive trees which, after their first two years, thrive without much water.

Agricultural resources development in Yarmouk basin

The International Fund for Agricultural Development (IFAD, 1999) prepared an inception report for an agricultural resources development project to be implemented in the Yarmouk River Basin in Jordan. The principle objectives of the proposed project were to improve food security and income

levels of target group of farmers by arresting degradation and restoring soil fertility for sustainable use of land and water resources in the Yarmouk River Basin. Increase in farm productivity, in turn, would derive from the combined effect of improved technology and on-farm soil and water conservation activities. The IFAD's strategy in the Yaromuk River Area concentrated exclusively on rainfed rural development with emphasis on fruit trees development, integration of small ruminant production with field crops production in the high rainfall areas and development of pasture and range in the low rainfed areas. More importantly, investments in terracing and associated planting of olive orchards would provide the rural poor with the livelihood security for generation. The project would have a positive impact on the income and quality of life of 2,840 resource poor rural households. The beneficiaries from soil and water conservation measures would be about 2,625 households, of which 2,495 would though direct project support and 460 through credit. Income generating programs would assist about 800 women to develop small-scale business enterprises. In addition, a further group of households would receive direct benefits from credit and technology transfer programs. This has been conservatively estimated to be about 2,490 and 5,460 households, respectively.

Small Grants Program

The Global Environmental Facility (GEF) was established by UNDP and the World Bank after 1992 Earth Summit in Rio De Janeiro in order to support development in environmental project of international importance. Within the this initiative, small grants program (SGP) was created to support local communities and NGO without going through the governmental channels.

The Small Grants Program in Jordan has been operating since the end of 1992. It has supported 57 projects in all parts of the country; urban, rural and the Badia for a total of 1.7 million US dollars. The supported projects managed to mobilize other resources including in-kind and cash support for more than 2 million US dollars. About 40% of these projects address biodiversity issues, 10% are for climate change issues, 19% are directed to international waters issues, 20% deal with biodiversity and climate change issues, 8% deal with biodiversity and international water issues and 12% deal with issues of multiple focal areas. In this respect, the Ministry of Agriculture/ Forestry Department delegated the management of forestland to several NGOs particularly women and youth NGOs. The municipalities and other local authorities also delegated public land to women NGOs for the purpose of implementing projects. Several projects were implemented in cooperation with official institutions leading to an improvement of their policies and procedures. Working with the private sector institutions has led to the integration of sound environmental measures into those institutions' production procedures.

Among the 57 projects, about half of them are given to women NGOs or societies of which 8 are dealing with land, water and irrigation activities. Below is a list of these projects with more explanation on some of them.

Role of Women in Integrated Management of water and land resources in the Jordan valley

This project has been be implemented by the Women Committee in Damia/ Jordan Valley, contributing to the improvement of living conditions of the local community in Damia, which suffered greatly. The activities involve women and their families in income-generating activities that contribute to the comprehensive management of land and water resources in the Jordan Valley. The activities include herbal plant production and bee keeping. Awareness activities are conducted to promote the significance of proper natural resource management practices that can be implemented at the local community level. The project has tested the use of "water management gel", a substance that prolongs water retention in the soil after irrigation. This experiment has undertaken the support from the Water Efficiency and Public Information for Action (WEPIA). The Women Committee will be supported by the Damia Youth Social Club that has been implementing a successful palm plantation project since 1998 with support from the GEF Small Grants Program. The grant value amounts to US$ 22,147.

Environmental awareness campaign and improved land resource management

The implementing agency for this project is Al Jabal al Akhdar and Khshaibeh Women Cooperative. The cooperative has organized an environmental awareness campaign that involves the Department of Forests and Rangeland, schools, and the local community members in the two villages. Other components of the project include land protection measures such as construction of stonewalls, tree stone basins, efficient irrigation systems, rain collection cisterns, bee-keeping and

flowering trees and shrubs planting. The project has been technically assisted by the GTZ-Watershed Management Project of the Ministry of Agriculture and has taken the support of (WEPIA) to test the water management gel mentioned above. The grant value amounts to US$ 30,383.

Productive gardens and water harvesting in Deir Yousef in Irbid governorate

The Rural Women Development Society is implementing this project entitled. The project aims at promoting the sound management of natural resources in a semi-arid ecosystem close to a forest area overlooking the Jordan Valley. It will support income-generating activities that improve local community's livelihood without jeopardizing the delicate ecosystem in the area. Traditional productive home gardens and domestic water harvesting techniques has been promoted among local community members with special emphasis on women and youth. The grant value amounts to US$ 26,834.

Community watershed management program

Mukheibeh Development Society was given a Pilot Phase SGP grant of 5000 US$ to establish a Palm Trees Nursery, but the project lacked a training component at the time. This grant will help the proponent meet their objectives in an important watershed where training and exchange of experiences would enhance the community's capacities to manage the land and water in their area.

Rural women in sustainable management of natural resources

This project was supported to the General Fedration of Jordanian Women/ Irbid Branch. They are using Pilot Phase projects and other experiences to train women NGOs in Irbid Governorate on sound management of natural resources and integrate environmental considerations in their field of interests, the project started in June, 1998 for two years with a grant value of 30,000 US$.

Qastal cistern rehabilitation and xeriscape

The project was executed by Qastal Conservation and Development Society. The project involves installation of drought-resistant landscaping in Qastal village to demonstrate traditional natural resource management practices in an arid to semi-arid area in the East Mediterranean eco-system complementing, at the same time, the restoration of a significant historical and archaeological site. The project will rehabilitate several historical cisterns on site, and will produce a replication package to guide other villages and communities through using these methods. The duration of the project is one year for a grant value of 37,640 US$.

Rehabilitation of biodiversity/ water harvesting and soil conservation in Senfha/Tafileh

The project was implemented by Ruweim Social Development Society, in cooperation with the Queen Alia Social Development Center in Tafileh. The project aims to enhance and disseminate sound approaches to biodiversity, soil and water conservation through rehabilitation of sloppy lands and protection of soil through re-introducing indigenous plant species and traditional water harvesting techniques. The project is located in Senfeha/ Tafileh, an area of special topographical features overlooking the Jordan Valley in the arid to semi-arid east Mediterranean eco-system. The project cost was 17,726 US$.

Community watershed management

Rakin Women Charitable Association (RWCA), a woman NGO is re-introducing traditional water harvesting techniques and rain water collection wells in the community of the town of Rakin. GTZ and the Department of Agriculture in the area are providing the technical assistance needed by the NGO. The NGO is using a loaning system whereby beneficiaries pay back part of the cost of constructing the well provided by the NGO, which makes it possible for other households to benefit from the project. The project has already constructed 15 wells, and many people in the village are seeking to obtain loans for digging wells. The NGO is building its capacities and will go into other activities that would promote environmental awareness and action in the village. This project will be discussed in details as a case study.

CASE STUDY: COMMUNITY WATERSHED MANAGEMENT (RAKIN VILLAGE)

Introduction

The Jordanian rural communities suffer most from lack of water, and they are being challenged on daily basis with the task of securing clean water and sanitation for households, farms and small businesses. Efforts in community-based water management are always a major priority in Jordanian water policy. Experiences at the community level for the optimal use of water resources are spreading all over the country based on successful demonstrations. One of the successful initiatives in community based, and gender mainstreamed water management projects was introduced by the joint activities of the local women community of the village of Rakin with the support of GEF Small Grants Program.

The following case study focuses on the efforts by the Rakin Women Charitable (RWCS) Society to manage a revolving loan system for establishment of water cisterns and water harvesting measures in Rakin Village that benefited many women and secured water resources in households, with a great degree of sustainability.

Background

Rakin is the center of a cluster of villages and small towns located in the south west of Karak Governorate South of Jordan. Rakin has a total population of 5500 persons. According to Karak social development directorate data, Rakin is classified as a poor village on the basis of level of incomes of the population, which relies heavily on army and government employments.

The basic services (water, electricity, telecommunication and roads) are available. Two secondary schools and one elementary school form the educational base of the area. The topography of the region shows areas with slopes as steeps as 23-30%. Rainfall is in the range of 250-300 mm annually.

The village economy is based on services in the state's public institutions and agriculture. The main agricultural products of the village are:

- Fruit trees orchards: mainly olives and Almonds.
- Field crops: barely and wheat.
- Forest crops: 600 dunums of old forest and 500 dunums newly planted
- Herb's planting
- Livestock: 15000 heads of sheep and goats.
- Good experience in apiculture (bee-keeping).

RWCS was established in 1991 aiming at improvement of the social, economical, cultural and health conditions of the rural women in Rakin.

Issues

The topography of the area, human pressure on land and inappropriate land use practices, are some of the reasons that contributed to increased degeneration of land and increased soil erosions, resulting in a rapid loss of productive lands. Due to overgrazing great proportion of the annual rainfall is lost as run –off.

Women are bearing the responsibility of household management, with a basic reliance on water gathering and utilization. Most of the households in the area depend on their own cultivation of basic food supply, with the availability of water resources making the essential ingredient in household food security.

Insufficient supply of water for human consumption, livestock and irrigation is considered a major problem. Rakin gets piped water once every two weeks for six hours only, which does not meet even the inhabitants' basic requirements. Water has to be bought at a very high price. Without cisterns as storage facilities, the households are not able to store all the water that is delivered by tankers even though families have to pay for it all.

Development

This basic need of water provided the justification for Rakin women society to tackle this challenge. The Rakin society gained first grant from the GEF/SGP to install water cisterns and water harvesting measures in households. The success of this project in the society of Rakin village was evident to the point that enormous applications for loans were presented to the Society's board. The project was based on a 66% grant repayment system that eventually exhausted the financial resources provided in the first phase.

A second phase was initiated in 1998 with the support of the GEF /SGP in Jordan, and the continuous technical assistance from the GTZ Watershed management project. This new project, however, was based on a 100% repayment revolving loans system to meet the needs of more than 150 households applying for such loans.

RWCS implemented the project with the technical assistance of Watershed Management Project supported by GTZ. A steering committee was formed to be responsible for the implementation of the activities, such as training issues, follow up of the loans and repayments, as well as selecting the beneficiaries according to a certain criteria, and overall organization of the groups.

Results

The loaning system was structured to provide a 100% repayment to ensure the sustainability of the project resources, and seriousness of the individual projects.

The main impacts and results of the project were:

1- Securing a sustainable resource of clean water in households to provide for irrigation and food security.

2- Reducing the cost of buying water from tankers, and the cost of the water consumption bill in households while increasing water consumption rate.

3- Empowerment of women in the Rakin society in being responsible for bringing additional resources to households and families. This contributed to increasing their status as decision-making partners in households.

4- Capacity development and knowledge acquisition by women in managing the grants.

Lessons Learnt

1. The project proved that the 100% payback system for loans is sustainable and ensures that the capital money could be distributed to a wide range of beneficiaries, and will not be exhausted in a short term. The high payback ratio could be attributed to the fact that women play a leading role in managing the household economy.
2. The project proved the high efficiency of implementation, and management by rural women provided that they gain the basic support and capacity development needed in project management. Involving women directly contributes to enhancing the project's effectiveness and sustainability.
3. The project proved the immediate positive impacts and benefits for local communities at the house hold economy level. This has been manifested mainly in securing sustainable water resources in a water-scarce area.
4. The loaning system supported, in addition to water cisterns, bee keeping activities and solar cells installations. It is important always to diversify the income-generation activities to sustain the impact of the loaning systems.
5. Community-based participatory water conservation projects are an essential component of any concerted effort of a water-scarce country in conservation of its water resources.

CONCLUSION

The scarcity of water in Jordan is considered one of the major constraints for economical and social development. The future demand is far exceeding the supply and the gap is increasing due to natural population growth and other associated demands. On the other hand, the increase in water supply is very limited because all economical possible sources have been exhausted. The option, thus would remain in the efficient management of water uses at all levels and it would be the responsibility of everyone in Jordan including women. Women are very good managers especially in

issues that involve the well beings and the health of the family member and the society at large. They are considered good audience for public awareness campaigns who take matter seriously when it comes to issues of survival. Women play an important role in water management at the house hold and in irrigation water management the farm level. Women role is limited only to the action they can take but to their role in family education and awareness. Family member, including children, follow the advice of the mother in home economics, behaviors and skill development. Therefore, the family as well can take major responsibility in water conservation such as reducing leaks from water network, avoiding over-irrigation; adjusting irrigation limiting; using water saving systems; recycling of water including gray water; using drought tolerant crops; using mulching to reduce evaporation.

The status of women in Jordan has improved significantly for the last two decades as reflected by the increase in their participation in the labor force, high life expectancy and improvement in their education attainment. Their involvement in irrigated agriculture now is much better as farm manager, decision makers and extension agents. The performances of female irrigation and agricultural engineers are much better than men as they are easily accepted by farmers. Many of the University graduate in irrigation are working in the private sectors as design engineers or sale persons.

In spite of the significant improvement of women movement in Jordan and their high potential in social development, the role of men is dominant. As a result of that the women activities are directed to work as NGOs or private societies.

The number of female in the NGOs represents about 70% of the total number. Most of these NGOs are working with women in rural communities in income generating projects, improving irrigated agriculture, rehabilitation of water harvesting works and land water conservation.

Base on the above discussion and conclusion the following recommendation can be considered:

1. Improve women's skill in water resources management
2. Realize and value the women role in poverty elimination
3. Modify legislation and institutional set-up to allow for effective participation of women in irrigated agriculture.
4. Involve women in participating in policies and decision making process
5. Review extension services to increase women role in extension and training
6. Increase opportunities to women in irrigation management by assigning more female engineers in irrigation projects.

REFERENCES

Abu-Karaky, F. (1999). Increasing the contribution of rural women in productive activities in the Hashmite kingdom of Jordan. International seminar on increasing the contribution of rural women in productive activities. Egypt- Cairo, 14 –16/9/1999. Arab organization for agricultural development proceeding. pp. 179-184.

Al –Naber, S. and M. Shatanawi (2003), The Role of Women in Water Management in Jordan. Presented at the 6th International Water Symposium in Canne, France, June, 2003.

Al-Hadidi, L., S. Naber and M. Shatanawi (2002), The Role of Women in irrigated Agriculture in Jordan. workshop of gender and Water resources Management in the Miditerranean (M. El Kady and A. Hamdy, eds).

Barker, R. & Van Hoppen, B. (1999). Water scarcity and poverty. IWMI Water Brief 3. Colombo, International Water Management Institute

Bastidas, E.K. (1999). Gender issues and women participation in irrigated agriculture: The case of two private irrigation canals in Carchi, Ecuador. Research Report 31. Colmbo, Srilanka: International Water Management Institute.

Cleaver, F; Jobes, K. (1996). Donor policies and gender in the water and sanitation sector. Natural Resources Forum 20 (2): 11-117.

DAVISON. S. (1993). Women and environment in developing countries: Issues and linkages. Women and Environment. 13 (34): 6-9.

DOS. (1997). Department of Statistics. General results of the agricultural census 1997. Amman-Jordan.

DOS. (2002). Department of Statistics. General results of the agricultural census 2002. Amman-Jordan

DOS. (2003). Department of Statistics. General results of the agricultural census 2003. Amman-Jordan

DOS. (2001). Department of Statistics. General results of the agricultural census 1983. Amman-Jordan.

ESCWA (2001). Economics and social commission for western Asia," progress achieved in the implementation of chapter 18 of agenda 21, with emphasis on water for sustainable agricultural production", New York.

FAO. (1996). Comparison of five studies on enrolment of women in higher agricultural education: Côte D'Ivoire, Jordan. Nigeria. The Philippines and the University of the West Indies

GTZ. (1993). Women's role in agriculture with focus on their use of pesticides. Research report submitted by Near East foundation in fulfillment of a contract service to "Women in Development Project".

http://www.fao.org/focus/e/women/water-e.htm

http://www.ifad.org.

http://www.worldfacts.us/jordan.htm

NCARTT. (2001). National Center For Agricultural Research And Technology Transfer. Regional workshop on the actual situation of rural women contribution in agriculture.

Quagliariello, R., G. Trisorio-Liuzzi and A. Hamdy (2002), Gender Prospective in Water resources Management,, workshop of gender and Water resources Management in the Miditerranean (M. El Kady and A. Hamdy, eds).

RODA, A. (1991). Women and the environment. London: Zed Books Ltd.

Shatanawi, M. Al-Zu'bi Y. and Al-Jayoussi O. (2001). Irrigation management dynamics in the Jordan Valley under drought conditions. University of Jordan, Amman-Jordan.

Snobar, B. (1996). Enrolment of women in higher agricultural education in Jordan. University of Jordan. Faculty of Agriculture.

UNIFEM (2004), Status of Jordanian Women Report UNIFEM Regional Office for Arab Countries, Amman, Jordan (www.unifem.org.jo).

WORLD BANK. (2001). The Hashemite Kingdome of Jordan; Water sector review update, Report No. 21946-JO, Ministry of Water and Irrigation, Amman- Jordan.

Yearly statistical report for higher education in Jordan. (1998/1999). Higher Educational Council, Amman-Jordan.