Role of gender in water availability and food security relationship (a case study : Matrouh resource management project)

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ROLL OF GENDER IN WATER AVAILABILITY AND FOOD SECURITY RELATIONSHIP (A CASE STUDY-MATROUH RESOURCE MANAGEMENT PROJECT)

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Abstract - The available quantity of water has a direct impact on the country's capacity to produce food. At the same time, agriculture is the main consumer of water. In Egypt, water availability, has therefore a direct influence on national food security. Egypt is among the countries with high water stress, where the Nile is the only surface source of renewable freshwater,other than small amounts of rainwater on the coast and flash floods in the valleys. The mean annual rainfall ranges from 0 mm/year in the desert to 200 mm/year in the northern coastal region. The water balance of Egypt shows that the available water supply is sufficient for the future, at least until the year 2017. The Egyptian government has accepted to launch challenging agriculture projects, which may influence its economy in the present time, but which will guarantee food security for its population at least for the forthcoming decades. In this regard, Egypt plans to expand its agricultural area by 1.43 million ha. These vast projects will reclaim desert land in Sinai, and in the West and Southwest of Egypt (Toshka Project). Matrouh Resource Management Project has started adopting sustainable resource management practices thus alleviating poverty in its mandated areas. In the Project area rainfall is low and erratic, averaging 147 mm along the coast and for about 20 km inland, dwindling rapidly inland thereafter to 50-75 mm. Four agro-ecological zones are distinguished in the Project area. Most of the rural population of the Project area, estimated at around 150.000 people in about 22.000 households, live in scattered settlements. The Project area's agricultural production is limited, consisting of rangeland, sheep, goat and camel production, cultivation of cereals, particularly barley which is used as animal feedstuff during the dry season, and fruit tree production. MRMP has improved women's participation in resource management and productive activities providing skill training and access to small loans for income generating activities in order to enhance their economic independence and alleviate their work burden through financial support for water pumps, gas stoves and donkey carts. In some communities, women look for opportunities to get additional income by making some craft products or clothes. Scarcity of water is the critical constraint to development in the Project area. Therefore, the water harvesting activities under MRMP were mainly focused on the Construction of cisterns and reservoirs for water storage and Dykes (earthen, stone and cemented) for water spreading. Water harvesting had a significant impact on productivity enhancement, mainly due to substantial increases in fruit trees. The 10-year weighted-average increase in physical productivity was grown by 91%, and the weighted annual net income was increased by 52%. The annual rate of net return for the extra cost incurred due to the building and use of water harvesting structures was over 300% on average. Moreover, water harvesting has impact their basic water needs and also reduced women's time and drudgery in collecting water.

Key words: Water availability in Egypt, water management, Matrouh resource management project, gender activities, water harvesting and watershed management.

INTRODUCTION

One of the greatest challenges facing humanity is how to use the scarce resources in an equitable and sustainable way.

According to Seckler (1999) water scarcity is now the single greatest threat to human health, to the environment and to the global food supply. Besides the qualitative aspect of water, its available quantity has a direct impact on the country's capacity to produce food. At the same time, agriculture is the main consumer of water. In Egypt, water availability has therefore a direct influence on national food security, (Hazma, W. and Mason, S. 2004).

WATER AVAILABILITY IN EGYPT

According to the United Nations Comprehensive Assessment of the freshwater resources of the world (1997), Egypt is among the countries with high water stress, where the Nile is the only surface source of renewable freshwater other than small amounts of rainwater on the coast and flash floods in the valleys. The mean annual rainfall ranges from 0 mm/year in the desert to 200 mm/year in the northern coastal region (Aquastat, 1955). According to the 1959 Agreement with Sudan, Egypt has the right to use 55.5 km^3/year of water from the Main Nile measured at Aswan.

The quantity of fossil groundwater in the Western Desert is large reaching up to 1500 m depth. However, it can't be used in great quantities due to its quality and economic costs of pumping. Fossil groundwater storage in the Western Desert is estimated at 40.000 km^3 (salinity 400 700 ppm) (Abu Zaid 1991). At the same time, the groundwater storage capacity in the Nile Valley and Delta system is estimated at 200 km^3 (salinity: 800 ppm) and 300 km^3 respectively (Abu Zaid 1991). The wells in Egypt are concentrated along the North coast, the Red Sea coast, in the Sinai region and in the South Western Desert.

At present, seawater desalination produces about 0.03 km^3/year of water, but it is too expensive (0.5-2 $ US/m^3) for its agricultural use (Egypt 1999).

The water balance of Egypt shows that the available water supply is sufficient for the future, at least until the year 2017 as shown in Table 1.

Table 1. Egypt's water availability and demand (Mason 2004)

	1999 (km^3 $year^{-1}$)	Planned by 2017 (km^3 $year^{-1}$)
Nile water according to the 1959 agreement between Sudan and Egypt	55.5 (a)	55.5 (a)
Fossil groundwater	0.5 (a) – 0.9 (e)	1.2 (b) – 3.3 (d)
Rain	1.4 (a)	1.4 (a)
Desalinated water	0.03 (a)	0.5 (b)
Water lost to the sea	-4 to -1 (c)	-0.3 to 0 (a)
Total available	53.4 – 58.3	58.3 – 60.7
Re-use/increase in efficiency:		
Recycling of drainage water	4.3 (a)	9 (a)
Recycling of sewage water	0.4 (a)	2.5 (a)
Nile-groundwater (reused Nile-water)	2.6 (d) – 4.8 (a)	4.9 (d) – 7.5 (a)
Improved irrigation system	0.5 (a)	3 (a)
Changed crop sorts and patterns		3.5 (a) – 4.2 (b)
Total amount of water that can be used (=total available + recycling/efficiency increase)	61.2-66.6	81.2-86.9
Use:		
Agriculture	56 (a)	66.6 (e)
Municipal	3 (a)	6.8 (e)
Industry	6 (a)	12.4 (e)
Total use	65	85.8 (e)

WATER MANAGEMENT IN EGYPT AND FOOD SECURITY

Egyptian agriculture can be divided into old and new lands. Both amount to about 3.2 million ha of which the old land comprises 2.5 million ha.

Water withdrawal directly depends on the area, yield, production and water demand of the main crops. Cotton, wheat, rice, maize and berseem account for 80% of the cropped area (Aboul - Enien et al, 2000) and about 60% of the water consumption of the agricultural sector in Egypt (EAAE, 2000). Rice is the greatest water-consuming crop. It accounts for about 15% of the total agricultural water consumption in Egypt. Rice and sugarcane are the two main crops from a water efficiency point of view.

The new lands mainly grow cash crops, e.g. fruit, vegetable, aromatic plants and flowers, both for local consumption and exports. Most farmers believe that the most suitable irrigation system on the old lands is flood irrigation due to the clay soils, even if it is less water efficient than the technology used on the new lands. All new lands use modern technology, e.g. sprinkler or drip irrigation.

The Egyptian government has accepted to launch challenging agriculture projects, which may influence its economy in the present time, but which will gurantee food security for its population at least for the forthcoming decades. In this regard, Egypt plans to expand its agricultural area by 1.43 million ha. These vast projects will reclaim desert land in Sinai, and in the West and Southwest of Egypt (Toshka Project). They are integrated projects that include the development of industry, cities and tourism.

MATROUH RESOURCE MANAGEMENT PROJECT (MRMP)

Introduction

Matrouh Resource Management Project (1994-2003) has started adopting sustainable resource management practices thus alleviating poverty in its mandated areas.

The Project area, located in Matrouh governorate, forms part of the NWC region, which extends 500 km from Alexandria in the east to the Libyan border in the west, and is bounded by the Mediterranean Sea on the north and the Great Sahara Desert on the south (Map 1). Most of the eastern part of the region will receive irrigation water from a Nile-canal system and hence MRMP focuses on the area extending 320 km along the coast from Ras-El-Hekma in the East to Salloum in the west on the Libyan border, and some 50-70 km inland. More than 80% of Matrouh Governorate is inhabitable and the remaining 20% is inhabited only by an indigenous Bedouin population, well adapted to the harsh climate of the Western Desert.

In the Project area rainfall is law and erratic, averaging 147 mm along the coast and for about 20 km inland, dwindling rapidly inland thereafter to 50-75 mm. (Table 1). Droughts occur in two to three years out of ten. The rainy season extends from mid-October to March, with 75% of the rainfall during the period November to February. Temperatures are warm in summer (maximum 29°C in July) and cool in winter (minimum 9°C in January) and the area is frost-free. Wind is a constraint in some locations, causing soil erosion and plant damage.

The topography of the area is characterized by a low, narrow coastal plain, extending some 5 km in width, with sand dunes and interdunal plains, and by an inland plain extending a further 10-15 km inland that slopes gently upwards to the escarpment of the 200 meters high Libyan plateau. The area is bisected by some 218 wadis formed by run-off water from the plateau-Rainfall and its Wadi and sheet run-off is the primary source of water. Utilizing run-off entails large investments in water harvesting, conservation and storage in the form of cisterns and dykes. Water stored in cisterns is mainly used for domestic use and livestock, and partly for summer irrigation of trees. Dykes are exclusively used for spreadsheet irrigation.

Four agro-ecological zones are distinguished in the Project area. (i) a narrow coastal strip, about 5 km inland, which has good alluvial soils and where horticulture is the main farming activity, with livestock and barley; (ii) a strip for mixed production, 5-15 km inland, with lower rainfall and soil quality, and where a mixed small ruminants-barley farming system prevails with orchards grown in the wadis; (iii) a rangeland strip, 15-50 km inland, of semi-nomadic population, largely used as grazing land for small ruminants with scattered barley cultivation in land depressions; (iv) an open-range area, beyond 50 km inland, where a nomadic population lives on animal production, mainly camels.

In the Project area the agricultural production is limited, consisting of rangeland, sheep, goat and camel production, cultivation of cereals, particularly barley which is used as animal feedstuff during the dry season, and fruit tree production. Livestock rearing, and to some extent, barely cultivation have a long tradition and are deeply rooted in the nomadic Bedouin culture. Only in the last 20-30 years, due to the gradual Bedouin sedentarization since the 1960s, the Bedouins have begun to systematically explore opportunities for increased horticulture in the form of orchards and watermelon cultivation to boost their income. Now more than 75% of households own some fruit trees. Orchards consist mainly of figs and olives, which are peculiarly adapted to the harsh semi-desert environment, though there is a growing experimentation with a variety of other fruits. Livestock rearing (including barley production) remains the dominant activity accounting for 60% of agricultural GDP in Matrouh, while horticulture comprises 32%.

Cultivated areas and farming systems are dynamic elements in the Project area. Farming systems have evolved thanks to the sedentarization process with the traditional livestock/cereal farming system being superseded by a tree/livestock/cereal (T/L/C) system which constitutes about 50% of all farms. The development and spread of the T/L/C system has depended on the installation of water harvesting and storage devices such as bunds, dykes and cisterns. It has also been supported by the inculcation of farming know-how among the Bedouins who are not familiar with the cultivation and management demands of these crops in such an environment.

Most of the rural population of the Project area, estimated at around 150.000 people in around 22.000 households, live in scattered settlements.

The tribal hierarchical social structure, traditions and customary laws govern the Bedouin community life. Pronounced solidarity is maintained with responsibilities recognized at each hierarchical level. The Project area differs from most other parts of Egypt since its traditional tribal structure is still vibrant and represents a very rich and strong force for the organization of the society. Customary laws still apply for local administration, adjudication and common issues. There are 40 sub-tribes (qabila) in the Project area, representing 6 main tribes, and these are made up of clans (aila) which are patrilineages of 5-7 generations depth, further divided into extended households (*bayt*) of 3-4 generations depth. Leaders are designated at each tribal level comprising *sheikhs* at the tribe and sub-tribe level, *omda* at the *aila* level and *aila* (wise man or elder) at the bayat level. These compose the customary law council (*majlis`urfi*) at each level above the clan. MRMP has built upon this indigenous organization, identifying 38 Local Communities, which represent geographically and socially coherent units. Each corresponds to a territory with its watersheds and the people who live on the resources of that territory. The tribes are very inter-mixed in the Project area and most of the 38 Local Communities are composed of clans that belong to two or three tribes.

To facilitate the effective participation of the targeted population, the Project area was administratively divided into five sub-regions. A sub Regional Support Center was established in each of the five sub-regions.

Gender Activities in MRMP

In the past Bedouin women were far less restricted in their economic and public roles than at present. In the traditional pastoral society, both men and women participated in livestock management. However, whilst sedentarization has restricted women's mobility, intensification of agriculture activities, tree plantation and maintenance, and the provision of water and fuelwood have all brought new responsibilities to women. Collection of fuelwood and water, in particular, have become burdensome and time-consuming activities.

Illiteracy is widespread and girls are unable to pursue an education. MRMP has improved women's participation in resource management and productive activities providing skill training and access to small loans for income generating activities in order to enhance their economic independence and alleviate their work burden through financial support for water pumps, gas stoves and donkey carts. Extensive literacy programs have been organized for girls in order to provide the next generation with greater opportunities (Table 2).

Table 2. Achievement of water harvesting (MRMP): number of structures (and households)

SRSC	Cisterns		Reservoirs		Stone dikes		Cement dikes		Earth dikes	
	No.	OOOM^3	No.	OOOM^3	No.	Fed	No.	Fed	No.	Fed
Hekma	1751	279.6	93	12.6	808	581	6	20	4	116
% of the total	24	24	22	22	17	17	7	12	18	32
Matrouh	1762	275.4	226	30.5	1107	824	45	45	9	63
% of the total	25	24	54	53	23	24	49	27	41	17
Nigila	1360	254.1	34	4.4	788	532	15	40	1	15
% of the total	19	22	8	8	17	15	16	24	5	4
Barrrani Est	1083	173.2	32	5.0	1246	869	7	9	3	91
% of the total	15	15	8	9	26	25	8	5	14	25
Baarrani west	1213	176.4	36	5.5	788	638	19	54	5	82
% of the total	17	15	8	9	17	19	20	32	22	22
Total	7169	1,158.7	421	58	4737	3444	92	168	22	367
% of the total	100	100	100	100	100	100	100	100	100	100

Fed = 4200 m^2

In some communities, women seek opportunities to get additional income by making some craft products or clothes. These products are generally used by the household. In the coastal region, women sell a part of their production either in their community or in the local markets. The oldest women are generally those who sell these products. The money earned is spent by the woman to meet her needs or those of her children. When the family has financial difficulties, her money is used to acquire the necessary food products for the entire household.

Water Harvesting and Watershed Management in MRMP

Scarcity of water is a critical constraint to development in the Project area. Many households do not have water storage facilities (cisterns) even for domestic use and women have to satisfy water needs by using far away neighboring sources. Water is also the critical factor in supporting sedentary, and more productive agricultural systems. Therefore, the water harvesting activities under MRMP were mainly focused on:

1. Construction of cisterns and reservoirs for water storage; and
2. Construction of dykes (earthen, stone and cemented) for water spreading.

Water harvesting. The Project built water storage structures (7170 cisterns and 421 concrete reservoirs) to create an annual storage capacity of about 1.2 million m^3. This harvested rainwater is used for domestic needs, for animals and for supplemental irrigation purposes and is likely to mitigate drinking water and sanitation problems of about 6.000 households within the Project area. The distribution of cisterns and reservoirs by SRSC is shown in Table 3.

Table 3. Gender activities implemented by Matrouh Resource Management Project

Center	Education		Training/ Carpets		Training of Hiyaka				No. of trees distributed	Home gardens	Preparation of jam	
	No. of teach Room	No. Of girls	No. of session	Trainees	No. of seminars	Trainees	No. of seminars	No. of beneficiaries			No. of session	Trainees
Ras El Hikma	42	1072	4	60	7	131	21	320	681	52	25	396
Matrouh	44	1268	5	89	3	51	23	657	680	28	22	282
Nigila	40	990	7	103	4	88	19	607	494	406	16	293
Brani Est	59	1323	3	56	1	21	31	633	590	475	24	344
Barani west	48	956	3	44	0	0	22	485	522	517	16	169
Total	233	5609	22	352	15	291	116	2702	2967	1478	103	1484

Center	Olive preserving		Poultry	No. of stoves	No. of sewing machines	Donkey carts	Hand pumps	Social center	Rehabilitation
	No. of session	No. of benefi-ciaries							
Ras El Hikma	18	228	118	128	17	47	433	3	168
Matrouh	13	208	153	112	10	52	602	3	178
Nigila	16	247	125	65	3	43	408	3	162
Brani Est	16	227	116	56	10	48	499	3	189
Barani west	7	78	72	54	10	40	560	3	172
Total	70	988	584	415	50	230	2502	15	869

Credit for goats: 26; wells widowed women: 169; sensitization environment : 688

Water harvesting structures (stone, earthen and cemented dykes) were constructed in order to improve crop production and vegetation cover over an area of about 4.000 fd (see Table 3). Dry stone dykes were constructed to support an area of about 3.444 fd, cemented stone dykes on 168 fd and earthen dykes on 367 fd. These dykes not only harvest water for the crops but also curb soil erosion in the streams by reducing the flood flow velocities in the reaches of the dyke and immediate downstream area. Additionally, 204 hand pumps and 55 diesel-operated pumps were procured and distributed among the Bedouin women in order to facilitate the use of water from the cisterns. Furthermore, 8 plastic greenhouses and drip network over 4 fd were developed.

Water harvesting had a significant impact on productivity enhancement, mainly due to substantial increases in fruit trees. The greater the relative importance of fruit production in the farming system, the greater was the impact. The 10-year weighted-average increase in physical productivity was increased by 91% (about 58 tones per farm on average) and the weighted annual net income was increased by 52%. The annual rate of net return for the extra cost incurred due to the building and use of water harvesting structures was over 300% on average. Net benefits to poor farmers were higher in percentage as compared with medium and large farmers, providing a good justification which will give priority to the poor in any future development. Moreover, water harvesting has impact their basic water needs and also reduced women's time and drudgery in collecting water.

Resource conservation. Re-seeding has been carried out by the Project in order to improve the vegetation cover and reduce soil losses over an area of about 2.260 fd, and 69 km of windbreaks have been planted (using local plant “Boos”) to conserve the sandy soil from wind drift erosion. The details are given in Table 4. The re-seeding showed a good survival rate providing encouragement for replication. While the latter remained highly effective in Barrani area.

Table 4. Achievement of soil conservation for watershed management

SRSC	Structure work		Stone dikes		Earth dikes		Reseeding		Tree belt	
	Fed	%	Fed	%	Fed	%	Fed	%	Fed	%
Hekma	27	48	88	14	64	42	710	32	0.4	1
Matrouh	20	36	5	1	0	0	208	9	0.0	--
Nigila	0	0	22	4	0	0	617	27	0.9	2
Barrrani East	7	12	140	22	0	0	675	30	45.7	77
Baarrani west	2	4	369	59	89	58	50	2	22.0	20
Total	56	100	634	100	153	100	2260	100	69.0	100

Fed = 4200 m^2

The Project also built check dams in order to control excessive gully and channel erosion, which additionally helped about 831 fd. to harvest some water for crops of lower water requirements. Land use planning and soil suitability classification were also carried out for two selected watersheds, which proved very helpful in the planning process of similar watersheds.

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