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WATER CONSERVATION POLICIES, PRACTICES AND FUTURE OPTIONS IN PALESTINE: A SPECIAL FOCUS ON AGRICULTURE

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ABSTRACT - Palestinian Authority Territories represented in the West Bank and Gaza Strip has an acute water stress since the allocated water per capita per year is 70 m³. Agricultural sector plays a crucial role in the social well being of the Palestinian people due to the fact that it is considered for a lot of people the main source of their living, and to others, it is considered as an additional income because they can save nutritional materials. Total current water use in the West Bank and Gaza Strip (WBGS) is estimated to be about 286 million cubic meters (MCM) per year. Agriculture continues to be the largest consumer of water accounting for more than 60 percent of total use (167 MCM, about half each in the West Bank and in the Gaza Strip). Groundwater wells constitute the only source of irrigation water in the Gaza Strip. In the West Bank, wells and springs contribute almost equal amounts of irrigation water, though the vast majority of springs are concentrated in the Jordan Valley (Jericho District). This critical situation related to water resources in Palestine motivated Palestinian National Authority (PNA) in cooperation with national and international bodies to set the required policies for water conservation and design the possible future options for water use. This paper addressed in brief the following: Water resources budget, water use, agricultural water demand, and the base of water policy, main water supply policy elements, agricultural policy objective, existing water conservation practices and proposed practices.

Keywords: water stress, water use, irrigation water, water conservation practices.

Water resources budget

Water resources in the WBGS would be classified into conventional and non-conventional resources, the following table outlined the water resources budget in Million Cubic Meters (MCM):

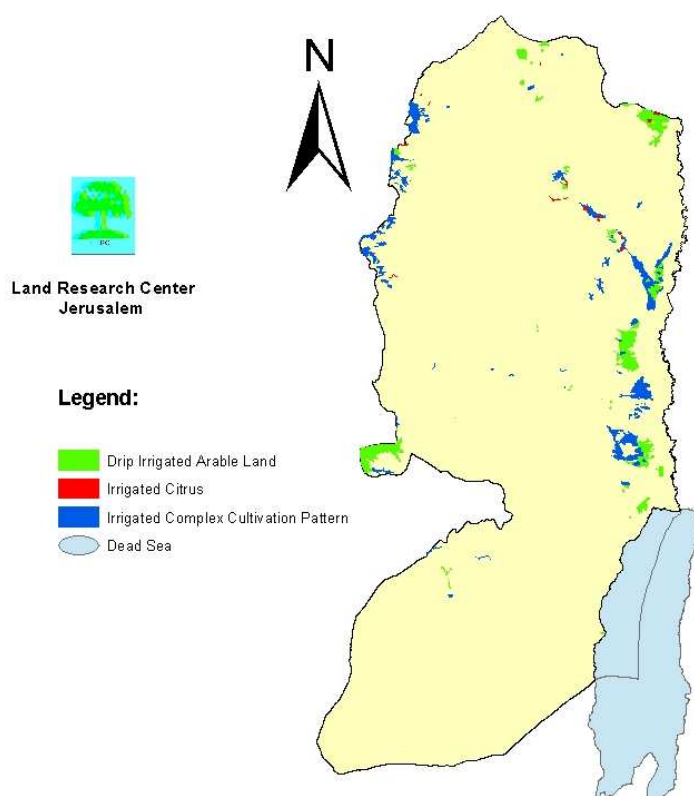
Water Resources	Quantity (MCM)
Conventional Resources	
Total Annual GW. Replenishment	679
Total Well Abstraction (Palestine + Israel)	-107.7
Max Spring Discharge	-55
Potential GW Storage	516.3
Available storage (assuming 50% of this potential Flows inter boundaries)	258.15
Surface Water (Jordan River)	200
Total Conventional Resources	458.15
Non-Conventional Resources	
Total flood water (assuming that 2/3 is captured)	30
Recycled Domestic Waste Water from urban areas	10
Brackish water available from springs	15
Total Non-Conventional Resources	55
Total available	513.15

Water Use

Palestinian total water use in the West Bank has been estimated to be 120 million m³/year. About 86 million m³/year of this amount (71%) is used to irrigate 90,000 dunums. The remaining 34 million m³/year is used for domestic and industrial use (industry's share is about 3%) with more than 40% of unaccounted for water. In Gaza, Palestinians total use of water is about 125 million m³/year. 80 Mcm is used to irrigate 120,000 dunums. The remaining 45 million m³/year is used for domestic and industrial use (industry's share about 3%) with more than 50% unaccounted for water.

The total irrigated land which is 210,000 dunums in the West Bank and Gaza forms only 11% of the total cultivated land. In addition, there is 400,000 dunums of potential irrigable land. Agriculture uses nearly 60% of the total water allocated to Palestinians in the West Bank. It used to contribute by nearly 25% of the GDP. Currently, it only contributes by 8% now.

The following map displays the irrigated sites in the West Bank.



Map 1 Irrigated land in the West Bank.

Agricultural Water Demand

Based on the assumptions of nearly 800 m³ / dunum and 0.072 dunum / capita irrigated land, the following table displays the agricultural water demand in the WBGS:

Projection year	Population million	Irrigated lands dunum	Water demand Mcm/year
2010	4.95	356,400	285.12
2040	9.98	718,560	574.85

Estimation based on BCPS (1998) Population Figures

The Base of Water Policy

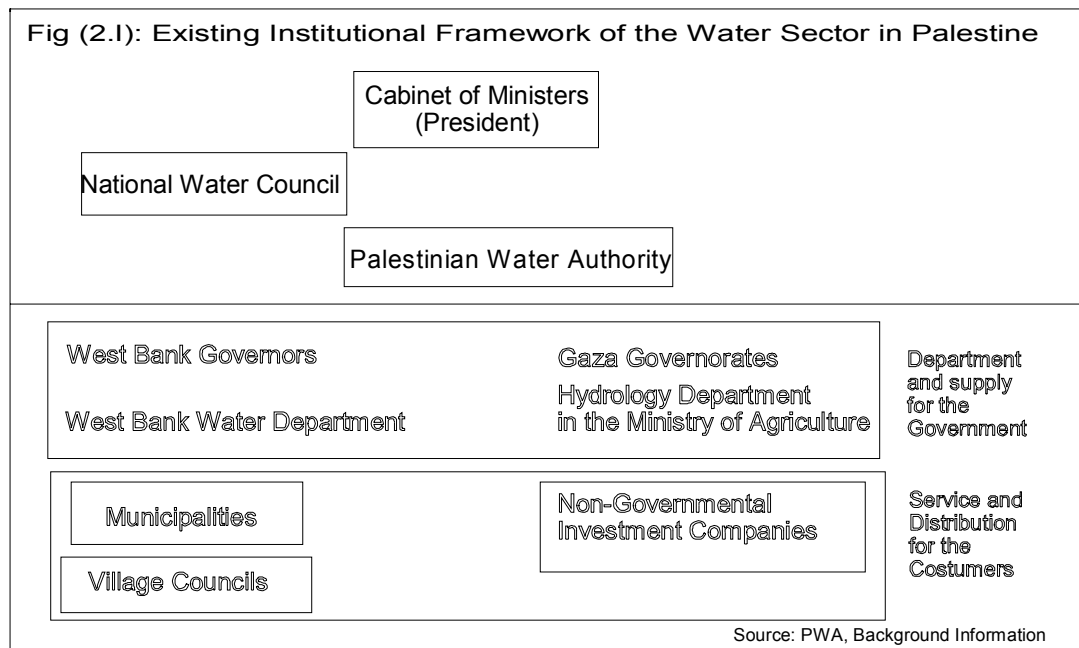
The following laws and legislation items form the basis of water policy in Palestine:

Law n. 3 (water law) has been approved by the legislative council on 18/2/02. The law has been approved by the President of Palestinian National Authority (PNA) on 17/7/02 and was then published in the official newspaper on 5/9/2002.

- Article 2 of the law states that all water resources have been declared public property.
- According to article 7, Palestinian Water Authority (PWA) has full responsibility over managing water resources and sanitation in Palestine.
- Article 8 deals with the creation of the National Water Council (NWC).
- Article 25 states that Regional Water Utilities (RWU) will be established, based on the desire of the local utilities and water user associations, to provide water and wastewater services for Palestinian communities
- Article 41 states that local village and municipal councils, government bodies and NGOs continue to provide water and wastewater services until the RWUs are established.

Water Supply Management

The following figure (Figure 2.1) displays the existing institutional framework of the water sector in Palestine:



Main Water Policy Elements

The following items constitute the main water policy elements of the Palestinian National Authority:

- All sources of water should be the property of the state.
- Water has a unique value for humans' survival and health, and all citizens have the right to water of good quality for personal consumptions at cost they can afford.
 - Domestic, industrial and agricultural development and investments must be compatible with the water resource quantity available.
 - Water indeed is an economic commodity; therefore, the damage resulting from the destruction of its usefulness (pollution) should be paid by the party causing the damage (pollution).
- The development of the water resources of the Palestinian territory must be coordinated on the national level and carried out on the appropriate local level.
- Water supply must be based on a sustainable development for all available water resources.
- Public participation in water sector management should be ensured.

- Water management at all levels should integrate water quality and quantity.
- Water supply and wastewater management should be integrated at all administrative levels.
- Consistent water demand management must complement the optimal development of water supply.
- Protection and pollution control of water resources should be ensured.
- Conservation and optimum use of water resources should be promoted and enhanced
- The Palestinian will pursue their interests in connection with obtaining the rights of water resources shared by other countries.

MOA Agricultural Policy Objective is efficient management of irrigation water to maximize returns per cubic meter of irrigation water. This objective can be attained through the realization of the following priority actions:

- Rehabilitation of water infrastructure (wells, springs, ponds, etc.).
- Increasing the efficiency of water delivery and irrigation systems.
- Benefiting from the use of brackish and treated wastewater for irrigation.
- Enhancing water availability by encouraging water harvesting and water gathering.
- Intensifying and strengthen extension and research activities and the transfer of technology.
- Encouraging investments in water projects and preserving them.
- providing appropriate legal and institutional frameworks

Existing water conservation practices

A number of useful water conservation practices are already adapted to some degree in the West Bank and Gaza Strip, and these practices should be expanded to help conserve agricultural water use. These practices are:

- Harvesting local water runoff and floodwater to increase water supplies for dry land agriculture (construction of rainwater cisterns and ponds).
- Reducing evaporative water loss by cropping within closed environment (desert greenhouses). This method is economic with land and water use, avoids soil salinization, and produces high yields of exportable crops, such as ornamentals, fruits, vegetables, and herbs.
- Introduction of irrigation scheduling and French Project in Al-Bathan is a good example.
- Considering the use of brackish water for irrigation of salinity tolerant crops.
- Saving more freshwater by switching to irrigation with treated wastewater or with brackish water if possible.
- Shifting from high demand water crops to low demand water crops.

Conservation Program

Because of the above listed challenges, the Ministry of Agriculture and the Palestinian Water Authority should follow comprehensive water conservation and saving program. In this program, a set of the Best Management Practices (BMPs) should be presented as a guide for crop growers and practiced in Palestine where it is applicable. BMPs for agricultural water users are combinations of site-specific management, educational, and physical practices that have proven to be effective and are economical for conserving water. BMPs should focus on increasing the water use efficiency of water users such as producers of agricultural crops and of water suppliers such as irrigation districts. Best-management practices contained in the BMP Guide should be voluntary efficiency measures that save a quantifiable amount of water, either directly or indirectly, and can be implemented within a specified timeframe.

The proposed conservation practices would be outlined as follows:

- Rainwater Harvesting Reuse
- Public Awareness
- Re-Use of Treated Wastewater
- Irrigation Scheduling
- Volumetric Measurements of Irrigation Water Use
- On-Farm Irrigation Audit
- Land Levelling
- Contour Farming
- Lining of On-Farming Irrigation Ditches
- Drip/Micro-Irrigation System

- Replacement of Irrigation District Canals and Lateral Canals with Pipelines and replacement of On-Farm Irrigation Ditches With Pipelines

CONCLUSIONS

The following concluding remarks would be drawn out of all the above mentioned:

- The challenge of implementing water policy in Palestine is mainly constrained by the Israeli Occupation.
 - On-farm water conservation and saving programs are still at the pilot-scale while in the off-farm considerable activities have been conducted since the establishment of the Palestinian National Authority.
 - Palestinians already established their policies and strategies regarding water management and conservation while the enforcement of regulations is still very weak due to the sovereignty issue over land and water.
 - Appropriate regulatory frameworks need to be developed to accommodate best management practices in water management
 - Stakeholder participation and the creation of Water User Associations are needed to improve water management efficiency
 - It is important to define roles and responsibilities of the various institutions dealing with water management.

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