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SUSTAINABILITY DIMENSIONS OF THE PRACTICAL EXPERIENCE IN WATER SAVING FOR AGRICULTURE IN PALESTINIAN AUTHORITY TERRITORIES

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SUMMARY- It is evident that the Palestinian Authority Territories (PAT) represented in the West Bank and Gaza Strip are facing severe water stress (70 m^3 per year per capita) which is very far below the redline figure of 1000 m^3 per capita per year. The driving forces leading to this situation are both human and natural induced. This situation put a lot of pressure on various water using sectors and often lead to allocation type that is governed by the political situation and other factors rather than demand driven case. The impacts of these pressures were clearly reflected on the social, economic, environmental and institutional state in PAT. Since the establishment of Palestinian National Authority (1994), responses at the governmental and civil society levels have been taking place to mitigate the resulted negative impacts of this situation.

This paper displays and analyses the sustainability dimensions of a practical experience of Palestinians in PAT after 1994 in the context of Integrated Water Resources Management (IWRM) paradigm. These dimensions are environmental, economic, social and institutional. The experiences displayed would be represented in the integrated watershed management of Al-Fara'a Valley Watershed. This experience would reflect the cons and pros of IWRM, and how the political dimension predominates other dimensions at the local and regional levels. In addition, the institutional challenge and the reduced solution space are highlighted as major constraints that lead to the absence of enabling environment for policy implementation.

In the context of the social dimension of IWRM, the urgent need and necessity to engage other social actors to strengthen the current architecture of institutions and networks is analyzed. This analysis would help in making IWRM more operational, since policies were written and new institutional arrangement were laid out but the main stakeholders have not yet understood their role due to the lack of effective and constructive engagement of those stakeholders.

Key words: Palestinian Authority, West Bank, Gaza Strip, IWRM, water saving in agriculture.

INTRUDUCTION

Water Situation in Palestine

The West Bank and Gaza Strip (W&G) are located east to the Mediterranean Sea. The total area of Palestine (including the Palestinian part of the Dead Sea) is about 6245 km^2 (365 km^2 in Gaza Strip). It is populated by more than 3.5 million Palestinians.

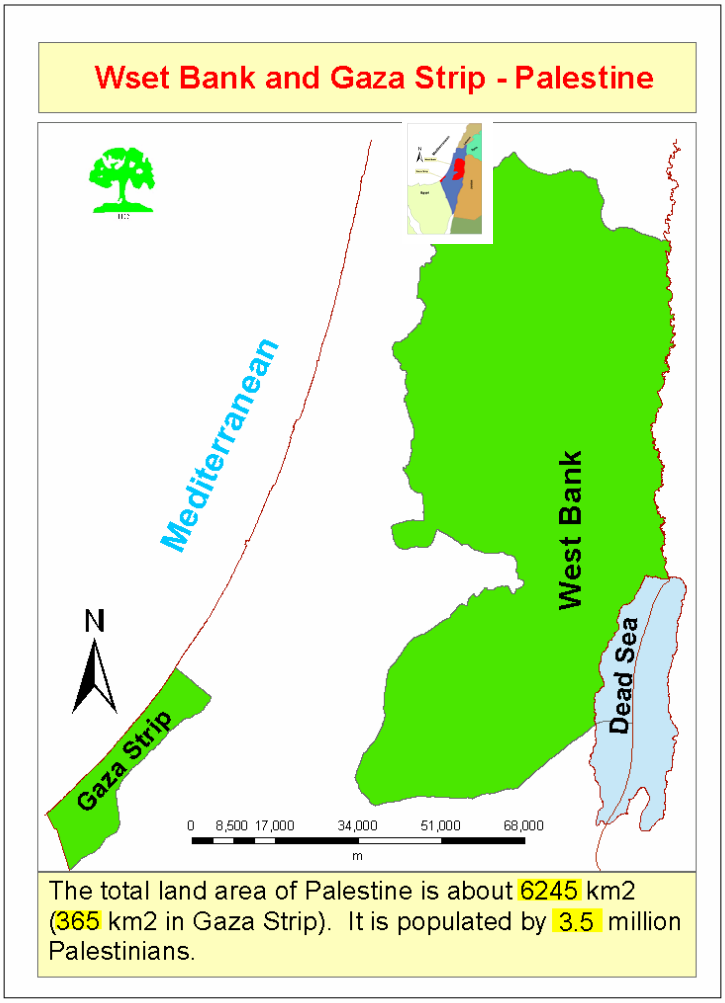


Fig. 1. West Bank and Gaza Strip – Palestine

Palestine is among the countries with the scarcest renewable water resources per capita due to both political and natural constraints, amounting to only 70-85 cubic meters per capita per year. The available water resources to Palestinians are about 286 MCM only. Available estimates of the water resources are displayed in *Table1* that provides an approximate breakdown of the water resources according to various water resources studies.

Table 1 - Breakdown of Yearly Available Water Resources

Source	Approximate Capacity (MCM)
Groundwater	785
Surface water	52
Spring water	121
Wastewater	16
Runoff	73
Total	**1047**

This paper concentrates only on a Palestinian experience in natural resources management in the context of Fara'a Integrated Watershed Management Project taking in consideration that Palestinians do not have control over their natural resources. An objective of this paper is to review ideas on how natural resources can be managed for sustainable development.

Ecosystem Approach and Sustainable Development

Although the ecosystem approach is not a new one, it is gaining currency in the last few years as it is mainly compiled with sustainable development. The notions of ecosystem and sustainable development predominate because of the world's awareness of the emerging problems due to different pressures on the ecosystems has increased considerably. The need to improve the protection and management of ecosystems in a way that balances and integrates environmental and development questions, is now recognized as an important challenge for sustainable development.

The concept of ecosystem is essential in the context of sustainable use of natural resources although this concept has been variously defined. A relatively simple definition is "Ecosystem is a dynamic complex of plant, animal, fungal, and micro-organism communities and their associated non-living environment interacting as an ecological unit" (Heywood and Watson 1995). The term ecosystem can be used not only in connection with different types of land use and land-cover, but also at a variety of spatial scales.

The ecosystem management has several definitions. Grumbine (1994) said, "Ecosystem management is integrating scientific knowledge of ecological relationships within a complex sociopolitical and values framework toward the general goal of protecting native ecosystem integrity over the long term". The Ecological Society of America (Christenson *et al.* 1996) indicated that: "Ecosystem management is management driven by explicit goals, executed by policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem composition, structure, and function. Ecosystem management includes sustainability, goals, sound ecological models and understanding, complexity and connectedness, the dynamic character of ecosystems, context and scale, humans as ecosystem components, adaptability, and accountability". These definitions, explicitly relate ecosystem management to the integration of ecological, economic, and social factors.

According to Stankey (1995), sustainability is fundamentally a sociopolitical construct rather than a scientific concept capable of precise, unequivocal measurements. In the Rio Declaration on Environment and Development, sustainability is defined as the equitable meeting of development and environmental needs of present and future generations.

Bormann *et al.* (1994) pointed out that ecosystem sustainability is the degree of overlap between what people collectively want - reflecting social values and economic concerns - and what is ecologically possible in the long term. The overlap is dynamic because both societal and ecological capacity continually changes. They advocate that the desires of future generations be protected by maintaining options for unexpected future ecosystem goods, services, and states. The approach presented by Bormann to calculate sustainability deserves to be tested in practical situations. It would be a good step in the future to systematically apply this approach to a practical experience.

Despite the above-mentioned definitions, the practical application of criteria and indicators in management and policy is still distant. As Brooks (1996) pointed out, "Although it required a considerable effort to define the criteria and select the preliminary list of indicators, no consensus has been reached on how individual indicators should be interpreted". The reasons may be found in the important limitations of the notion of sustainability.

Other obstacles still need to be tackled in order to define and select these indicators like: first, spatial and temporal scale at which sustainability should be attained, second, "What should be sustained?" what "sustainable use of a resource" means, is not always clear. The third obstacle is the scarcity of scientific knowledge on many issues of sustainability. An impressive body of scientific results exists about individual elements and processes of ecosystems at the site scale, but not enough is known about many long-term effects or interactions at larger scales. The fourth obstacle is "How should we understand sustainability, given the increasing world population?".

Ecosystem management is clearly a complex and interdisciplinary type of management that needs good monitoring and relevant scientific contributions. In addition, people clearly are fundamental elements of ecosystem management. The above-mentioned limitations and obstacles should not be an excuse to reject sustainable management of ecosystems as an ideal.

Fara'a Watershed at a Glance

The area of interest is located at the northern part of the West Bank and extending over three districts: Nablus, Tubas and Jenin as shown in Fig. 2. The estimated area of the mapped area of interest is about 330 km^2.

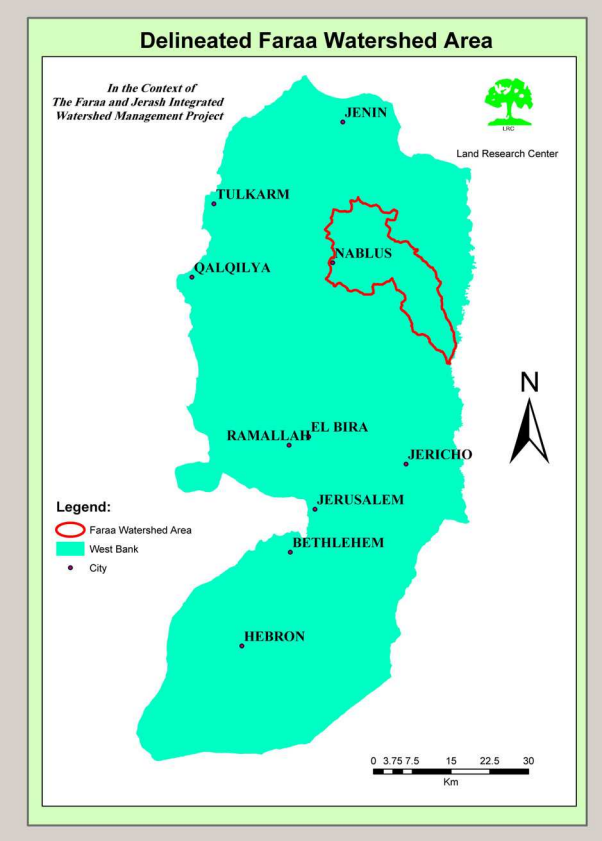


Fig. 2. Location of the area of interest.

Methodology

DPSIR environmental model approach is adopted in displaying the cause effect status of Fara'a Watershed (FW). n this report, we look at DPSIR model or framework for the aim to help identify the cause-effect chains that let us understand and scientifically analyze environmental resources, use and problems and then help in identifying prospected interventions to mitigate the ecosystem degradation. All social solidarities, i.e. governmental agencies, NGOs, private sector and civil society were involved in this process. The obtained results would be displayed in the following sections.

Factors Inducing FW Degradation

FW is considered here, as the ecosystem but it should be taken in consideration that this ecosystem is affected by external factors especially the socioeconomic situation in the surroundings. The driving forces or factors inducing FW degradation can be classified into human activities and natural factors. These factors would be described as follows:

Human Induced Factors

Historical Aspects

It is beyond the scope of this report to describe in detail the history of activities in the FW. The oldest city inhabited in the world (Jericho) is located nearby this area. The successive civilizations and wars put certain degree of pressure on land and water resources in FW which lead to severe vegetation destruction. At the same time, the positive impact of Romans management of land by building retaining walls to prevent soil degradation should be noted.

Economic Driver

Irrigated agriculture is the most important economic activity in the Wadi. Moving towards intensive and irrigated agriculture reduce the required area to be planted and increases family income significantly. In addition to the high returns of irrigated agriculture, it requires more labor. Therefore, irrigated agriculture is playing an important role in creating jobs.

At the beginning of Israeli occupation, the labor market forced some inhabitants in FW to quit the agricultural work as a main source of living. The reduction of prices due to marketing problems combined with the lack of agricultural industries that are able to absorb the surplus agricultural products in the area resulted in the creation of a situation where prices are reduced down into a level where it is no longer economically feasible to cultivate. Therefore, solving marketing problems to the farmers is an essential step towards agricultural development and agricultural sustainability.

Sociopolitical Drivers

Two categories of sociopolitical forces appear to be undergoing major changes in the last 40 years in FW:

- The general role of the public in decision-making appears to be expanding as evidenced by the extent of democratization and participatory approach represented in municipal elections and formulation of cooperatives. As well, there is some evidence of improving governance of natural resources at the national and FW levels. This governance enhancement is noticeable after the establishment of the Palestinian National Authority.
- The voices that are heard and how they are expressed has changed, as evidenced in the changing role of women and the rise of civil society represented by the involvement of NGOs in FW activities.

Population growth rate is estimated to be about 3.5%, which means that population doubles in nearly every 16 years which is mainly a young society. The inadequacy of health services in the area is clearly noticed in FW. The inadequacy of educational facilities represented in shortages in the number of schools (the only secondary school in the Wadi is located in Al-Aqrabaniyya) and well maintained schools is evident in the area.

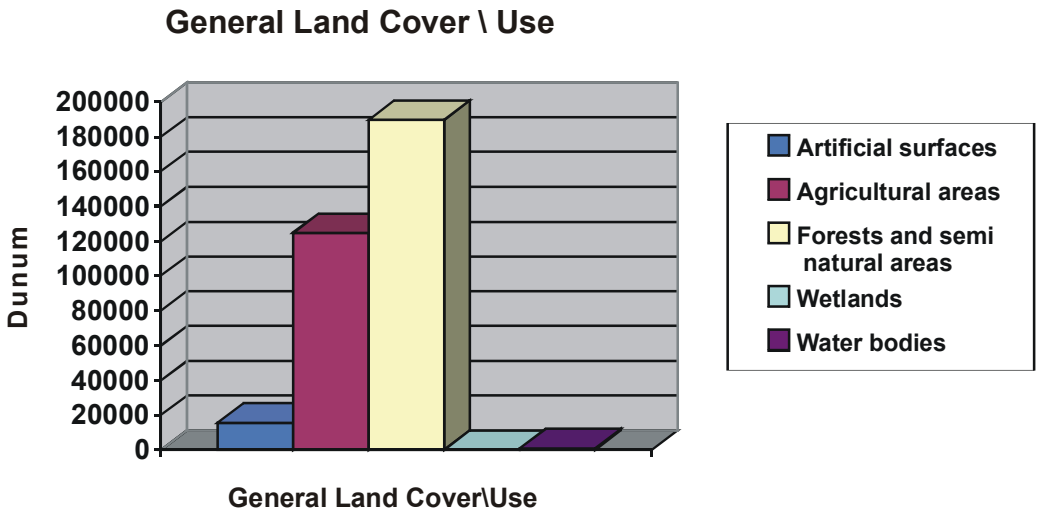
Despite the above-mentioned positive driving forces at the social aspect, Israeli occupation and absence of control over land remain to be the main factor affecting the state of land degradation in FW. This situation affected all aspects related to land conservation and land use planning.

National – Land Use (mismanagement of land)

The influence of humans over FW is most obvious at the local level. The land use is a clear reflection of this factor when looking especially at the urban communities and other artificial surfaces. If we classify the Faraa watershed area at the first CORINE level, the following table and chart displays the results:

Table 2. General land cover/Use of FW

General Land Cover/Use	Area (km^2)	Percentage (%)
Artificial surfaces	16.94	5.1
Agricultural areas	115.89	35.1
Forests and semi natural areas	197.17	59.7
Water bodies	0.28	<0.1
Total	**330.28**	**100**



Unfortunately, the urban community is localized at land with high agricultural value. The reason for this may be the harsh topography of the non-agricultural land. Demographic projection distribution suggests that future population growth rates will not be uniform throughout the ecosystem.

Discharge of wastewater effluents from built up areas into the open environment contributes to the extent of the health and environmental health hazards existing in the area. Solid waste management in the area is another aspect of land mismanagement. FW produced slightly more than 5000 tones of waste every year and this amount is expected to increase up to more than 12,000 tones per year in 2020.

In general, Effective land management is negatively affected by the absence of land use planning.

Natural Factors

Natural drivers include climate variability and extreme weather events (such as droughts), pest and disease outbreaks, harsh topographic features and natural biological evolution.

Climate

The climate of the West Bank (as well as FW) is traditionally described as Mediterranean, which is characterized by winter rain and summer drought. However, there is a great diversity in this climate. This diversity ranges from hyper arid in the southern part to sub humid in the northwest. The total area of the hyper arid is 34 km^2 which comprising about 10% of the land area of the FW; the area of the arid part is 131 km^2 (about 40%); the area of the semi arid part is 105 km^2 (about 32%); the sub humid area is 60 km^2 (18%).

The area suffering from the aridity (82%) is located at the eastern and far southern part of the FW. However, this degree of aridity imposes hard restrictions on utilizing this land for agriculture in the absence of control on it.

Geomorphology

Although it is a comparatively small area, FW is characterized by a large degree of variation in topography. Its topography is characterized by its very steep hills surrounding Fara'a Valley which contribute to land degradation. The elevation ranges between 920 m above sea level to 350 m below sea level. FW watershed is composed of the following landform elements prone to severe land degradation:

- Very steep hills (>25% of slope): It has an area of 64 km^2 which is about 19.5% of FW. This area is very difficult to utilize either for agriculture or for urbanization. The most probable use of this part is forests or rangeland.
- Moderately steep hills: It composes the highest percentage among the landform elements. It covers about 101 km^2 which represents 31% of the watershed area. This part is biased toward the highest slope % (20-25%) which indicates that the topography of the area is harsh one. It is possible to reclaim this land utilizing the mechanical land reclamation techniques. However, is such area with low amount of precipitation, it is preferable to utilize it either as forest or rangeland area.

Pressures on Land

The following are the main land degradation processes that are taking place in the FW:

Water pollution

Soil Erosion

Soil Salinization

Soil Contamination

Soil sealing

Loss of biodiversity

Relative Water Scarcity and Deteriorating Water Quality

The apparent situation in FW indicates that there is a surplus of water; on the contrary, careful analyses of the water situation indicate that there is a relative water scarcity in some domains as shown in the following: Annual discharge from springs varies from 4.4 MCM to 41 MCM with an average amount of about 14 MCM/year. Based on the data available, the total utilization of the Palestinian wells ranges from 4.5 to 11.5 MCM/year. Domestic water supplies to the villages and towns in Wadi Al-Fara'a is obtained from the existing springs and wells in the area. Ras Al-Fara'a and Wadi Al-Fara'a villages don't have domestic pipe networks[6]. The rest of the villages have either partial pipe networks or full pipe networks.

The water quality also is deteriorating due to several reasons. Records for wells in upper Cenomanian, alluvium and Eocene aquifers in the middle and lower areas of Fara'a Valley showed significant reductions in water table elevations. This leads to an increase in water salinity for wells in the lower parts of the FW. Water salinity for these wells is the major concern for utilizing water from these wells. Also, spring water is mixed with untreated waste water from Nablus and Al-Fara'a camp resulting in serious deterioration for the water quality along the main stream of Valley.

RESULTS AND DISCUSSION

Land in FW has been affected greatly by a series of combinations and interactions of topographical, hydrological and climatic conditions, as well as by political conditions. These driving forces are dominated and exaggerated by the current political situation of the division and classification of Palestinian territory into different classes, depending on authorities exerting control over each area. This situation is rendering comprehensive natural resource management, which in turn, renders sustainable management and development.

Absence of land use planning is an important driving force toward land and soil degradation. This absence leads to a lot of human induced pressure on the land. Waste disposal resulted from either municipal or industrial origin is a serious land degradation source

Natural conditions like topography, climate are representing major driving forces toward land and soil degradation. The harsh topography in large areas of the FW induced soil degradation by various erosion processes.

Pressures, resulted from the above-mentioned driving forces, affect the quality of land and accelerate soil degradation.

The impacts of land degradation on health, agriculture and environment are not displayed due to the unavailability of statistical data and information.

Palestinian National Authority (PNA) has recently developed national policies in the areas of water, environment and agriculture. However, such policies have not been implemented at the local level. There is no single authority or agency responsible for regional planning in the area. The village councils and municipalities plan and work separately. Stakeholders' analyses showed that the institutions in the area are working independently of each other. Therefore, constructive engagement of the various stakeholders took place in order to advance policy implementation in the context of this Project.

The local people and the farmers are misrepresented at most levels. Their participation in the decision making process is also minimal. There are no active farmers unions that represent the interests of farmers. There are no water user associations that represent the interests of water users, operate, and manage water systems.

In response to the impacts, although very few due to several reasons, PNA set the necessary legislation, policies and strategies of the concerned ministries to conserve land resources in general and soil in particular. On the ground, a lot of practical measures and actions took place by PNA in cooperation with concerned NGOs to prevent the acceleration of soil degradation and increase water harvesting. This work is mainly done with farmers and land users in the form of land reclamation projects, afforestration, water harvesting and agricultural advisory fieldwork.

As a matter of fact, there are challenges faced the technical team in addition to government representatives in identifying the most urgent and sustainable interventions according to the above mentioned stresses as driving forces, pressures or impacts. How should natural resources be managed for sustainable development?. Although tools for managing most of the natural resources are generally known and available, the answer is difficult for the following main reasons:

- limited scientific knowledge on the long-term processes, reactions, and interactions in the ecosystem.
- the difficulty to reaching consensus among the different groups of interest on the multiple objectives of management.
- the challenge of defining sustainability.

CONCLUSION

Natural resources are most effectively managed using an integrated approach, including consolidation of authority in watersheds where possible. Clean environment is a function not only of

natural processes, but also of responsible social behavior by citizens and integrated and coordinated management by government agencies. Management of natural resources requires understanding that the human dimensions, including economic and social processes, are components of the overall system that should be accounted for in planning and management.

Although the integrated natural resource management is the best available management paradigm, efforts to operationalize this approach and the ecosystem idea should be exerted by first pinpointing the shortcomings in this approach. From the Fara'a watershed management experience, it would be fruitful to highlight that there is little consensus about the new terminology, conceptual categories, and classifications used to discuss ecosystem management. Because of this diversity, it is important that we look at all aspects of ecosystem management to determine the full range of its possibilities and limitations.

There is a need to work on the following domains:

- Develop and demonstrate a general ecological assessment process, along with the associated analytical tools, that will allow managers to define realistic environmental goals; assess current ecological conditions relative to those goals and identify major environmental problems; evaluate and compare the ecological consequences of alternative management strategies; and target geographic areas for protection, restoration, or other management actions.
- Advance the understanding of ecosystems, ecosystem dynamics, and ecosystem responses to human activities to reduce uncertainties in ecological assessments and improve confidence in ecosystem management decisions.

Science and policy must function together for watershed management to be successful, so there also must be more attention to the role of politics in decision-making. A solid scientific foundation of basic and applied research is needed to provide the data, information, and tools necessary for effective implementation of watershed management activities.

Finally, sustainable development is a learning process. If we want to succeed, we have to go through all steps of the process, one step after the other. To do so, we need an understanding of management of natural resources for sustainable development and a vision of implementing it.

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