Resilience to Climate Change in Palestine

The Fine Balance between Floods and Droughts

INTERNATIONAL UNION FOR CONSERVATION OF NATURE – REGIONAL OFFICE FOR WEST ASIA

ACKNOWLEDGMENTS

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SEARCH is a three year (2011 - 2013) regional project led by the International Union for the Conservation of Nature – Regional Office for West Asia and implemented in partnership with ten organizations (CEDARE, PHG, AWO, CEOSS,UAWC, BDRC, SPNL, MADA Association, Abdelmalik Essadi University, IUCN MED and ATED) from the five countries mentioned above and is supported by the IUCN Global Water Program in Switzerland and the Centre for Development and Innovation (CDI) - Wageningen in the Netherlands.
The objective of the project is to increase social and ecological resilience in watershed ecosystems of the Mediterranean Region in the face of climate and other drivers of change. Among the results that the project aims to accomplish is joint development and application of practical tools and guidelines (i.e. the toolkit) with policy makers to contribute to regional, (sub-)national and sector strategies and plans for climate change adaptation, water resources management, poverty reduction and economic development.

This case was produced with the support and commitment of the SEARCH partners and team. They are:

- Palestine Hydrology Group in the Occupied Palestinian Territories
- Union of Agricultural Work Committees in the Occupied Palestinian Territories

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INTRODUCTION

West Bank / Occupied Palestinian Territories

The West Bank which is part of the Occupied Palestinian Territories is divided into eleven governorates under the jurisdiction of the Palestinian National Authority. According to the Palestinian Central Bureau of Statistic, the West Bank has a total land area of 5,655km^2 while its population reached 2.7 million in 2013. It has a temperate weather with warm to hot dry summers and cool to mild rainy winters.

Combating climate change in the Occupied Palestinian Territories induces challenges that are not present in any other country in West Asia. In addition to the centralized management and marginal involvement of stakeholders in decision-making processes, the Israeli control of most natural resources has been dominating natural resources in the West Bank.

Marj Sanour Watershed

Marj Sanour is located in the north of the West Bank within Jenin governorate. The Marj Sanour watershed forms a unique closed watershed area in the West Bank. The total area of the watershed is about 58.58km^2, including a lake area of around 16 km^2. The Marj watershed area has an almost rectangular shape with northwest-southeast elongation. The lands of Marj Sanour watershed are mainly owned by inhabitants from seven villages: Meithaloun, Sanour, Siris, Judeida, Sir, Misilya, and Jarba. The population of these villages was around 25,000 inhabitants in 2010.

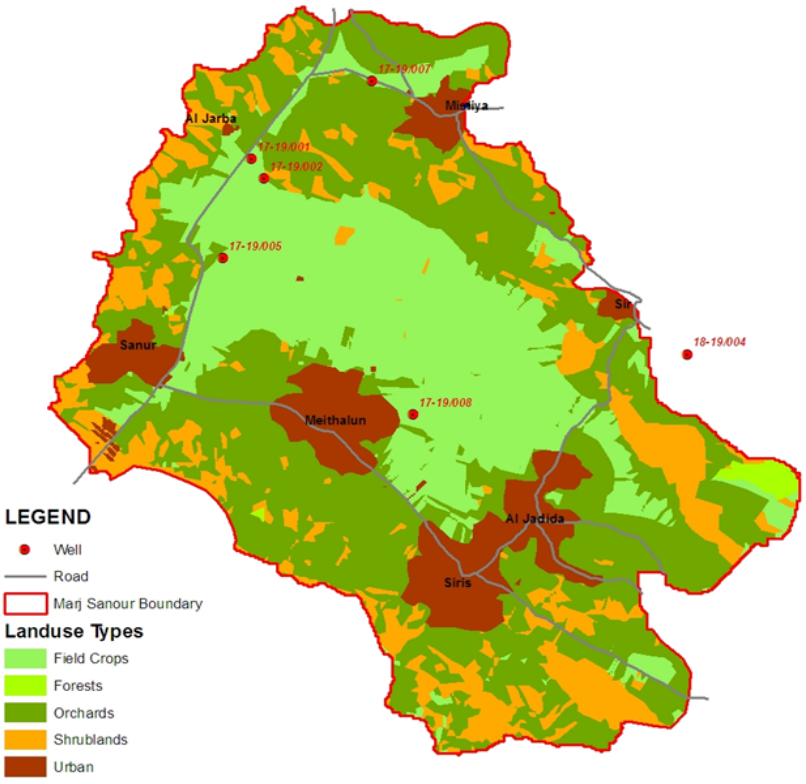

Figure 1: Location and land use map of Marj Sanour Watershed

The lake region is located between 350 and 375 contour lines above sea level. As a result of its nature, the Marj area forms a closed surface watershed. In heavy rainfall years, the Marj Lake is flooded by rainwater that drains from the surrounding valleys and from rainwater directly precipitating on the Lake area itself. The rainfall season starts typically in October through May, ranging from 400 to 1200mm with an average of 619mm. Rain-fed crops dominate most of the Lake plain while irrigated crops occupy limited areas. Rain-fed trees such as olives are mostly cultivated in the hilly surrounded area.

The concerned communities here depend in their livelihoods on agriculture and

livestock. Historically, the watershed region is known for its agricultural activities, where several types of trees and crops are cultivated such as olives, grapes, figs and nuts in addition to several rain-fed crops including grain and vegetables. Irrigation is also common for producing all basic kinds of vegetables. Keeping bees and livestock are also practiced in the watershed region.

A segment of the population depends on other sources of livelihood like working in governmental agencies, trade, industry and labor. The region hosts 745 commercial and industrial facilities, governmental and private, hiring over 1300 employees.

Groundwater and rainwater harvesting are the main water resources in Marj Sanour watershed area. Groundwater is abstracted by the several wells drilled while the inhabitants are storing the precipitating rainwater on the roofs of their houses in cisterns to be later used in the summer.

In 2010, the total quantity of water used for domestic purposes reached about 0.5 MCM with an average of 55 l/c/day. Sources of that quantity were: cisterns covering 23%, agricultural wells covering 42%, public network (the Sanour well) covering 11% and the Meithaloun shallow municipal well covering 24%. The total quantity of water used for agricultural purposes was estimated to be about 2,065,355m^3. While the total domestic water needed by this area is about 871,000m^3, meaning a deficit of 371,000m^3, the water needed for agricultural purposes was estimated to be 2,764,780m^3, with a deficit of 699,425m^3.

Resilience to Climate Change

Marj Sanour watershed is considered vulnerable to climate change variables, a grievous fact as the local communities economically depend mainly on the natural resources of the Marj and also due to their poor adaptive capacities to these variables. Groundwater, one of the most important natural resources in the area and the backbone of the agricultural and domestic needs, is affected by the amounts of rain falling in the region. This is reflected -either positively or negatively- on the citizens' economic situation. The locals consider floods and droughts as the most climate-related risks affecting their region while strong winds and the risk of frost spells are regarded of less negative impacts.

The factors enhancing this vulnerability include:

- The topography and geology of the watershed as a closed water basin with no natural water outlet.
- The steep slopes of some high mountainous areas around the Marj Lake.
- The nature of the Marj Lake's soil, characterized by low permeability on one hand and high cracking by drought or moisture decrease on the other.
- Extreme climatic events of rain, temperatures and wind.

Against this background, SEARCH (**S**ocial, **E**cological & **A**gricultural **R**esilience in the face of **C**limate **Ch**ange) project aimed to "improve the conjunctive use of both ground and surface water in order to improve the agricultural sector". Partners of SEARCH Palestine included the Palestinian Hydrology Group (PHG) and the Union of Agriculture Work Committee (UAWC) in cooperation with the Ministry of Agriculture and the Ministry of Environmental

Affairs and the Water Authority.

Early on, the SEARCH team worked to involve all key stakeholders in the planning, implementation and sustainability of the project. These included the Water Authority, Ministry of Agriculture, Environment Quality Authority, Palestinian Environmental NGOs Network and Ministry of Local Governorate.

APPROACHES AND METHODOLOGY

Stakeholders Dialogue and Concrete Action

The above key stakeholders became members in "SEARCH Advisory Committee" with the main role of advising SEARCH and later taking part in scaling-up of approaches developed and tested through the linkages they create to national and regional processes. In their meetings, they discussed the project work plan, the selection criteria of the watershed and the roles of each institution in supporting the project team.

Local stakeholders were also identified at the watershed level in light of their interests, involvement and influence on the watershed. Stakeholders were categorized regarding their roles into primary and secondary. The primary stakeholders were farmers, municipalities and village councils, well owners, women center, Joint Council for Water and Sanitation and the Watershed Association. They also included the Agriculture Directorate, Environmental Quality Authority, Local Governance Directorate and Jenin Governorate Office.

Discussions by watershed-level stakeholders showed that coordination between some stakeholders was limited or even absent, which creates conflicted in some cases. The farmers and Marj Sanour Association do not have any activity or role relevant to the work of Environmental Quality Authority in the area, particularly in environmental issues. At the same time, coordination between the Joint Council for Water and Sanitation and other parties is still weak. On the other hand, the strong coordination between farmers and well owners (who are the main water suppliers in the area) was very evident.

It was also noted that there is a clear difference between the actual roles played by some stakeholders on the ground and the roles assigned to them. This resulted in poor "stakeholder effectiveness"

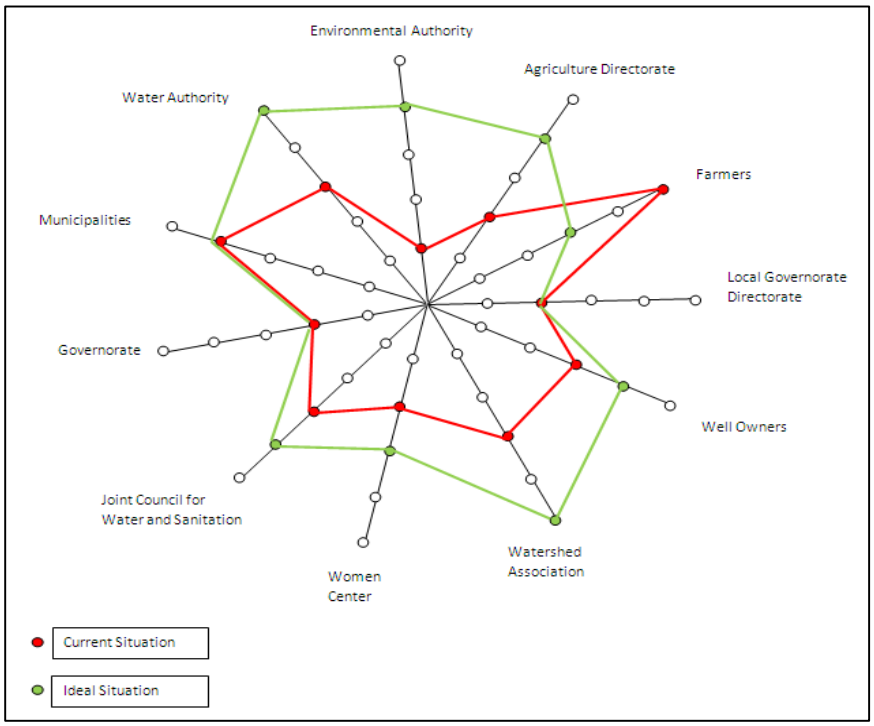

Figure 2: Stakeholder Effectiveness

and weak management of the Marj Sanour watershed.

Problem Identification

The problems faced at the watershed level were identified by stakeholders, highlighting those that are directly relevant to climate change and affect their daily life. Through the problem tree exercises stakeholders embarked on the following risks to the watershed inhabitants:

- **Irregular Rainfall**: It is a rainfall occurring in unusual times of the year, either before the start of the rain season or following it. This has often led to the spread of agricultural diseases and pests new to the region, which resulted in intensive use of pesticides and chemicals by farmers. In addition to the negative environmental impacts, the resultant expenses increased the economic burden on farmers.
- **Rain Season Delay**: This delay adversely affects the winter crops productivity. It also affects the quantity of water percolating to the groundwater. Reduction of groundwater recharge causes a decline in the water level that in turn affects the quantity and quality of the water abstracted through wells, which is the main water source for the irrigated crops in the region. In addition, the low level of groundwater often resulted in damage to pumping equipments, leading to high pumping costs and increasing the financial burdens on the agricultural sector.
- **Temperature and Humidity Increase:** The higher temperature that is associated with higher humidity during summer led to a significantly higher consumption of electricity which represented another source of financial burdens on the citizens and increasing pressure on the electricity distribution network, causing frequent power cuts and damages to appliances.
- **Obstacles to Resilience Interventions:** Lack of funding and the Israeli occupation pose obstacles to developing the region, with an ultimate outcome of a general deterioration in economic conditions and human health problems in the area.

Visioning

Upon the identification of the main watershed problems, local stakeholders formulated their initial vision as to be: "Rural livelihoods in Marj Sanour watershed area will demonstrate effective ecosystem/watershed management and improve the conjunctive use of both ground and surface water in order to improve agricultural practices" through:

- Raising the water table level to ensure increase in the amount of water available for use.
- Developing the ability to exploit the flood water for agricultural uses.
- Reusing the crops irrigation water.
- Increasing the capacity of the current energy system to accommodate changes/ future needs through exploring environment friendly sources.

Adaptation Analysis / Vulnerability Assessment

Subsequent to the verification of the collected data from the different sources, a data analysis was conducted. Then an adaptation analysis and a general vulnerability assessment of the watershed were prepared.

Floods were found to constitute a factor causing

high vulnerability in the downstream area of the watershed due to the high sensitivity of this area to floods. Consequences of floods included soil erosion, flooding of agricultural lands hindering cultivation, damaging crops and infrastructure and spreading diseases. Suggested adaptation measures included reclaiming lands and building new retaining walls, recharging wells, cultivating fodder crops, turning the flooding lands into natural reserves, cultivating types of crops that are tolerant to flood water like alfalfa and improving the roads and developing a drainage system. These suggested measures were considered only partially effective due to the magnitude of the interventions needed and the necessary high costs.

Figure 3: Floods in SEARCH Project Site in Palestine

Drought was considered a factor of high vulnerability affecting water resources, particularly groundwater that is directly dependent on precipitation quantity. Droughts resulted in a decline in groundwater level, increased salinity of groundwater, excessive water extraction, decreased quantities of harvested water, decreased cultivation of lands and agricultural production and increased consumption of electricity and fuel. The extent of the watershed's sensitivity to droughts is high especially that water needs are already greater than production and many regulatory problems face groundwater abstraction. One of the chronic outcomes of drought and the resultant water scarcity is conflicts on water resources between the different uses. The degree of adaptive capacity to droughts is considered medium as there is ability to regulate groundwater exploitation while some upgrading measures are already in place; however, this is not sufficient.

Frost affecting plants and infrastructure constituted a medium degree of vulnerability. The area suffers from frost waves in winter causing impacts that are variable in different years. The adaptive capacity of the area is considered low although some actions were adopted recently but still need modifications.

Wind, damaging facilities and greenhouses, induces a medium degree of vulnerability and is also active against a medium degree of sensitivity. Certain modifications can be introduced to enhance adaptive capacity such as frequent maintenance of facilities and building windbreaks while the mere rehabilitation of facilities that is sufficed with currently is considered insufficient.

From the stakeholders' point of view, local and national obstacles to applying adaptation measures include lack of the necessary funds, the current administrative regime and land fragmentation as the Marj Sanour lands are owned by different families from different communities.

Turning to Actions

Stakeholders developed evident readiness to decide on practical actions to realize their vision under a range of possible future scenarios. These actions were to be based on the concept that achieving the locals' vision and building resilience will have to be done through reducing vulnerability and improving the adaptive capacity of the watershed.

Local people are mainly interested in improving their livelihoods. Climate change is just one of many factors they need to have managed at the same time to attain such improvement.

Four resilience strategies were developed, the first three of which are considered applicable under all different scenarios:

Diversity Strategy

Creating and working on the different alternatives of the economy, livelihoods and nature. This strategy will be realized through:

- Diversification of income sources. People need to abandon their exclusive reliance on a unique source of income and seek other alternative sources.
- Diversification of water resources. Such as connecting the main water pipeline supplying the watershed communities with domestic water to other wells adjacent to the area like the Toubas, Tammoun and Sanour wells. These would provide alternative water resources if the Meithaloun well is not operative.
- Establishing water harvesting techniques like cisterns, ponds and reservoirs that can provide additional water source for agricultural uses.
- Introducing new crop patterns and new agricultural practices. Researchers and agronomists can advise farmers to introduce appropriate crops tolerant to flooding in the lake areas and crops tolerant to drought conditions. In addition, introducing new effective equipments to the area such as deep plowing machines can help the farmers to better use their lands.
- Combining between crop cultivation and livestock keeping. Due to the expensive cost of imported fodder, farmers can grow fodder in part of their lands to feed their livestock.
- Helping local institutions by creating new job opportunities such as manufacturing and marketing products by women centers members.
- Promoting agro-industrial investments. Investing in processing agricultural products will improve the products prices, which in turn leads to improving farmers' situation.

Self-Organization Strategy

Strengthening links between the relevant institutions on one hand, and between the locals and institutions on the other through participatory governance:

- Identifying local and national relevant institutions and their responsibilities.
- Encouraging participatory approaches and enhancing coordination between the different institutions.
- Encouraging the locals' participation in meetings and workshops at local level.
- Encouraging the locals to engage in the community-based organizations.
- Activating the Watershed Association's role to become the focal point of the watershed development.
- Building capacities of the local institutions to face the different threats and impacts.
- Educating the locals about their rights and

empowering them for advocacy work.

Figure 4: Local institutions' engagement

Learning Strategy

Improve the knowledge, awareness and skills of the locals and community organizations at the watershed level as to enhance their ability of accommodating adaptation strategies:

- Raising the awareness of students, women and farmers on the climate threats causes, impacts and the needed adaptation strategies. This can be done through brochures, posters, leaflets, websites and the media.
- Encouraging university researchers to conduct detailed investigations of the watershed.
- Verifying the watershed data and facilitating information flow and access.

Sustainable Infrastructure and Technology Strategies

While all activities suggested for 'learning', 'self-organization' and 'diversity' strategies were applicable under the different scenarios reached by the participants, several activities suggested for this strategy differ in accordance with differences in scenarios. However, there are activities for this strategy valid for all scenarios:

- Constructing domestic and agricultural cisterns and reservoirs.
- Reclamation and rehabilitation of lands.
- Introducing new crops (organic crops).
- Building stone retaining walls and terraces.
- Activating farmers associations.
- Encouraging home gardens and animal husbandry.
- Improving olive trees and olive oil production.

Projects Proposed

Several activities and projects were suggested by the technical team and local community to improve the Marj Sanour watershed area. These can be categorized as follows:

Water harvesting projects: These projects mainly focus on harvesting rain and flood water into pools, cisterns, dams and reservoirs. The water harvested during winter season will be used later in dry months for both domestic and agricultural purposes. Water harvesting techniques can be implemented at small scale or large scale. Cisterns and reservoirs can be constructed at house and farm levels while dams and earth pools can be made at large level on the plain's margins or the lake area. The construction and operation costs of these systems mainly depend on type and storage capacity. In general, water harvesting can be adopted to provide supplemental water for domestic and irrigation purposes, increase soil moisture, reduce runoff, or mitigate urban flooding.

Land reclamation and rehabilitation projects: These projects aim at improving land uses by making the unusable or neglected lands more productive. Reclamation and rehabilitation activities also contribute effectively in increasing water infiltration ratio and reducing runoff and soil erosion. In the study area, such activities can be

applied in the mountainous parts where some lands need improvements including constructing terraces, stone walls and agricultural roads.

Groundwater recharge projects: Groundwater recharge is considered one of the most significant projects that can be implemented in the area to recover the water level that had gone considerably in the past few years due to over-pumping by groundwater wells and the drought. Recharging groundwater can be done through several methods such as spreading systems or injection wells.

Water transfer actions: Through this project, water would be moved from the watershed by pipes or open channels. Such projects decrease the flooded area while at the same time can supply neighboring watersheds with water quantities.

An evaluation of all proposed projects resulted in identifying land management and water harvesting projects as the most beneficial to the target area in all respects.

Pilot Project Implementation

The Judeida community was chosen to implement a water harvesting project as had been suggested by stakeholders. The PHG proposed to implement a water harvesting project in Judeida area as a contribution in SEARCH project. In addition, PHG and UAWC obtained funding from the Netherlands Representative Office (NRO) in Palestinian Territories through the Land and Water Resources Management Program to construct a water-harvesting pond of 25000m^3 and drill two artificial recharge groundwater wells in Marj Sanour area.

The main objective of this project is to improve access to water for domestic and agricultural uses for ten families living in Judeida through the constructing six rainwater harvesting cisterns and conducting training for members from target families on their use and maintenance. After completing the construction of the harvesting cisterns, each family obtained a storage capacity of about 70m^3.

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