



**Technical Assistance Project to Support  
Adaptation to Climate Change in the  
Agricultural Sector of the West Bank**

**TACAIF**

**Integrative Watershed Management  
in the context of Climate Change  
Adaptation**

**20<sup>th</sup> December 2015**

A project assisted by the German Government via the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH  
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**Technical Assistance Project to Support Adaptation to Climate  
Change in the Agricultural Sector of the West Bank - TACAIF**

**I n t e g r a t i v e W a t e r s h e d M a n a g e m e n t i n t h e  
c o n t e x t o f c l i m a t e c h a n g e a d a p t a t i o n**

**B y I n t e r n a t i o n a l S h o r t T e r m E x p e r t  
B e r n d W a l t e r M u e l l e r**



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## List of abbreviations

ASSP	Agricultural Support Service Providers
CBLWM	Community Based Land and Water Management
CCAP	Adaptation to Climate Change in the agricultural sector of the West Bank (the project)
DA	Development Advisor
DoA	Directorate of Agriculture
GFA	GFA Consulting Group GmbH
GIZ	Gesellschaft für International Zusammenarbeit
IWRM	Integrated Water Resources Management
IWSM	Integrative Watershed Management
MoA	Ministry of Agriculture
ME	Middle East
NGO	Non-governmental organization
SSC	Staffing Service Contract
WRL	Water Retention Landscape
WRLD	Water Retention Landscape Design
WS	Watershed
WSMC	Watershed Management Committee

## 0. SUMMARY

The approach of the CCAP in the West Bank, to work with watersheds, allows an Integrative Watershed Management that enables sustainable ecosystem restoration in the area. The local ecosystem is degenerating and livelihood decreasing. This is a global problem that can be addressed locally.

### **IWSM allows local ecosystem regeneration and increase of livelihood.**

Decentralized rainwater management and natural vegetation management are crucial in this approach. The aim is to create ecosystems with more resilience to even more extreme climatic events. The big advantage of the chosen watersheds is that local farmers are still cultivating their lands wherever it is possible in the political situation. These farmers can help in the transformation process from a degenerating into a regenerative ecosystem when they are trained in IWSM.

The consultant recommends to concentrate the implementation of the CCAP to model areas, where 'best agriculture practices' can be showcased. These model areas can serve as training centers where the local community can learn and understand these best practices and implement them into their local culture. Schools for example are perfect model areas for climate smart home-gardening. For the supervision of these model areas long term commitments are needed.

As the technical expertise for some of the recommendations given in this report are locally not yet available, the consultant suggest to use some model implementations under professional leadership for capacity building amongst local experts. Mainly the training in building small scale rainwater retention structures, like swales, will enable people to protect micro- watersheds from erosion and floods, so that local food and water autonomy can be achieved.



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# 1 CONTEXT

## 1.1 Background

The Palestinian Ministry of Agriculture (MoA) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) have started the Technical Assistance project “Adaptation to Climate Change in the agriculture sector of the West Bank (CCAP)” (working title TACAIF) to support farming communities adapt to the impacts of climate change in the West Bank. The UNDP (Reference) expects at least 2,2 degrees temperature rise and 20% less total rainfall by 2050, while rainfall will be more erratic in duration, intensity and distribution. Since the large majority of farmers rely on rainfall for their productivity they are particularly vulnerable to the impacts of climate change. The project’s core objective is therefore **to enhance the capacities of farming communities to adapt water and land resources management practices to the impacts of climate change.**

The Palestinian Water Authority (PWA) is mandated to implement the 2013 water act according to the principles of Integrated Water Resource Management (IWRM). The Ministry of Agriculture (MoA) is mandate to provide water management support services to farming communities to enhance their capacities to utilize the available conventional and non-conventional water resources most efficiently for their farming systems. However, it cannot be ignored that the Israel-Palestina conflict limits the extent to which IWRM can be practiced. Israel exercises a great level of control over the land and water resources in the Palestinian area, limiting the sense of ownership or power to improve their situation. The potentials for improved water use by Palestinian farmers lies in the management of surface water in the upper reaches of the watersheds and enhancing the efficient use of water resource in existing irrigation systems in the lower reaches of the watersheds.

The Climate Change Adaptation Project is supporting the Ministry of Agriculture in piloting innovative land, crops and water management practices in three watersheds. Two of these watersheds are situated in the western drained area in the northwestern and southwestern corners of the West Bank, and one is situated in the Lower Jordan River Basin, which forms the eastern drained area. The three pilot intervention areas cover all agro-ecological zones of the West Bank: 1. Central High lands, 2. Semi-Coastal, 3. Eastern Slope and 4. Jordan Valley. The farming systems in these four zones differ widely and need different land and water management technological packages.

## 1.2 Objectives of the assignment

The GFA Consulting Group, for the first time, invited Bernd Walter Mueller, to come to Ramallah Palestine as international consultant and expert with practical experience in Integrative Watershed Management and Water Retention Landscape Design to advise the team of CCAP. Frederick Weihe is accompanying Bernd Müller as assistant.

The Terms of Reference (ToR) for the assignment “development of an intervention model for integrative-watershed management” are found in Annex 1. The main objective was advise the team of the Climate Change Adaptation Project in the West Bank on the following aspects of Integrative Watershed Management:

1. Technical interventions to promote Integrative Watershed Management through appropriate rainwater management in mini- and micro-watersheds by groups of landowners / farmers in different watersheds in the West Bank.
2. Organizational concept for supporting the on-farm soil and water conservation initiatives

and linking these to off-farm drainage infrastructures.

3. Training of the MoA and DoA staff responsible for providing support services in the field of soil and water conservation.

The essence of the consultation is the development of a Watershed Management which takes the natural water cycles as well as the reality of the surrounding landscape and existing infrastructure into consideration. This new manner of Integrative Watershed Management is the base for the proposals, which will be presented in this report as the results of the consultation.

Since the start of the project the following activities relevant to Integrated Watershed Management have been performed:

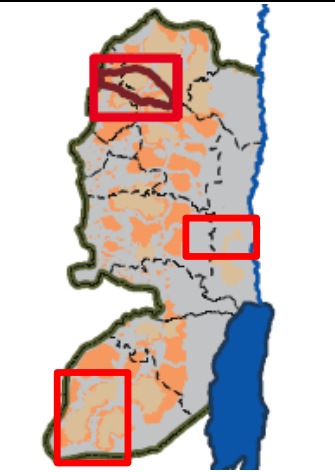
- Short-term mission of an International Water Management Expert to develop guidelines for Community-based Land and Water Management (CBLWM) in January 2015. The findings and recommendations of this mission are presented in the CCAP STE mission report Agricultural Water Management of January 2015 (L.Woltering).
- Micro-Watershed Vulnerabilities and Opportunities mapping in Jaba'a village catchment-Jenin Governorate, Ein Samiya catchment-Ramallah Governorate and Al Alaga catchment-Hebron Governorate.

These activities are integrated in the proposed intervention model to support communities improve land and water resource management in watersheds.

### 1.3 Meetings and field visits

Annex 2 shows the program of the Consultant. The mission was conducted from the 28<sup>th</sup> of November till the 4<sup>th</sup> of December 2015. Due to GIZ security directives the Consultant could only visit soil and water management initiatives proposed by farming communities in the Al Massin and Al Auja Watersheds. Meetings with the MoA and GIZ, and a workshop was conducted for the Watershed Coordinators of the five Directorates of Agriculture involved in CCAP and members of the CCAP Technical Committee. Two of the three pre-selected catchments were visited, and meetings were held in the village councils or agricultural committees of the communities marked bold in Table 1.

**Table 1: Catchments and communities visited (bold) in the Northern and Central West Bank of Palestine**

Catchment	Governorate	Communities	
Al Massin (North)	Jenin	<b>-Jaba'a and Anza-</b>	
	Tulkaram	<b>-Illar</b>	
Al Auja (Central)	Ramallah	<b>-Al Mughayyir-Abu Falah-Kafr Malik-Deir Jareer</b>	
	Jericho	<b>Ras Ein Al Auja</b>	

The findings of the field visits and the proposed approach towards Integrative Watershed Management were discussed at the workshop in the Ministry of Agriculture on 03.12.2015. The session was chaired by Eng. Muhannad Alhaj Hussain, Director of Irrigation Studies and Design of the MoA. The findings of the workshop are incorporated in the proposed model for Integrative Watershed Management.



## **2 INTEGRATIVE WATERSHED MANAGEMENT**

### **2.1 Basic Principles**

Desertification, droughts and floods have a common reason: the damage of the hydrological balance by deforestation, industrial agriculture and sealed surfaces in urban areas. Naked soil becomes hot and loses the ability to absorb water. Rain erodes the topsoil. The earth body dries out, global groundwater reserves and soil fertility decrease. For food and water sovereignty we need a proper water balance.

Integrative Watershed Management is a model for natural and decentralized water management and restoration of damaged ecosystems. It is a basis for reforestation, horticulture and agriculture in regions threatened by desertification, and is part of a comprehensive model for sustainability on a large scale including water, food, energy and community building.

In short the basic principles of Integrative Watershed Management are:

No rainwater should run over the earth surface, but rather should be infiltrated into the soil where it falls. Taking a certain territory into the focus the goal would be that no more rainwater and waste water leaves the territory but rather all water flowing away comes from springs.

If the aquifer is recharged water is available from springs and from wells in sufficient quantities for all human usage. In most cases the soil and the earth body is not able to infiltrate the rainwater immediately due to mismanagement. Therefore different methods are applied within the Integrative Watershed Management to restore the water balance. This includes: building of retention reservoirs (ponds, earth and sand dams), terraces, low proportion of sealed surfaces, road water infiltration, swales, permanent vegetation cover, mulching, adequate grazing management, afforestation...

If the principles of IWSM are understood and integrated in the planning and management, water is available all through the year, erosion is stopped, landslides are avoided, vegetation grows vigorously, rivers are constantly flowing, floods are moderate, risk of fire is low, decentralized biological agricultures enables local food security...

Therefore we stress the importance of this way of sustainable water management. In countries which have a low development of infrastructure there is a large potential to implement it in the right manner and not repeating the mistakes of past and current management elsewhere.

A detailed description of Integrative Watershed Management and Water Retention Landscape Design is published in the brochure "The Secret of Water as a basis for a new earth" by Bernd Walter Mueller:

[http://www.tamera.org/fileadmin/PDF/2.2\\_The\\_Secret\\_of\\_Water.pdf](http://www.tamera.org/fileadmin/PDF/2.2_The_Secret_of_Water.pdf)

### **2.2 Assessment Ecological and hydrological situations of the watersheds**

In the watersheds Al Auja and Al Massin we find very different rainfall patterns, with a yearly average rainfall from approx. 150mm to 600mm. In both areas we can observe clear signs of an ongoing desertification process. Most farmers try to adapt to the desertification process

through the implementation of modern irrigation systems and the building of water reservoirs. Meanwhile everywhere erosion occurs as a result of heavy rainwater runoff. New built infrastructure in villages, paved and unpaved roads are creating a lot of uncontrolled rainwater runoff.

All areas show strong degradation of soil and vegetation. The vegetation cover of the soil is very little, often the ground is bare or the soil has already disappeared completely. The missing anchoring roots of vegetation and the mismanaged soils lead to low infiltration and massive runoff. Small and large gullies have formed. Ancient terraces built with natural stonewalls are not able to hold once rainwater is running over the land. When the first terrace collapses all the lower structures are in danger to collapse too. Larger infrastructural damages are than the consequence in the whole lower watershed.

High runoff rates lead to low groundwater recharge, springs are drying out and groundwater table falls. That leads to an ecosystem collapse that can be avoided through locally applied Integrative Watershed Management. The main factors for this ongoing degradation process can be summarized by:

Unmanaged rainwater runoff from infrastructure. Low vegetation cover, low soil vitality and low absorption capacity of the soil.

Soil and water conservation must work hand in hand to stop the process of degradation and lead to a regenerative state of the watershed. Therefore the goal should be the full restoration of a watershed from top down.

### **3 MODEL FOR INTEGRATIVE WATERSHED MANAGEMENT INTERVENTION**

#### **3.1 Findings and recommendations Upper AL Auja Watershed**

In the upper watershed rainwater runoff from village and paved road infrastructure has to be addressed in order to prevent the collapse of the terraces and other infrastructure below. Decentralised rainwater retention methods being applied here help to convert the ongoing degeneration process into a regeneration process. In this case the building of a large enough rainwater retention space can prevent the lower micro-watershed from floods and erosion.

A project for IWSM and WRLD can be formulated according to the consultation given on the site. As this land is in area C different permissions are needed before this project can be implemented.

Further down in the watershed I recommend the building of very decentralized smaller water retention measures like on-contour swales, to prevent rainwater from running off the land. When all the rainwater can be held on the land ( zero runoff), olive trees can grow well without irrigation. Best permaculture practices like mulching and whole-year vegetation cover can improve the quality and quantity of olives without using chemical fertilizer, herbicides or pesticides. I recommend encouraging farmers to make the transition to ecological agriculture. Farmers who build new terraces for olive culture should implement water retention structures on contour for rainwater harvesting. Investment in artificial irrigation can then be avoided and the quality of soil and water conversation will be improved.

In order to be able to guarantee the sustainability of small scale water retention structures, all landowners of the micro-watershed should participate in a Watershed Management Committee.

#### **3.2 Findings and recommendations Lower AL Auja Watershed**

Currently the irrigation channel of Al Auja is cleaned and will soon be repaired. To avoid ongoing investment in cleaning of the channel, eroded material should be prevented from silting the channel. Contour swales can be designed along the channel to prevent the channel from being silted. These contour structures infiltrate runoff rainwater into the ground and through this vast vegetation can grow on these structures that also prevent flooding.

The design of these structures can be done as explained during the consultation. The proposal for this project should be well formulated, as it has to be approved by various authorities. Once approved, it can serve as guideline for other soil and water conservation interventions in area C.

A large part of the area shows very little vegetation and/ or leaf cover (living or dead mulch). A sustainable livestock management seems to be the key to a successful ecosystem restoration. The watershed needs a grazing management plan. This should include private and communal areas for grazing. Also the steep slopes in area C should be managed to allow natural vegetation growth. Grazing rhythms which support the natural dynamic of this bush and grassland may be applied. Heavy and unmanaged grazing without rotation leads to high runoff which the lower part of the catchment can not cope with. There are numerous grazing management approaches known all over the world. I strongly recommend taking

local consultation, and training for the involved landowners.

### **3.3 Findings and recommendations Al Massin Watershed**

In the Jaba micro-watershed the origin of major infrastructural damages could be identified in the upper part of the micro-watershed. Damage repair with ever more concrete and effort is very cost intensive and does not address the reason for the ever-stronger coming floods. Also here water and soil conservation has to start at the top of the watershed. There I recommend to formulate a project for IWSM through implementation of small rainwater retention structures, as explained during the consultation. It is important to have high awareness of the rainwater runoff that is created on dirt roads. Small water retention structures should be used for olive and other tree growth. So that farmers can have higher productivity on their land and the municipality less costs with flood damages. Shared responsibility through the establishment of a WSMC will help the sustainability of this intervention.

The new local sewage treatment plant in the watershed is operating and distributing its purified water during the irrigation season to a storage tank. The situation is probably much better than before. Still some questions are not addressed. What happens to the solid waste that is constantly produced in the plant?

What happens with the purified water during non irrigation season? I recommend to evaluate alternative systems that work on much lower maintenance costs, and that recycle all input converting it to profitable biomass. ( Wetland Ecosystem Treatment)

The dam building project in Tulkarem is designed for a dam and a series of check dams in the lower main riverbed. There are many NGO's with expertise in this kind of implementation. Those responsible for the implementation should contact these NGO's and visit similar implementations before going into the detailed planning. Like this unnecessary mistakes can be avoided.

Consultant stresses that these proposed interventions will not address the management mistakes that lead to floods and erosion. Water and soil conservation has to start in the upper watershed, where the erosion and the rainwater runoff starts. This community should find a way to take the responsibility for the waste that is still dumped and burned in the riverbed.

### **3.4 Organizational concept for supporting soil and water conservation initiatives**

The main goal is ecosystem restoration for whole watersheds, to secure water supply and livelihood from agriculture and other natural resources. This can only be achieved if all owners participate in Watershed Management Committees.

Goals on which the landowners communally agree, should be formulated, like:

1. **Zero runoff of rainwater** (full infiltration of rainwater to recharge the aquifer)
2. **Permanent vegetation covers of the soil**

### 3. **Zero runoff of sewage** (decentralized purification)

This concept is new to the Palestinian context. Still its implementation is needed to guaranty IWSM with shared responsibility.

#### **3.5 Capacity building of the IWSM support service providers**

During the consultation time a workshop was held at the Ministry of Agriculture. This kind of trainings is important for the establishment of a common base of expertise. For the planning and the implementation of some suggested measures local capacity is not available. Consultant suggests to use model implementations under professional leadership for capacity building amongst local experts.

## ANNEX 1

### Terms of Reference

#### Draft Terms of Reference for Short Term Expert Integrated Watershed Development

The Climate Change Adaptation Project in the West Bank is developing a package for supporting farmers groups in undertaking communal initiatives for soil and water conservation in mini- or micro-watersheds. The project has starting developing climate change vulnerabilities and opportunities maps for three pilot micro-watersheds. These latter maps provide location specific overviews of the off- and on-farm soil and water conservation potentials taking into consideration the farmers knowledge of erosion and flooding in the watershed and the hydro-geological and geo-technical conditions.

The CCAP would like to involve an integrated watershed development expert with experiences in water retaining landscaping to advise the CCAP TA team on the following aspects of the mini-watershed intervention package:

1. Technical interventions to promote for integrated watershed management ( water conservation, harvesting and storage) in mini and micro-watersheds by groups of landowners/farmers in the watersheds.
2. Organizational concept for supporting the on-farm soil and water conservation initiatives and linking these to off-farm drainage infrastructures.
3. Training of the MoA and DoA staff responsible for providing support services in the field of soil and water conservation.

The one-week mission is expected to take place in the period 29/11 until 3/12/2015 and Table One presents the preliminary workplan.

Date	Planned activities	Participants
29-11	Introduction meetings at the CCAP office about the project intervention model and strategies and courtesy visits to the PNA Ministry of Agriculture and the GIZ Water Programme	Aard Hartveld and Saad Dagher Thomas Riekel (GIZ) Issam Nofal DG MoA
30-11	Visit to the Al Massin Watershed to assess the water conservation/ harvesting potentials in the Jabba and Anza micro-watersheds	Saad Dagher and Maram Zaid (CCAP), Ir Muhanad Hussein Dir MoA, , Mustafa Amarna DoA Jenin and Bara Alghol DoA Tulkarem
1-12	Visit to the Al Samen Watershed to assess the water conservation/harvesting potentials in micro-watersheds where farmer groups proposed soil and water conservation initiatives	Maram Zaid and Saad Dagher (CCAP), Ir Ammar Salahat Dir MoA, Maram Zaid Fadwa Abu Sharar, Moh. Talahmed and Yusuf Abu Said DoA Dura-Hebron
2-12	One day workshop for DoA, MoA and PHG/PARC and CCAP staff on IWSM and water retaining landscaping	CCAP Technical Committee members, DoA watershed coordinators and DoA Land Development experts
3-12	Visit to the Al Auja Watershed to assess the water conservation/ harvesting potentials in mini and micro-watersheds where farmers groups proposed water harvesting; debriefing meeting with Dr Thomas Riekel GIZ	Maram Zaid, Saad Dagher, Aard Hartveld, Ir Issam Nofal MoA, Jihad Barghouti DoA Ramallah and Jafar Salahat DoA Jericho

Ramallah, 16 October 2015

## **ANNEX 2**

### **Mission Itinerary**

#### **Places and issues assessed during the visit**

#### **29.11.2015 Ramallah and Al Auja - Introduction meeting at GFA CCAP office in Ramallah.**

With GFA TACAIF team leader Aard Hartveld, national expert Saad Dagher, Frederick Weihe and Bernd Walter Müller

##### **- Field trip to Al Auja Lower Watershed**

- Evaluation of ongoing interventions at the irrigation channel of Al Auja.
- Assessment of possibilities for erosion and flood reduction in the watershed of the Al Auja irrigation channel. (with GIZ DA Thomas Koenig from Eco Peace ME)
- Identification of meaningful interventions for a pilot for erosion prevention and rainwaterretention in area C.

#### **30.11.2015 Al Massin - Field trip to Al Massin Watershed**

- Arrival to different city halls in the watershed.
- Evaluation of infrastructure damages caused by rainwater runoff floods in the micro-watershed of Jaba.
- Identification of their origin in the upper watershed. - Recommendation of practical implementation of decentralised water retention structures in the upper watershed.
- Visit of a local sewage treatment plant. -  
Visit of a dam building project in Tulkarem.

#### **01.12.2015 Al Auja**

The planned visit to the Al Samen WS to assess the water harvesting potentials in the Micro-WS, where farmer groups had proposed soil and water conservation initiatives, had to be cancelled due to security reasons.

- Field trip to upper Al Auja watershed
- Visit of olive cultures on terraced land.
- Evaluation of farmers' requests for implementation of irrigation systems.
- Identification of the origin of the lack of water in the olive cultures.
- Recommendation of practical implementation of decentralised water retention structures in the upper watershed.
- Visit of recently built olive cultures on newly- terraced land.
- Evaluation of farmers' requests for implementation of irrigation systems.
- Identification of the origin of the lack of water in the olive cultures.
- Recommendation of practical implementation of decentralised water retention

structures.

- Identification of recently- built infrastructure ( paved road) that creates uncontrolled rainwater runoff in the upper watershed ( area C).

**02.12.2015 Ramallah - Meeting with Head of Water & Sanitation Programme Thomas Riekel in the GIZ office.**

- Introduction meeting - Strategical evaluation of effective implementation and capacity building in the area. - Brainstorming about further cooperation possibilities.

**- Workshop 'Integrative Watershed Management'**

held by Bernd Walter Müller at Ministry of Agriculture.

**03.12.2015 Ramallah and Al Auja - Meeting with GIZ DA Thomas Koenig from Eco Peace ME in the CCAP office.**

- Review and evaluation of the proposal draft for the project: 'Erosion Prevention Along the Al Auja Channel'.

**- Field trip to Al Auja upper watershed**

- Assessment of the upper micro- watershed.
- Identification of rainwater mismanagement on the paved road.
- Recommendation of practical implementation of decentralised water retention structures.

**- Meeting with the CCAP team in the GFA CCAP office**

- Summary report of the consultation time.
- Evaluation of the consultation.
- Discussion about future cooperation.



