Emerging practices from Agricultural Water Management in Africa and the Near East

Thematic Workshop

Theme 3

Water Harvesting

Laura Guarnieri – Maher Salman
CBL
29 August 2017
Theme 3: Water Harvesting

PRESENTATION OUTLINE

- BACKGROUND AND DEFINITION
- MEASURES OF WH
- INTRODUCTION TO TOOLS/METHODOLOGY
- TOOLS/METHODOLOGY IN ACTION
- THE PROJECT
Rain-fed agriculture in Africa, the untapped potential

“The greatest potential increases in yield are in rainfed areas where many of the world’s poor live and where managing water is the key to such increases” (Molden, 2007).

- 80% of Ugandans depend on rainfed farming which covers 60% of export earnings (CDKN)
- In Burkina Faso there are 3.5 millions ha of farming land of which 0.68% is irrigated (INERA);
- In Morocco there are 8.4 million ha of farming land of which 1.5 millions ha are irrigated (potential of 1.6) (Aquastat)

<table>
<thead>
<tr>
<th>Region</th>
<th>Arable land (million ha)</th>
<th>Rainfed area (million ha)</th>
<th>% of rainfed area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>247</td>
<td>234</td>
<td>94.5</td>
</tr>
<tr>
<td>Northern Africa</td>
<td>28</td>
<td>21.5</td>
<td>77.1</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>218</td>
<td>211</td>
<td>96.7</td>
</tr>
</tbody>
</table>

Source: FAOSTAT
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**BACKGROUND AND DEFINITION**

Improving Agriculture Water Management (AWM) is a key approach to improve water use efficiency and productivity within rain-fed agriculture.

**Water harvesting** is one possible approach to AWM, which can be combined with irrigation and green water management.

**Definitions of WH:** “The process of concentrating precipitation through runoff and storing it for beneficial use” (Oweis et al., 2012)

“The collection and concentration of rainwater and runoff and its productive use for irrigation of annual **crops**, **pastures** and **trees**, for **domestic** and **livestock consumption** and for **ground water recharge** (Prinz, 2011).

**Direct benefits** to farmers, herders and investors.

- **Environmental health** (controlling soil erosion and desertification, supporting ecosystems, reducing flood risk)
- **Social benefits** (creating employment, reducing migration to cities, better health for rural households)

Do more than just harvest water: maximize beneficial relationships and efficiency by “stacking functions”. (Lancaster et al. 2007)
Background and Definition

Managing Microclimates through WH

1. Coordinated/ High density SWC+WH measures (water buffering)
2. Re-greening/ Agroforestry
3. Landscape/watershed approach/Land use planning

→ Building global resilient agro-ecosystems with a local perspective

Trees effects:
- Vapor condensation
- Hydraulic lift
- Windbreak / Shade
- Runoff slowdown
- Reduction of erosion
- Groundwater recharge

→ PLANTING WATER!
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### MEASURES OF WH: CLASSIFICATION OF WH METHODS

**Theme 3:** Water Harvesting

**Overview and examples of water harvesting systems for agriculture.** (Prinz, 2006; Rocheleau et al., 1988; Prinz, 1996).

**Benefits of water harvesting. Source:** WOCAT, 2012

- Increased production ($P$) and income ($I$)
- Improved water use efficiency
- Reduced erosion

<table>
<thead>
<tr>
<th>Method</th>
<th>Case Study (%)</th>
<th>Number of Case Studies Included in Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floodwater Harvesting</td>
<td>none/n.a.</td>
<td>low medium high</td>
</tr>
<tr>
<td>Macro WH</td>
<td>none/n.a.</td>
<td>low medium high</td>
</tr>
<tr>
<td>Micro WH</td>
<td>none/n.a.</td>
<td>low medium high</td>
</tr>
<tr>
<td>Rooftop and Courtyard WH</td>
<td>none/n.a.</td>
<td>low medium high</td>
</tr>
</tbody>
</table>

**Catchments:**
- Rooftop & Courtyard Systems
- On-Farm Systems
- Long - Slopes Water Harvesting
- Floodwater Harvesting

**Storage:**
- Tanks
- Reservoirs
- Cisterns

**Catching:**
- Roofs
- Including surfaces of rock, compacted earth, sealed or paved surfaces, plastic sheets, corrugated iron sheathing

**Features:**
- Semi-circular bunds
- Cross-slope barriers: vegetative strips, contour bunds and ridges, tied ridges, stone lines and bunds, contour bench terraces (e.g., fanya juu)
- Courtyard WH combined with rooftop WH

**Water storage in soil:**
- Hillside runoff / conduit
- Foothill reclamation: e.g., limans
- Large semi-circular or trapezoidal bunds
- Road runoff
- Gully plugging / productive gullies
- Cut-off drains (redirection of water)

**Water storage facilities:**
- Surface storage: natural depressions, ponds and pans, excavated ponds (e.g., halafs), cultivated reservoirs / tanks, ponds for groundwater recharge
- Surface dams: small earth and stone dams, check dams, rock catchment masonry dams
- Subsurface storage: subsurface, percolation and sand dams, subsurface reservoirs, cisterns

**Traditional wells:**
- Horizontal wells, recharge / injection wells

**Vegetative strips**
- Contour lines and trenches
### MEASURES OF WH: Water harvesting Detailed Assessment at national level

#### Performance assessment of and potential for different WH technologies

<table>
<thead>
<tr>
<th>WH technique</th>
<th>U</th>
<th>B</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>WH from Roads</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Small WH Ponds</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>WH from Rock Outcrops</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permeable Rock Dams</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rooftop WH</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valley Dams</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valley Tanks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Covered cisterns/ Matias</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hill lake</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WH ponds (farm, ifered)</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boulis</td>
<td></td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Gully Plugging</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsurface Dams</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Tube Recharge</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Sand Dams</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Percolation ponds &amp; contour trenches</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khettara</td>
<td></td>
<td></td>
<td>o</td>
</tr>
<tr>
<td>Half-moons</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Grass Strips</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Improved Trash-lines</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contour Bunds</td>
<td></td>
<td>o</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WH technique</th>
<th>U</th>
<th>B</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mulching</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Terraces</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Trapezoidal bunds</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WH for Banana Plantations</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stone bunds</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Spate irrigation</td>
<td>o</td>
<td>o</td>
<td></td>
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<tr>
<td>Fanyahuulla/ Fanyachini</td>
<td>o</td>
<td></td>
<td></td>
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<tr>
<td>Agricultural benches</td>
<td>o</td>
<td></td>
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</tr>
<tr>
<td>Diguers filtrantes (filtering dikes)</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manure and Compost</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Vallereani system (Delfino)</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zaï pits</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tied ridges</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agroforestry</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water spreading weirs</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check dams</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Conservation agriculture</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>Micro-basins</td>
<td>o</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>R’Fouassi</td>
<td>o</td>
<td></td>
<td></td>
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<tr>
<td>Jessours</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water and sediment control basin</td>
<td>o</td>
<td></td>
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</tr>
</tbody>
</table>

#### Objectives of the study:

- Present a number of WH practices (features, benefits, limitations)
- Evaluate their performance (with respect to several biophysical, technical, and socio-economic criteria) and suitability to different AEZ
- Guide decisions on the choice of WH technologies (combined techniques concluded most effective)
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MEASURES OF WH

Assessed WHTs in Morocco
1. Soil bunds
2. Matfias
3. Khettara
4. Hill lakes
5. WH ponds -Iferd
6. Micro-basins
7. Conservation Agriculture
8. Dry stone walls and stone bunds
9. Bench Terraces
10. Weirs/check dams (gullies treatment)
11. Spate Irrigation (Faid, Ougoug)
12. WH from roads and rural trails
13. WASCOB (Water&Sediment Control Basin)

- Rainfed and Irrigated terraces with trees plantation and crop rotation (Al Haouz) (M.Sabir)
- Elements de banquette and micro-basins with olive or almond tree plantation in Sidi Driss,
- Check dam – cemented stones, for the protection of the ravine in the Taza basin (Source: Berhailli)
- Continuous banquettes with olive plantation (M.Sabir)
- Concrete tanks (Matfias) open/closed, buried/semi-buried (M.Kharmouch)
- Surface water reservoir (Matfia) fed by a road, Morocco (Source: M. Sabir)
- The constitutive elements of the faïd terroir of the wadi Arghene, Anti Atlas (Humbert)
- Integrated system on Rheraya wadi: micro and macro-catchment (flood catchment), groundwater harvest/recharge, gravity irrigation, crop rotation. (M.Sabir)

Lac Collinaire, High Atlas (M. Sabir)
MEASURES OF WH

Assessed WHTs in Burkina Faso
1. Zaï pits
2. Half-moons
3. Permeable rock dams
4. Stone bunds and stone lines
5. Boulis
6. BCER (WH ponds)
7. Vallerani System – Delfino
8. Soil bunds
9. Grass strips
10. Manure and composting
11. Mulching
12. Tied ridges
13. Catchment basins
14. Flood spreading weirs
15. Agroforestry
16. Road WH

Natural assisted regeneration: acacia albida in a field of millet (Martina Wegner)

A Bouli in Center Region of Burkina Faso (L.Guarnieri/FAO 2017)

Staggered half-moons with and without plants (INERA)

Zai pits in the dry season and mobilization of organic manure (Botoni et Rei, 2001), Mil in Zai Holes (Photo M. Bonzi, 2007)

Implementing 3 line system of stone bunds (FIDA, 2003)

Effets of flood spreading weir (Source : Brückmann)

Tied ridges after rain (UICN), Mulched furrows in tied ridges (HP. Liniger)

Mulching and manure in combination with stones bunds (IUCN)
MEASURES OF WH

Assessed WHTs in Uganda
1. Harvesting water from roads
2. Harvesting water from rock outcrops
3. Permeable rock dam
4. Harvesting water from roofs
5. Valley dams
6. Water harvesting ponds
7. Valley tanks
8. Gully plugging
9. Subsurface dams
10. Tube recharge
11. Sand Dams
12. Contour bunds
13. Demi lunes
14. Grass strips
15. Trash lines
16. Organic mulching
17. Terraces
18. Trapezoidal bunds
19. WH for Banana Plantations
20. Stone bunds
21. Fanya juu and Fanya chini
22. Spate irrigation
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INTRODUCTION TO TOOLS/METHODOLOGY

The Multi-Criteria Analysis

**Approach**
- Comprehensive review of available literature
- Interviews with national experts from technical ministerial departments, agricultural research institutes, and NGOs (scoring)
- Validation workshop (criteria + weights) with various institutional stakeholders
- Integration of the Observations at national level
- Final document (SINF)
- Synthesis and publication (FAO/CBL)

**Steps of the MCA**

1. Selection of WH techniques to evaluate with the MCA
2. Definition of evaluation criteria and weights
3. Selection of evaluation indicators and sub-indicators for each criterion
4. Evaluation of actions
5. Integration of scores
6. Ranking of WH technologies

**Advantages of MULTIPOL method**

1. Flexibility
2. Ability to integrate uncertainties and conflicting judgements
3. Evaluation through a simple scoring system (scale from 0 to 5) + a weighted average
4. Risks related to uncertainties or conflicting judgements considered
5. Robustness of results tested

**Criteria and associated indicators used in the MCA**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicators</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Geographical suitability</td>
<td>1: Agro-ecological zones</td>
<td>WH techniques potentially applicable in a wider variety of AEZ within a given country received a higher score.</td>
</tr>
<tr>
<td>B. Technical and environmental suitability</td>
<td>1: Storage type</td>
<td>A measure of the potential of each WH technique to increase the water buffer at landscape scale, i.e. its contribution to the hydrological cycle.</td>
</tr>
<tr>
<td></td>
<td>2: Storage capacity</td>
<td>A measure of the volume of water that can be stored by a specific WH technique. This indicator applies only to water storage in open or closed reservoirs.</td>
</tr>
<tr>
<td></td>
<td>3: Soil quality</td>
<td>A measure of the positive impacts of each technique on soil properties (physical, chemical, biological) and against soil erosion.</td>
</tr>
<tr>
<td>C. Socio-economic suitability</td>
<td>1: Multiple uses of water</td>
<td>A measure of the use of water stored by a certain WH technique. Techniques that contribute to more uses received a higher score.</td>
</tr>
<tr>
<td></td>
<td>2: Costs</td>
<td>Consider investment, operation and maintenance costs (often expressed in labour requirements) for each technique and attaches a lower value to those techniques having higher costs.</td>
</tr>
<tr>
<td></td>
<td>3: Management and maintenance capacity</td>
<td>Provide information on the availability of local expertise and capacity to maintain and manage the techniques.</td>
</tr>
<tr>
<td></td>
<td>4: Gender</td>
<td>A qualitative assessment of the implications of the different techniques for both men and women. For instance, techniques that increase workloads of women or favour men more than women score lower.</td>
</tr>
<tr>
<td>D. Agricultural productivity and profitability impact</td>
<td>1: Productivity</td>
<td>A measure of the quantitative increase in crop yields compared to control (same crop without the adoption of the WH technique).</td>
</tr>
<tr>
<td></td>
<td>2: Diversification</td>
<td>A measure of the extent to which agricultural production can be diversified (also introducing higher value crops) thanks to the adoption of the technique.</td>
</tr>
<tr>
<td></td>
<td>3: Profitability</td>
<td>Inform on the relation between revenue obtained or anticipated by the farmer (long-term) and the resources deployed to obtain the revenue (cost-benefit).</td>
</tr>
</tbody>
</table>

**Limits:**
- Limited knowledge/experience on certain techniques
- Shortage of quantitative data on the impacts of WHT
The training enhanced the capacities of participants from a variety of national institutions on a number of topics:

- **WHTs** adapted to the various **agro-climatic conditions**: where to da what
- Conceptual and practical approaches to WH at **landscape/watershed scale**
- The use of **GIS and RS based applications** for planning, managing and monitoring WH systems
- **Hydrological modeling of WHTs** using SWAT
- **Social and economic suitability** of WH systems
- **Soil health** and regenerative practices for effective WH
- Agro-forestry systems for **microclimate management** and effective WH
INTRODUCTION TO TOOLS/METHODOLOGY

**Conceptual model for planning and redirect WH interventions:**

**GIS and Remote Sensing Applications:**

1. **For planning new water harvesting systems:**
   - Mapping potential/suitable areas according to spatialized MCA and integrated field surveys.

2. **As a decision-making tool for rehabilitation/improvement of existing WH systems:**
   - Integrated and participatory approach.

**Map Variable multiplied by Weight → Suitability map**

- **Weight:**
  - 1.0
  - 1.0
  - 10.0
  - 10.0

**Sum of the Products**

\[
\frac{3 + 6 + 90 + 60}{1 + 1 + 10 + 10} = 7.23
\]
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TOOLS/METHODOLOGY IN ACTION

The Multi-Criteria Analysis in action

Evaluation matrix using the MULTIPOL method, rating scale of indicators ranging from 0 to 5 (example du Burkina Faso).

Detailed fact sheet discussing benefits, geographic suitability, technical and environmental factors, socio-economic factors, productivity and profitability and sustainability/durability, limitations and Remark of WHTs (example of manure/compost)

Histogram representing results of MCA of different WH technologies and the risks relative to the robustness of results (i.e. standard deviation in red) (example of Burkina Faso)
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**TOOLS/METHODOLOGY IN ACTION**

**WH techniques to target**

- WHT for (also) **crop production**
- Already **present** in the region (suitable to the AEZ);
- **Mastered by the local populations** (implementation + maintenance);
- Made with local materials, and therefore **durable/sustainable**;
- Presenting **potential for innovating** in relation to traditional technique;
- Introduced with the **accompaniment of the Government**
- Integrated into **existing programs and action plans** (ADPs, IWRM, etc.).

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community organization and expertise</td>
<td>35%</td>
</tr>
<tr>
<td>Generation of added value</td>
<td>25%</td>
</tr>
<tr>
<td>Micro and Macro-catchment techniques</td>
<td>20%</td>
</tr>
<tr>
<td>Availability of land for cultivation and community around water source</td>
<td>10%</td>
</tr>
<tr>
<td>Multiple uses of water</td>
<td>10%</td>
</tr>
</tbody>
</table>

*Weighted criteria for the MCA implemented after field visits missions for the final selection of the most suitable pilot site (L.Guarnieri/FAO)*

Shortlisted/visited sites for WH pilot project in Marrakech-Safi Region of Morocco (L.Guarnieri/FAO)

GIS analysis on QGIS: a support tool for the selection of most suitable pilot sites (L.Guarnieri/FAO)
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TOOLS/METHODOLOGY IN ACTION

Methods for *Training programme on water harvesting*: Skills and materials for planning future systems

Theoretical sessions in the classroom (ppt + video projections)

Practical demonstration during field visit in Uganda – the water cycle experiment

Field visits – small rock catchment system and improved trash lines in Uganda; Jardin de Zineb (SWC+ Permaculture + in-situ WHTs) in Morocco

Guided exercises on GIS

Group works

Theoretical and practical sessions in FAO meeting room in Burkina Faso

Field trip in Rawlegue, Burkina Faso: WH ponds made by the community
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PROJECT

GCP/INT/231/SWI

Strengthening Agricultural Water Efficiency and Productivity on the African and Global Level

OUTCOME

Enhanced water harvesting capacity in Burkina Faso, Morocco and Uganda

OBJECTIVES

- To improve farmers’ resilience to dry spells
- To increase the productivity of small-scale rain-fed agriculture
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PROJECT ACTIVITIES

3.1 Carry out an **assessment of the status of water harvesting** sub-sector in the three countries

3.2 Implement **on-ground pilot projects** in Burkina Faso, Morocco and Uganda

3.3 Develop and implement a **training program on water harvesting**

3.4 Develop **sub-strategies for water harvesting** in the three countries that serve as input to national agriculture and water resources strategies
## Theme 3: Water Harvesting

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>SUB-ACTIVITY</th>
<th>When</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Carry out an <strong>assessment of the status of water harvesting</strong> sub-sector</td>
<td>1.1 <strong>Data collection</strong>: SINF Investigation missions + field visits on relevant WH sites at country level</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td>1.2 <strong>Drafting</strong> WH assessment report and MCA</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td>1.3 <strong>National</strong> Restitution + Validation workshop</td>
<td>Completed</td>
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<tr>
<td></td>
<td>1.4 FAO Publication</td>
<td>Completed</td>
</tr>
<tr>
<td><strong>2.</strong> Implement <strong>on-ground pilot projects</strong> in Burkina Faso, Morocco and Uganda</td>
<td>2.1 <strong>Site selection</strong> and concertation with national stakeholders</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td>2.2 <strong>Site investigation and surveys</strong> on biophysical, technical, socio-economic</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td>2.3 <strong>Technical Studies/ Design</strong> (pilot plots + solar pumping system + irrigation scheme + rehabilitation/improvement of reservoir)</td>
<td>September - December 2017</td>
</tr>
<tr>
<td></td>
<td>2.3 <strong>Implementation</strong> (training/demonstration to farmers on SWC/WH + solar gravity system + rehabilitation of reservoir)</td>
<td>Janvier – May 2018 (according to rainy-dry seasons)</td>
</tr>
<tr>
<td></td>
<td>2.4 <strong>Monitoring and evaluation</strong></td>
<td>All steps</td>
</tr>
<tr>
<td><strong>3.</strong> Develop and implement a <strong>training program on water harvesting</strong></td>
<td>3.1 Development of training package and learning material</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td>3.2 Implementation of training programme in the three countries</td>
<td>Completed</td>
</tr>
<tr>
<td><strong>4.</strong> Develop <strong>sub-strategies for water harvesting</strong></td>
<td>4.1 Development of conceptual models for planning and rehabilitate WH systems</td>
<td>2017</td>
</tr>
<tr>
<td></td>
<td>4.2 Concertation with main national institutions involved in WH and development of guidelines on sub-strategies of WH</td>
<td>2018</td>
</tr>
</tbody>
</table>
## Theme 3: Water Harvesting

### PARTNERS IN IMPLEMENTATION

<table>
<thead>
<tr>
<th>Country</th>
<th>ACTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Burkina Faso</strong></td>
<td><strong>3.1 Detailed Assessment on WH</strong></td>
</tr>
<tr>
<td>National Consultant + National Engineering Office</td>
<td><strong>3.2 Pilot project on WH</strong></td>
</tr>
<tr>
<td>Spate Irrigation Network Foundation (SINF)</td>
<td><strong>3.3 Training Programme</strong></td>
</tr>
<tr>
<td>National Consultant + Local NGO</td>
<td><strong>3.4 Sub-strategies for WH</strong></td>
</tr>
<tr>
<td>International consultant</td>
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<tr>
<td><strong>Morocco</strong></td>
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<tr>
<td><strong>Uganda</strong></td>
<td><strong>International consultant</strong></td>
</tr>
<tr>
<td>International consultant + Local NGO + local company</td>
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</tbody>
</table>
Theme 3: Water Harvesting

SCALING-UP

- Pilot projects implementation
- Joint Report on Lessons learnt/Main findings
- Application in sites with similar agro-ecological characteristics (Climate, Soils and Crops)

Phase 1
Morocco, Burkina, Uganda

Phase 2
3 countries in: Middle East /Africa/SE Asia
## IMPLEMENTATION/EXPANDING PRACTICE

<table>
<thead>
<tr>
<th>AEZ</th>
<th>Uganda</th>
<th>Morocco</th>
<th>Burkina Faso</th>
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</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>Southern and western tall grassland (P= 1000-1300 mm, Z= 1200 m)</td>
<td>Semi-arid mountains of center High Atlas (P = 600 mm, Z= 1300 m)</td>
<td>Soudano-Sahelian zone (P= 600 mm, Z=300 m)</td>
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<tr>
<td><strong>Main WHT</strong></td>
<td>Mubende District, Kiganda sub-county, Kinoni Parish, Lwenyange village</td>
<td>Tazlida, Souk El Had Zerken District, Al Houz Province, Marrakech-Sahel Region</td>
<td>Kambaogo Village, Boussouma District, Sanmantenga Province, Center-North Region</td>
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<tr>
<td><strong>Integrated SWCTs/ WHTs and Irrigation practices</strong></td>
<td>Valley Tank</td>
<td>Bench Terraces and WH ponds</td>
<td>Bouli</td>
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<tr>
<td>Valley tank and submerged pump in Kinoni (Mubende District, Kiganda sub-county, Kinoni Parish, Lwenyange village)</td>
<td>Bench Terraces and WH ponds</td>
<td>Farmer of Kambaogo, with typical mossi agricultural tool (daba), in front of the reservoir to be rehabilitated.</td>
<td></td>
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<tr>
<td><strong>Main constraint</strong></td>
<td>Competition for mulch and fodder</td>
<td>Relief cloisonné and difficult climatic and hydrological conditions.</td>
<td>Water scarcity and degraded soils</td>
</tr>
<tr>
<td><strong>Integrated SWCTs/ WHTs and Irrigation practices</strong></td>
<td>- WH for banana plantation</td>
<td>- Micro- basins</td>
<td>- Improved Zai pits + Stone bunds</td>
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<td></td>
<td>- ISFM</td>
<td>- Agro-forestry/ Arboriculture</td>
<td>- Assisted Natural Regeneration (ANR)</td>
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<td></td>
<td>- Vegetated fanya jua/ contour bunds/trenches</td>
<td>- water storage ponds for irrigation purposes (and secondly for livestock)</td>
<td>- Mulching and other agronomic techniques</td>
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<tr>
<td></td>
<td>- Improved agronomic techniques in banana-coffee intercropping</td>
<td>- SSI : irrigation of small gardens through WH ponds (from springs and runoff by seguias)</td>
<td>- SSI : solar irrigation from the reservoir to profitable crops</td>
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<td></td>
<td>-SSI : solar irrigation pumping water from the tank</td>
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THANK YOU FOR YOUR ATTENTION