Food and Agriculture Organization of the United Nations

CIHEAM IAM BARI

AgWA Partnership for agricultural water for Africa

**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

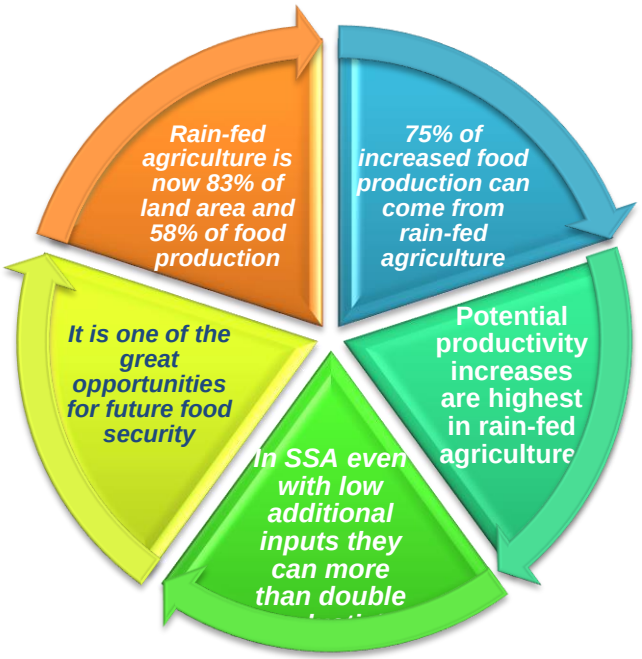
- BACKGROUND AND DEFINITION
- MEASURES OF WH
- INTRODUCTION TO TOOLS/METHODOLOGY
- TOOLS/METHODOLOGY IN ACTION
- THE PROJECT

Theme 3:

# Water Harvesting

## BACKGROUND AND DEFINITION

### Rain-fed agriculture in Africa, the untapped potential

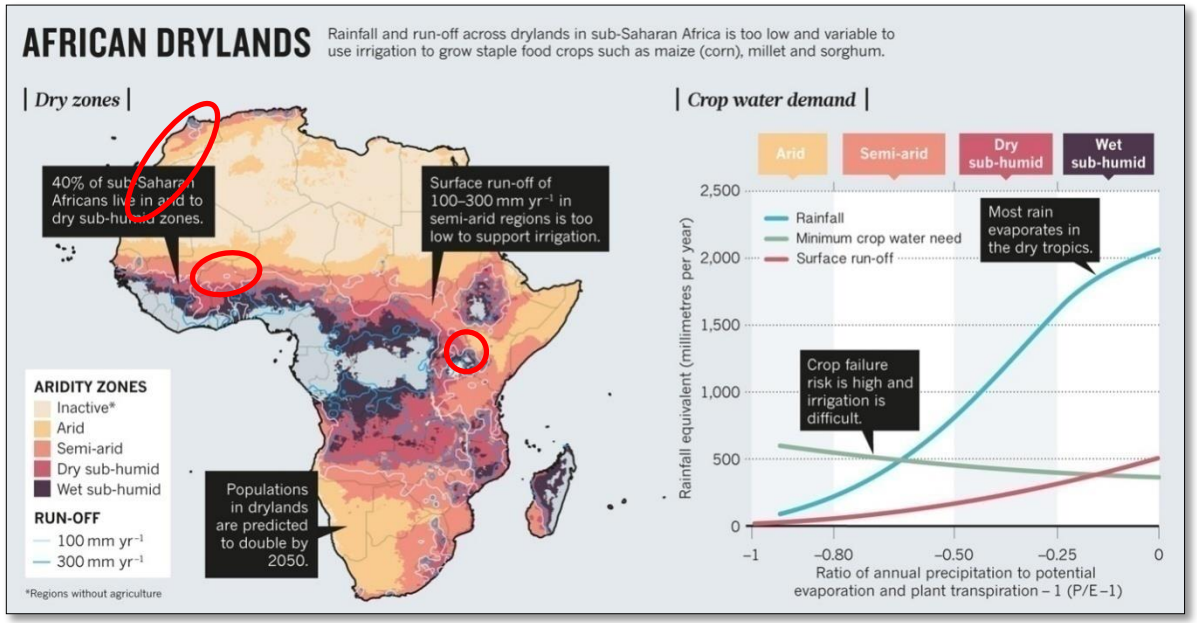



| | Arable land (million ha) | Rainfed area (million ha) | % of rainfed area |
|---|---|---|---|
| Africa | 247 | 234 | 94.5 |
| Northern Africa | 28 | 21.5 | 77.1 |
| Sub-Saharan Africa | 218 | 211 | 96.7 |

Source: FAOSTAT

*"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)*




*Source: Ingo Fetzer/Stockholm Resilience Centre*

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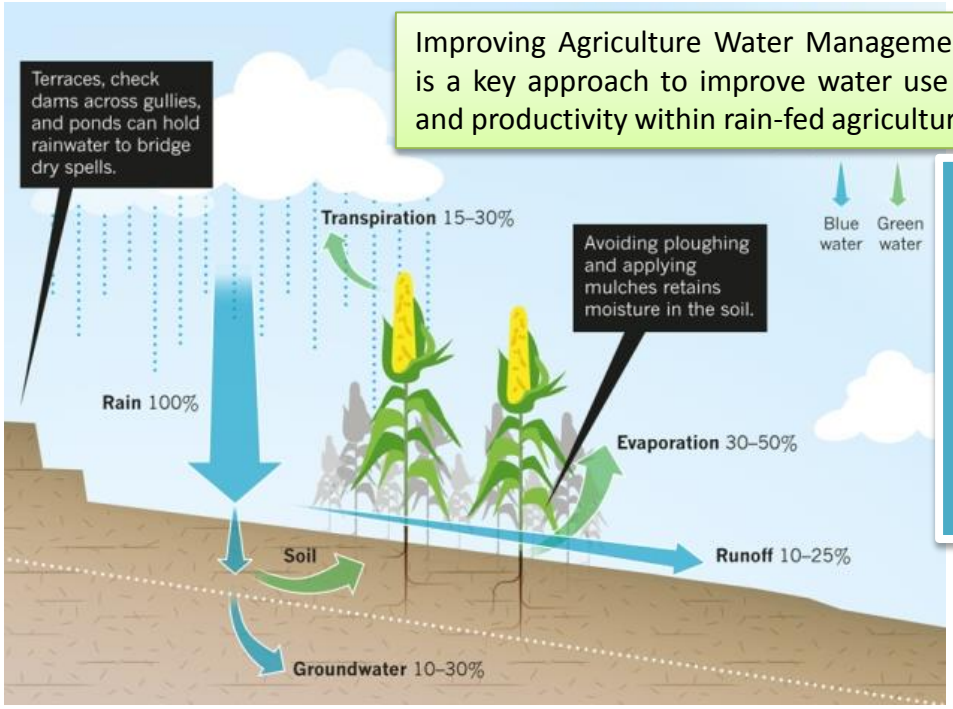
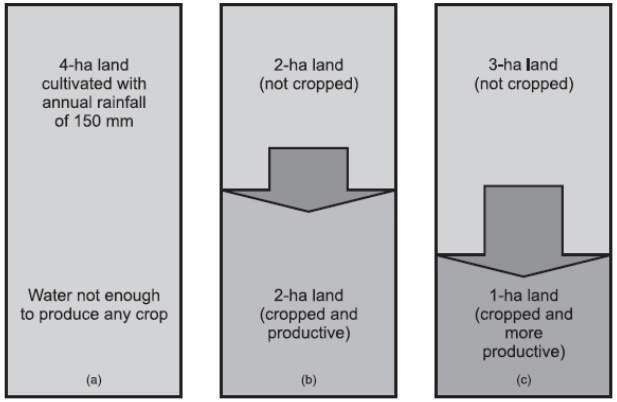
## BACKGROUND AND DEFINITION

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




*Average hydrological conditions in a semi-arid environment. Source: D. Molden (IWMI, 2007)*

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




*The basic concept of water harvesting for agriculture. (Oweis et al., 2012)*

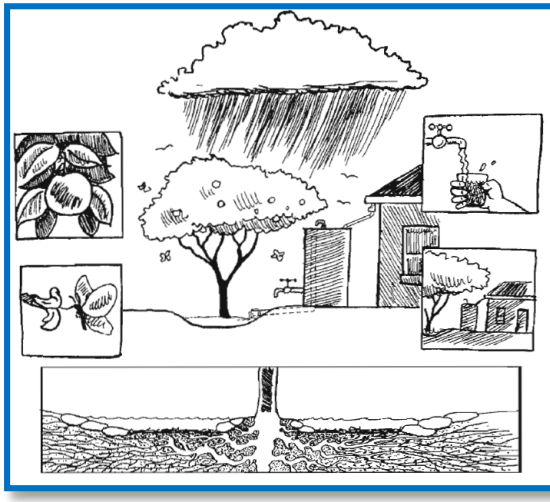
***Definitions of WH**: "The process of concentrating precipitation through runoff and storing it for beneficial use" (Oweis et al., 2012)*

*"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.

**Indirect benefits**:

- **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)*

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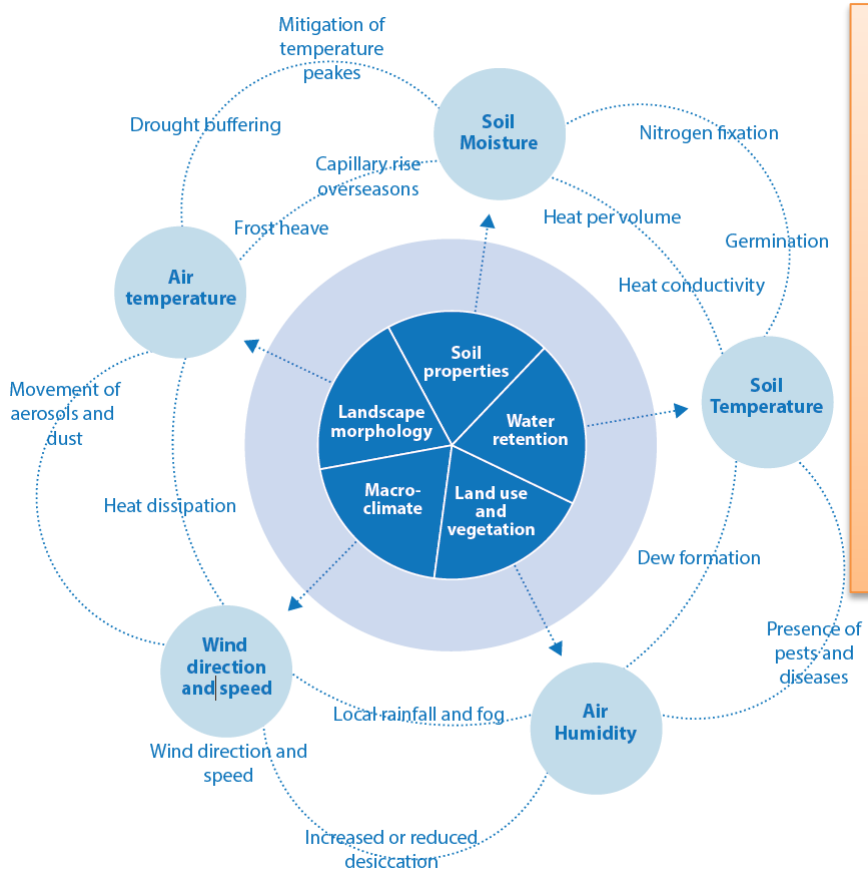
# Water Harvesting

## BACKGROUND AND DEFINITION

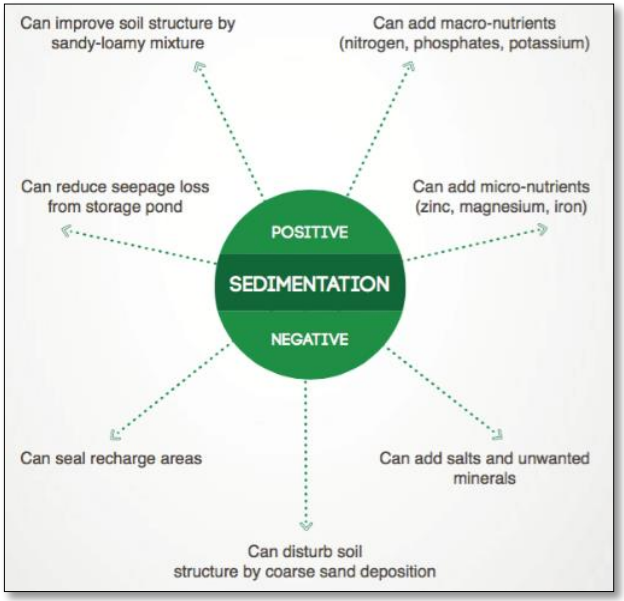
### Managing Microclimates through WH



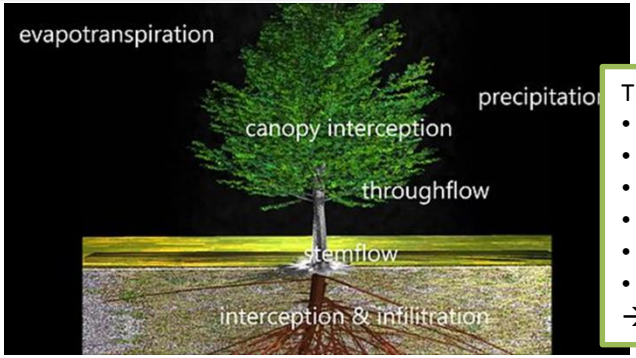

*Infographic on the effect of WH techniques on micro-climate (Source: MetaMeta)*

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**




*Effect of WH techniques on sediments (Source: MetaMeta)*




Trees effects:

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

→ **PLANTING WATER** !

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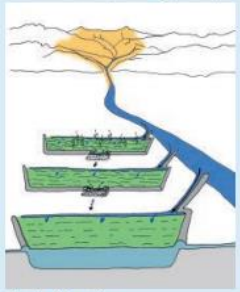
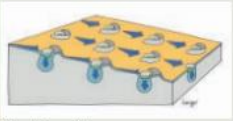
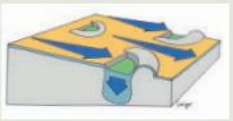
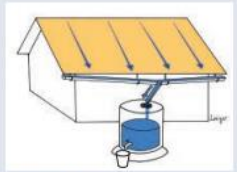
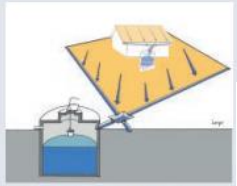
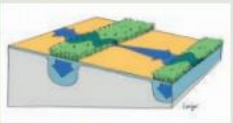
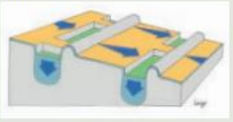
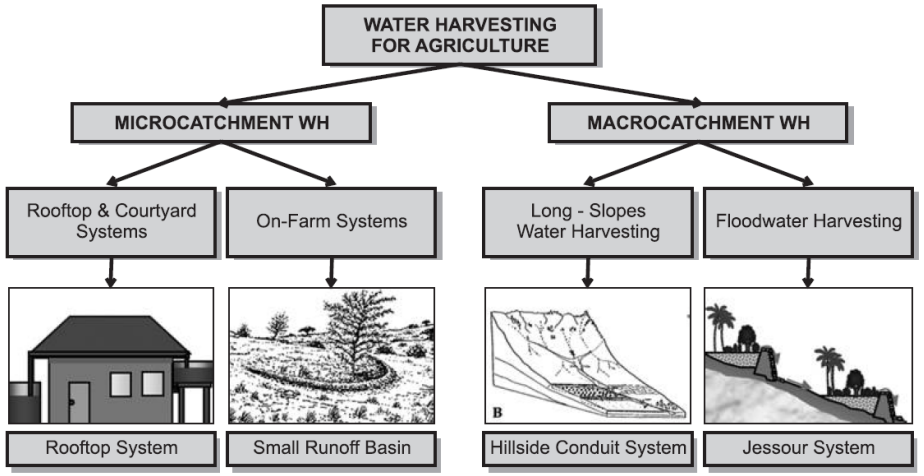
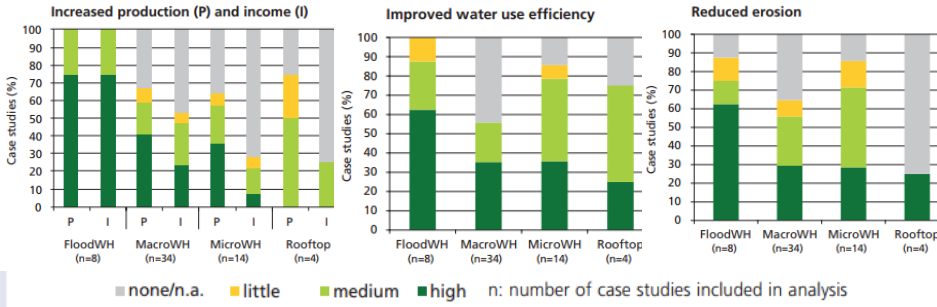
# Water Harvesting

## MEASURES OF WH : CLASSIFICATION OF WH METHODS

| (1) Floodwater harvesting (FloodWH) | (2) Macrocatchment WH (MacroWH) | (3) Microcatchment WH (MicroWH) | (4) Rooftop and Courtyard WH (Rooftop-Courtyard WH) |
|---|---|---|---|
| **Flood recession farming; Inland valleys; Floodwater diversion, off-streambed:**<br>– spate irrigation,<br>– floodwater spreading bunds; | **Water storage in soil:**<br>– hillside runoff / conduit,<br>– foothill reclamation: e.g. *limans*,<br>– large semi-circular or trapezoidal bunds,<br>– road runoff,<br>– gully plugging / productive gullies,<br>– cut-off drains (redirection of water); | **Pits and basins:**<br>– small planting pits: e.g. *zaï / tassa*,<br>– micro-basins: e.g. *negarims, meskats*, small semi-circular bunds, eyebrow terraces, mechanised Vallerani basins; | **Catchment:**<br>Roofs<br>Courtyards:<br>– including surfaces of rock, compacted earth, sealed or paved surfaces,<br>– plastic sheets, corrugated iron sheeting; |
|  <br>Spate irrigation | **Water storage facilities:**<br>Surface storage:<br>– natural depressions,<br>– ponds and pans,<br>– excavated ponds (e.g. *hafirs*),<br>– cultivated reservoirs / tanks,<br>– ponds for groundwater recharge,<br>– surface dams: small earth and stone dams, check dams, rock catchment masonry dams; |  <br>Planting pits | **Storage:**<br>– tanks,<br>– reservoirs,<br>– cisterns. |
| **Floodwater harvesting within stream bed:**<br>– riverbed / *wadi* and gully reclamation: e.g. *jessour, tabias*, "warping" dams,<br>– permeable rock dams | Subsurface storage:<br>– subsurface, percolation and sand dams,<br>– subsurface reservoirs: cisterns; |  <br>Semi-circular bunds |  <br>Rooftop WH |
|  <br>Riverbed reclamation |  <br>Macrocatchment systems | **Cross-slope barriers:**<br>– vegetative strips,<br>– contour bunds and ridges,<br>– tied ridges,<br>– stone lines and bunds,<br>– contour bench terraces (e.g. *fanya juu*), |  <br>Courtyard WH combined with rooftop WH |
| | **Traditional wells:**<br>– horizontal wells,<br>– recharge / injection wells. |  <br>Vegetative strips | |
| |  |  <br>Contour lines and trenches | |




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




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

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## MEASURES OF WH : Water harvesting Detailed Assessment at national level

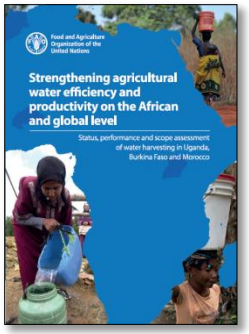
### Performance assessment of and potential for different WH technologies

Surface water | Groundwater | Soil moisture

5 best national WHTs (as per MCA) | Implemented in the pilots

| WH technique | U | B | M |
|---|---|---|---|
| WH from Roads | o | o | o |
| Small WH Ponds | o | o | |
| WH from Rock Outcrops | o | | |
| Permeable Rock Dams | o | | |
| Rooftop WH | o | | |
| Valley Dams | o | | |
| Valley Tanks | o | | |
| Covered cisterns/ Matfias | | | o |
| Hill lake | | | o |
| WH ponds (farm, iferd) | | | o |
| Boulis | | o | |
| Gully Plugging | o | | |
| Subsurface Dams | o | o | |
| Tube Recharge | o | o | |
| Sand Dams | o | o | |
| Percolation ponds & contour trenches | | o | |
| Khettara | | | o |
| Half-moons | o | o | |
| Grass Strips | o | o | |
| Improved Trash-lines | o | | |
| Contour Bunds | o | | |

| WH technique | U | B | M |
|---|---|---|---|
| Mulching | o | o | |
| Terraces | o | | o |
| Trapezoidal bunds | o | | |
| WH for Banana Plantations | o | | |
| Stone bunds | o | o | |
| Spate irrigation | o | | o |
| Fanyajuu,/ Fanyachini | o | | |
| Agricultural benches | | o | |
| Digues filtrantes (Filtering dikes) | | o | |
| Manure and Compost | | o | |
| Vallerani system (Delfino) | | o | |
| Zaï pits | | o | |
| Tied ridges | | o | |
| Agroforestry | | o | |
| Water spreading weirs | | o | |
| Check dams | | | o |
| Conservation agriculture | | o | o |
| Micro-basins | | | o |
| R'Foussi | | | o |
| Jessours | | | o |
| Water and sediment control basin | | | o |




*The FAO Publication "Status, performance and scope assessment of WH in Uganda, Morocco and Burkina Faso"*

**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)

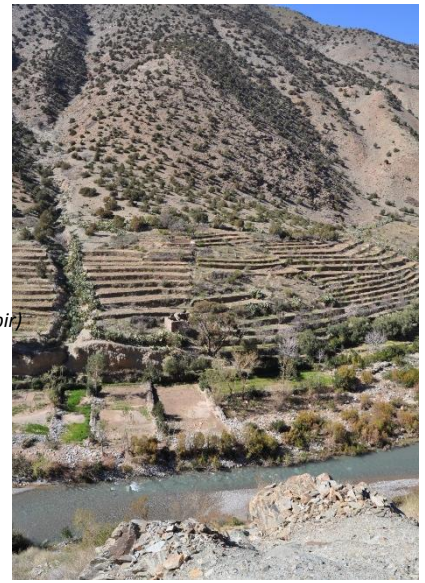
*Rainfed and Irrigated terraces with trees plantation and crop rotation (Al Haouz) (M.Sabir)*

***Elements de banquette and micro-basins** with olive or almond tree plantation in Sidi Driss,*

***Lac Collinaire,** High Atlas (M. Sabir)*

***Check dam – cemented stones,** for the protection of the ravine in the Taza basin (Source: Berhailli)*

Continuous **banquettes** with olive plantation *(M.Sabir)*



*Integrated system on Rheraya wadi : micro and macro-catchment (flood catchment), groundwater harvest/recharge, gravity irrigation, crop rotation. (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)*

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## 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)*

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

*Effets of **flood spreading weir** (Source : Brückmann)*

*Staggered **half-moons** with and without plants (INERA)*

***Zai pitsin** the dry season and mobilization of organic manure (Botoni et Reij, 2001), Mil in Zaï Holes (Photo M. Bonzi, 2007)*

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

***Mulching** and **manure** in combination with stones bunds (IUCN)*

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## 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

***Grass strips*** *and contour ploughing to enhance infiltration (GIZ, 2012)*

***Sand dam*** *(Source: MetaMeta 2014)*

*Constructing a* ***tube recharge*** *system (Connect International)*

***Rooftop Water Harvesting*** *(Metameta 2013)*

***Valley Tank****. Central Region of Uganda (FAO/AgWA, 2017)*

***Gully plug*** *(Source: MetaMeta, 2013)*

*Runoff flowing into a* ***small WH pond*** *(MetaMeta)*

***Mulched pits*** *for* ***banana*** *seedlings. Central Region of Uganda (L.Guarnieri/FAO, 2017)*

*Application of* ***Improved Trash lines*** *on a farmer's field (*WOCAT, 2007)

***Fanya chini/ trenches*** *for mulched banana plantation. Central Region of Uganda (L.Guarnieri/FAO, 2017)*

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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)

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**

*Steps of the MCA*

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 | | Indicators | Description |
|---|---|---|---|
| A. Geographical suitability | 1 | Agro-ecological zones | WH techniques potentially applicable in a wider variety of AEZ within a given country received a higher score. |
| B. Technical and environmental suitability | 1 | Storage type | 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. |
| | 2 | Storage capacity | 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. |
| | 3 | Soil quality | A measure of the positive impacts of each technique on soil properties (physical, chemical, biological) and against soil erosion. |
| C. Socio-economic suitability | 1 | Multiple uses of water | A measures of the use of water stored by a certain WH technique. Techniques that contribute to more uses received a higher score. |
| | 2 | Costs | 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. |
| | 3 | Management and maintenance capacity | Provide information on the availability of local expertise and capacity to maintain and manage the techniques. |
| | 4 | Gender | A qualitative assessment of the implications of the different techniques for both men and women. For instance, techniques that increase workload of women or favour men more than women score lower. |
| D. Agricultural productivity and profitability impact | 1 | Productivity | A measure of the quantitative increase in crop yields compared to control (same crop without the adoption of the WH technique). |
| | 2 | Diversification | A measure of the extent to which agricultural production can be diversified (also introducing higher value crops) thanks to the adoption of the technique. |
| | 3 | Profitability | Inform on the relation between revenue obtained or anticipated by the farmer (long-term) and the resources deployed to obtain the revenue (cost-benefit). |

*Criteria and associated indicators used in the MCA*

**Limits**:

- ➢ Limited knowledge/experience on certain techniques
- ➢ Shortage of **quantitative data** on the impacts of WHT

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## INTRODUCTION TO TOOLS/METHODOLOGY

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

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

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## INTRODUCTION TO TOOLS/METHODOLOGY

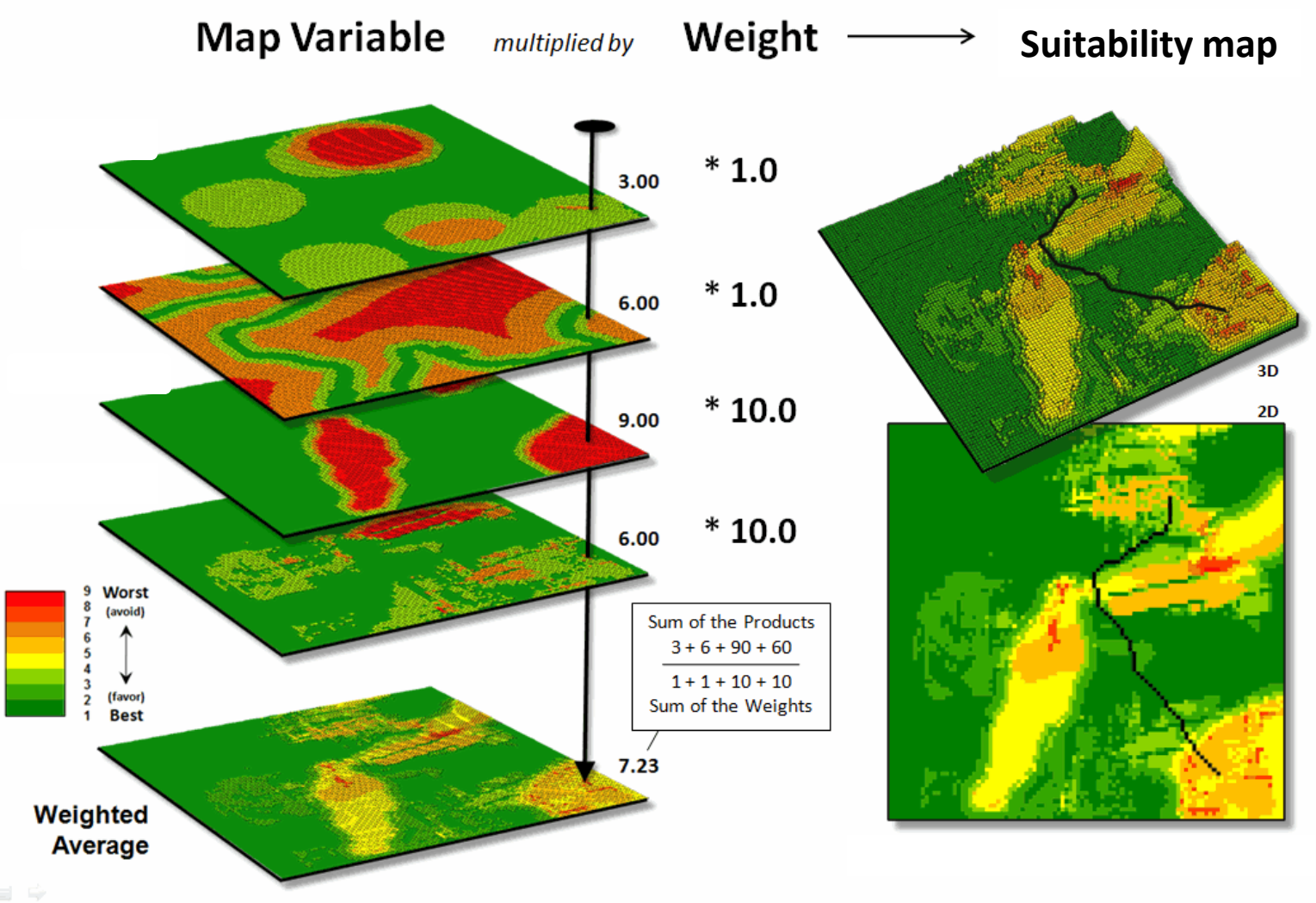
**Conceptual model** for interventions **:** selectin and redirect WH sub-st level

**GIS and Remot Applications:**

1) For **planning harvesting sy** mapping pote areas accordin spatialized M integrated field su
2) As a decision-ma **tool for rehabilitation/im** of existing WH sys

Integrated and participatory approach

Field surveys



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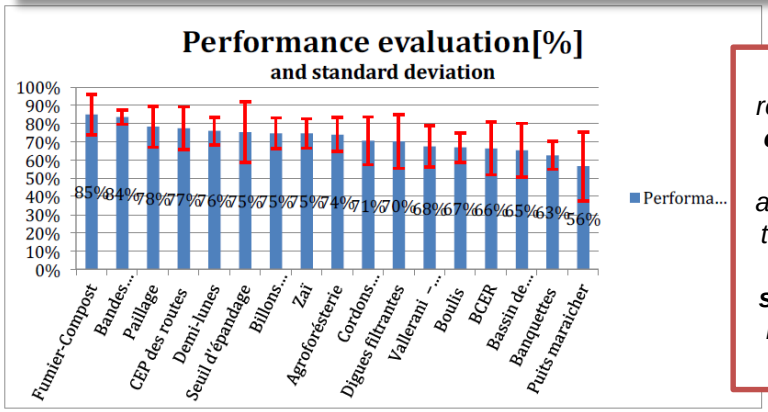
## TOOLS/METHODOLOGY IN ACTION

### The Multi-Criteria Analysis in action

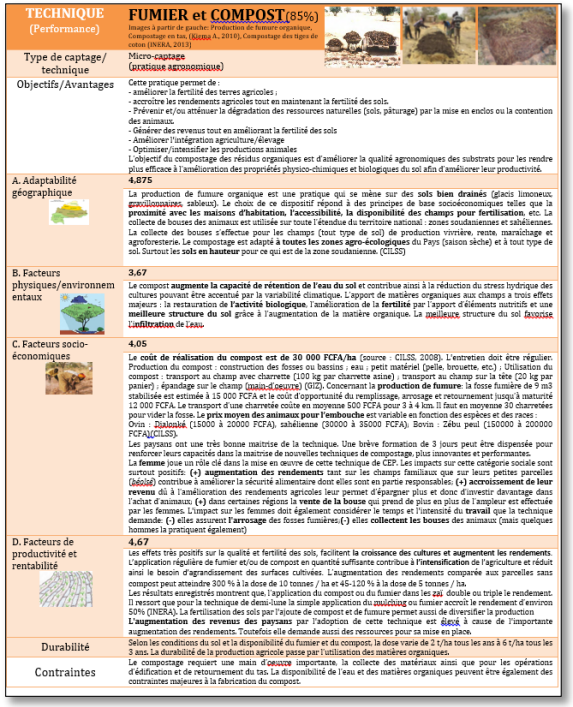
| Categorie de cep | Criteria | A. Geographical suitability | | | | | | | | | B. Technical and Environmental factors | | | | | | | | | | C. Socio.economic fatcors | | | | | | | | | | | | D. Productivity and Profitability | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Indicators | Agro-ecological zones | | | | Soil types | | | | | Storage type | | | | | | | | | Multiple uses of water | | | | | | | | | | | | | | | | |
| | Techniques/ Sub-indicators | Zone Nord-Sahélienne (P= 350-500mm) | Zone Sud-Sahélienne (P=500-700 mm) | Zone Nord-Soudanienne (P=700-900mm) | Zone Sud-soudanienne (P>900 mm) | Sandy soils | Stony soil | Clay soils | Silty soils | Total Score A | Weight Criteria A | Soil Moisture | Reservoirs | Groundwater | Sub-Total Storage Type | Storage capacity | Impact on soil quality and erosion | Total Score B | Weight Criteria B | Farming | Livestock | Domestic | Ecosystem | Sub-Total Use | Costs | Management & Maintenance Capacity | Gender | Women Access | Total Score C | Weight Criteria C | Productivity | Diversification | Profitability | Total Score D | Weight Criteria D |
| Micro-captage | Zaï | 5 | 5 | 3 | 3 | 1 | 2 | 4 | 5 | 3,5 | 10 | 5 | 1 | 2 | 2,67 | / | 5 | 3,83 | 30 | 5 | 0 | 0 | 4 | 2,25 | 5 | 5 | 4 | 5 | 4,25 | 30 | 5 | 1 | 4 | 3,33 | 40 |
| | Demi-lunes | 5 | 5 | 2 | 0 | 1 | 3 | 5 | 5 | 3,25 | 10 | 5 | 2 | 2 | 3,00 | / | 5 | 4,00 | 30 | 5 | 0 | 0 | 5 | 2,5 | 4 | 4 | 3 | 4 | 3,50 | 30 | 5 | 2 | 5 | 4,00 | 40 |
| | Vallerani Delfino | 5 | 5 | 1 | 0 | 2 | 4 | 4 | 5 | 3,25 | 10 | 5 | 2 | 2 | 3,00 | / | 5 | 4,00 | 30 | 5 | 0 | 0 | 4 | 2,25 | 3 | 3 | 4 | 2 | 2,85 | 30 | 5 | 2 | 3 | 3,33 | 40 |
| | Tied ridges | 3 | 3 | 5 | 2 | 1 | 2 | 5 | 4 | 3,12 | 10 | 5 | 2 | 3 | 3,33 | / | 5 | 4,17 | 30 | 5 | 0 | 0 | 3 | 2 | 5 | 5 | 3 | 3 | 3,60 | 30 | 4 | 3 | 4 | 3,67 | 40 |
| | Cordons pierreux | 4 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 4,5 | 10 | 5 | 2 | 2 | 3,00 | / | 5 | 4,00 | 30 | 5 | 0 | 0 | 4 | 2,25 | 3 | 5 | 4 | 3 | 3,45 | 30 | 4 | 3 | 2 | 3,00 | 40 |
| | Banquettes en terre | 4 | 5 | 3 | 0 | 1 | 1 | 5 | 4 | 2,87 | 10 | 4 | 2 | 4 | 3,33 | / | 4 | 3,67 | 30 | 5 | 0 | 0 | 4 | 2,25 | 3 | 3 | 4 | 2 | 2,85 | 30 | 4 | 3 | 2 | 3,00 | 40 |
| | Bande enherbées | 3 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4,12 | 10 | 5 | 2 | 3 | 3,33 | / | 5 | 4,17 | 30 | 5 | 0 | 0 | 4 | 2,25 | 5 | 5 | 5 | 5 | 4,45 | 30 | 4 | 3 | 5 | 4,00 | 40 |
| Macro-captage | Boulis | 5 | 5 | 5 | 3 | 1 | 2 | 5 | 4 | 3,75 | 10 | 1 | 5 | 5 | 3,67 | 4 | 2 | 3,22 | 30 | 5 | 5 | 5 | 3 | 4,5 | 1 | 2 | 5 | 2 | 2,90 | 30 | 4 | 5 | 2 | 3,67 | 40 |
| | Bassin de captage | 2 | 3 | 4 | 5 | 1 | 3 | 5 | 4 | 3,37 | 10 | 1 | 1 | 3 | 1,67 | 3 | 2 | 2,22 | 30 | 5 | 5 | 5 | 3 | 4,5 | 3 | 3 | 4 | 2 | 3,30 | 30 | 4 | 5 | 3 | 4,00 | 40 |
| | Seuil d'épandage | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 5 | 4,62 | 10 | 5 | 4 | 5 | 4,67 | 3 | 5 | 4,22 | 30 | 5 | 5 | 3 | 5 | 4,5 | 2 | 2 | 4 | 1 | 2,70 | 30 | 4 | 5 | 3 | 4,00 | 40 |
| | Digues filtrantes | 5 | 5 | 4 | 3 | 4 | 5 | 5 | 5 | 4,5 | 10 | 5 | 4 | 3 | 4,00 | 2 | 5 | 3,67 | 30 | 5 | 0 | 0 | 5 | 2,5 | 2 | 3 | 2 | 3 | 2,50 | 30 | 5 | 3 | 3 | 3,67 | 40 |
| | BCER | 4 | 5 | 4 | 3 | 2 | 3 | 5 | 5 | 3,87 | 10 | 1 | 5 | 1 | 2,33 | 3 | 2 | 2,44 | 30 | 5 | 1 | 2 | 2 | 2,5 | 2 | 3 | 4 | 4 | 3,10 | 30 | 4 | 5 | 3 | 4,00 | 40 |
| | CEP des routes | 5 | 5 | 5 | 5 | 3 | 4 | 5 | 5 | 4,62 | 10 | 4 | 5 | 4 | 4,33 | 3 | 5 | 4,11 | 30 | 5 | 3 | 3 | 5 | 4 | 3 | 3 | 4 | 2 | 3,20 | 30 | 4 | 4 | 4 | 4,00 | 40 |
| Agronomique/ forestiere | Paillage | 2 | 5 | 4 | 3 | 5 | 5 | 5 | 5 | 4,25 | 10 | 5 | 1 | 1 | 2,33 | | 4 | 3,17 | 30 | 5 | 0 | 0 | 4 | 2,25 | 5 | 5 | 5 | 5 | 4,45 | 30 | 4 | 3 | 5 | 4,00 | 40 |
| | Fumier et Compost | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 4,87 | 10 | 5 | 0 | 2 | 2,33 | | 5 | 3,67 | 30 | 5 | 0 | 0 | 4 | 2,25 | 4 | 5 | 4 | 5 | 4,05 | 30 | 5 | 5 | 4 | 4,67 | 40 |
| | Agroforésterie | 2 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 4,25 | 10 | 4 | 1 | 2 | 2,33 | | 4 | 3,17 | 30 | 4 | 0 | 0 | 5 | 2,25 | 3 | 4 | 5 | 4 | 3,65 | 30 | 3 | 4 | 5 | 4,00 | 40 |

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




***Histogram*** *representing* ***results of MCA*** *of different WH technologies and the risks relative to the robustness of results (i.e.* ***standard deviation*** *in red) (exemple of Burkina Faso)*

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

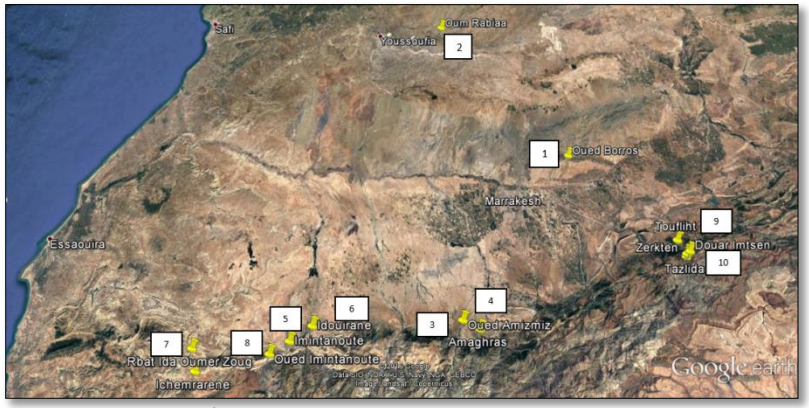


Theme 3:
# Water Harvesting

## TOOLS/METHODOLOGY IN ACTION

**WH techniques to target**

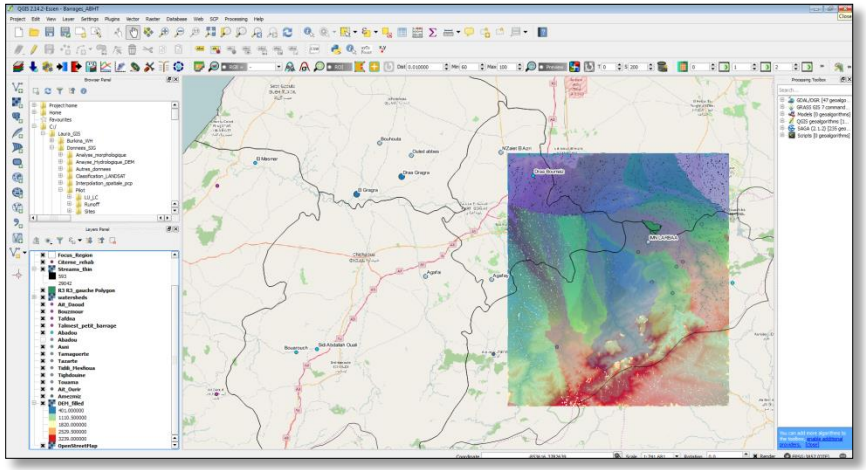
- ✓ WHT for (also) **crop production**
- ✓ Already **present** in the region (**suitable to the AEZ**);
- ✓ M**astered by the local populations** (implementation + maintenance);
- ✓ Made with local materials, and therefore **durable/sustainable**;
- ✓ Presenting **potential for innovating** in relation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




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

| Criteria | Weighting |
|---|---|
| Community organization and expertise | 35% |
| Generation of added value | 25% |
| Micro and Macro-catchment techniques | 20% |
| Availability of land for cultivation and community around water source | 10% |
| Multiple uses of water | 10% |

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



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

Theme 3:

# Water Harvesting

## 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)

*Field visit in Rawlegue, Burkina Faso: WH ponds made by the community*

***Theoretical and practical sessions*** *in FAO meeting room in Burkina Faso*

Practical demonstration

***Practical Demonstration*** *during field visit in Uganda – the water cycle experiment*

Group works

Field trips

Guided exercises on GIS

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

Theme 3:
# Water Harvesting

## 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

Theme 3:

# Water Harvesting

## 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

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

Theme 3:
# Water Harvesting

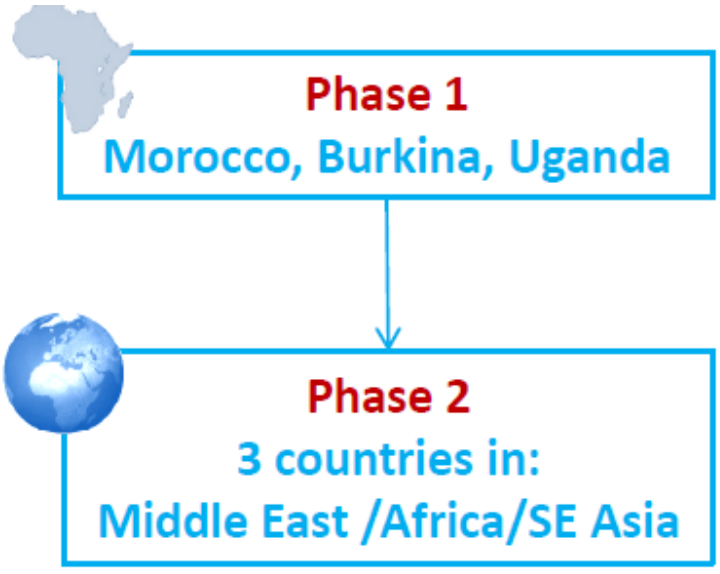
## PARTNERS IN IMPLEMENTATION



| Country | ACTIVITY | | | |
|---|---|---|---|---|
| | **3.1** Detailed Assessment on WH | **3.2** Pilot project on WH | **3.3** Training Programme | **3.4** Sub-strategies for WH |
| **Burkina Faso** | Spate Irrigation Network Foundation (SINF) | National Consultant + National Engineering Office | Spate Irrigation Network Foundation (SINF) | International consultant |
| **Morocco** | | National Consultant + Local NGO | | |
| **Uganda** | | International consultant +Local NGO + local company | | |

Theme 3:
# Water Harvesting

## SCALING-UP

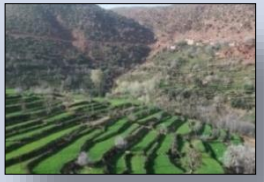



- ❑ Pilot projects implementation
- ❑ Joint Report on Lessons learnt/Main findings
- ❑ Application in sites with similar agro-ecological characteristics (Climate, Soils and Crops)

Theme 3:

# Water Harvesting

## IMPLEMENTATION/EXPANDING PRACTICE

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

Different AEZ

Different socio-economic conditions

Different biophysical constraints

Different WHTs

# THANK YOU FOR YOUR ATTENTION