Thematic Brief 3

Water Harvesting

Brief prepared for the Entry phase of the project:

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

The Project

The GCP/INT/166/SWI "Strengthening Agricultural Water Efficiency and Productivity on the African and Global Level" has the aim to improve Agriculture Water Management (AWM) practices and mainstream AWM in national frameworks and processes on the African and global level. The project is funded by the Swiss Agency for Development and Cooperation (SDC) and is composed of three phases: Entry Phase, First and Second Implementation Phases.

It is essential to increase WH capacity in the three countries

The overriding goal of the entry phase is to share the project document with a broad range of stakeholders and beneficiaries in each of its countries, in order to refine it in accordance to their interests and priorities, and to ensure that the final document is endorsed by the concerned parties.

The First Implementation Phase will focus on Africa and will be implemented in the three countries – Burkina Faso, Morocco and Uganda - within three years. The Second Implementation Phase will have a global focus and will expand to other three countries in Africa, the Middle East and South East Asia. The purpose of this phase is to develop country cooperation to promote knowledge transfer and experience sharing in improving AWM practices and mainstreaming them into national frameworks and processes.

This thematic brief is part of the Entry Phase work and relates to the proposed output of the project - Enhanced water harvesting capacity. The output will be targeted at enhancing water harvesting for agricultural production in smallholder settings in project countries.

Water Harvesting

Water Harvesting (WH) refers to the collection of rainfall for direct application to a cropped area, either stored in the soil profile for immediate uptake by the crop or stored in a reservoir for future productive use.

The majority of African farmers work in rain-fed agricultural systems, where rainfall is the only source of water for crop production. Therefore, in a situation where rainfall patterns are increasingly unreliable, WH offers an important mean to increase the resilience and productivity of rain-fed Africa. At the same time, WH provides a valuable source of water to uplift small scale irrigation adoption.

Ponds are WH technologies commonly used in the three countries

Food and Agriculture Organization of the United Nations

AgWA

Partnership for agricultural water for Africa

Thematic Brief 3

Water Harvesting

Excellent examples of local WH practices can be found in Africa. Nevertheless, the experiences are often scattered and sub-optimal. Therefore, there is a strong need to learn systematically from positive experiences and to upscale them at national and continental scale. Uganda, Burkina Faso and Morocco offer many examples of WH as shown in Table 1.

Table 1 - Water Harvesting options for agricultural production in Uganda (U), Burkina Faso (B) and Morocco (M)

1	**Soil moisture storage**	Zai pits (B)	Demi lunes (B,M)	Stone lines (U,B,M)	Bunds/ ridges (B,M)	Grass strips (B, U)	Delfino/ vallerani (M,B)
		Tabia (M)	Jessour (M)	Terraces (M)	Thrash lines (U)	Micro-basins	
2	**Surface**	Pans (U,M,B)	WH ponds (U,M,B)	Valley dams (U)	Water from roads (B,M)	Water spreading weirs (M,B)	Metfia (M)
		Rooftop (B,M,U)					
3	**Agronomic**	Mulching (U, M)	Composting/ FYM (U,B,M)	Ripping (B,M)	FMNR (B)	Contour ploughing (U,B,M)	
4	**Groundwater storage**	Sand dams (B,U)	Subsurface dams (U,B,M)	Injection wells (M)	Percolation ponds/ pits		

The benefits from WH are clear especially in areas with low and scattered rainfall. WH makes crop production viable by re-routing additional water to the production area where otherwise there would not be enough water. Additionally, the water stored in reservoirs can be a valuable source for supplementary irrigation. It is a low-input approach that is commonly rooted in local practice and therefore individuals and small groups can manage it locally.

Demi Lunes are used in Burkina Faso and Morocco

Zai pits are typically used in Burkina Faso

Burkina Faso

State of the art

Burkina Faso has been for long a country where WH was considered a fast developing track endorsed by the government and by non-governmental actors alike. The first impulse was given by the dramatic droughts that hit the area in 1970s. In 1980s, the campaigns against desertification gained again momentum with the advent of participatory approaches introduced by local and international NGOs. At the same time, bilateral and multilateral cooperation initiatives followed different paths of knowledge transfer and community participation.

WH technologies can be found in every region of the country with some being indigenous, while others have been introduced. The Sahelian and pre-Sahelian regions are mostly arid and semi-arid and the main drive of the rural economy is livestock production. In these areas pastureland rehabilitation with mechanical and biological measures and WH structures for livestock watering are the most common. The central and northern regions are mostly semi-arid sorghum producing areas and are the areas where the zai planting pits originated. Nowadays zai pits are used all around the country alongside with stone lines and demi-lunes. In these areas, surface runoff is also harvested in ponds, even though the water is rarely used for crop production.

In the maize producing areas with a higher rainfall regime the technologies adopted are mostly focused on excess water management and soil moisture retention.

The government of Burkina Faso is implementing several programs to spread the use of WH for agricultural production. Noteworthy is the recent program that aims at introducing small individual WH ponds for cash crop production.

Actor analysis

Table 2 - Actor Analysis in Burkina Faso

Organization	Role in WH/SWC	Technologies	Interventions/Projects
Ministry of Agriculture (MASA)	Financing, Implementation, Regulation, Advisory/Extension	1 2 3	PNSR, PDA (GIZ), ACACIA 2 (AGRFOR, CAP-M), PDRD (IFAD), PICOFA (IFAD) , PAPSA (WB), P4P (WFP), BRRM (WFP), Neer-Tamba (IFAD), PAGIRE (MCC), PATECORE
Ministry of Water	Financing, Implementation, Regulation	2	PNSR, River-Basin Plans
Centre Agricole Polyvalent – Matourkou (CAP-M)	Education, Training of Extension Agents	1 3	ACACIA 2 (MASA, AGRFOR)
Research Institutes (2iE, INERA, USTA)	Education, Research, Training	1 2 3	WHATER and WAHARA (EU-INERA), FMNR, WH Ponds (2iE), WH Mapping (MASA, INERA)
International Cooperation	Financing, Co-Implementation, Technical Assistance	1 2 3 4	PDA (GIZ), SOS Sahel, PRGDT (CILSS, EU, FFEM, CRDI), ACACIA 2 (AGRFOR, CAP-M)
Civil Society Organisations (CSOs)	Implementation, Promotion, Extension	1 2 3 4	Professional Associations, Zai Association, AVAPAS, Promotion Arabic Gum (VDS, CIFOR), Rainwater Harvesting Association

Main Findings per Country

Burkina Faso

Opportunities (gaps and needs) assessment

- To reach out to the rural communities, the government needs to strengthen the technical knowhow of its technicians by using tailor made courses and by updating graduate and undergraduate programs.
- The collaboration with research institutes has grown stronger in recent years and needs to be constant in order to have a permanent link between research and practice.
- Training in Small Scale Irrigation (SSI) after WH ponds implementation is weak.
- There is a lack of national guidelines on WH.
- Rural communities always adopted traditional forms of WH to enhance production in areas where rainfall is scanty and irrigation is not present. This has proved to be the base for a wider uptake at national and even regional level.

In Burkina Faso rural communities have always adopted traditional forms of Water Harvesting

In Burkina Faso it is essential to invest in farmers capacity building

The priorities and needs of the communities should be the starting point in formulating strategies for national interventions. The differences in needs and livelihoods between pastoralists and farmers must be acknowledged when devising water interventions

Morocco

State of the art

Morocco has a long tradition in WH and soil and water conservation (SWC). Through history, local communities have developed, adapted and integrated a great diversity of structures in their landscapes and combined them with agronomic practices to manage their limited soil and water resources to sustain food security and livelihoods. This diversity reflects the different socio-economic, cultural, and bio-physical patterns of Morocco's various regions and communities.

WH and SWC techniques in Morocco range from diversion weirs and trenches, and draining terraces in the humid and sub-humid Rif in the North to micro-basins, check-dams, stone and earth bunds, and terraces in the semi-arid zones, to water-spreading weirs in the more arid climates.

In several areas, however, these traditional techniques have disappeared due to wider agrarian and socio-economic forces (e.g. outmigration, intensification and modernization of agriculture) and due to the degradation of land and water resources. Nonetheless, WH and SWC still play a crucial role in smallholder farming, especially in marginal, mountainous and semi-arid zones.

Increasing concerns about soil erosion and the realization of the importance of rain-fed agriculture for food security have driven renewed attention to WH and SWC in both national and international cooperation projects. The Ministry of Agriculture and Fisheries has recently introduced a subsidy to stimulate local investment in WH and SWC.

Large-scale programs, such as the Millennium Challenge Account (MCA), promote land use change from cereals to high value tree plantations in marginal areas coupled with RH/SWC. Other projects such as MENARID endorse WH as an effective tool for restoring the biodiversity and productivity of large areas of communal rangeland in eastern Morocco. Other initiatives target the rehabilitation of traditional khettara, widespread in the arid zones in the South of Morocco (e.g. Tafilalet Oasis Program, funded by UNDP as part of CBO-Morocco Program).

Many Water Harvesting structures are being rehabilitated in Morocco

Again other efforts led by the High Commission for Water, Forests and Combating Desertification (HCEFLCD) within the National Watershed Management Plan (PNABV) are directed to reforestation and SWC upstream in the catchment to reduce soil erosion and siltation of dams downstream.

The National Water Strategy set up in 2009 provides a portfolio of actions to promote the development of WH for different uses.

Finally, many initiatives have also sprouted within local communities introducing and adapting techniques imported by migrants who returned to their original villages, and constructed with revenues from remittances.

There is compelling need to work in much closer cooperation with farmers and local communities to revitalize their knowledge and practices and to make sure actions are need-based and sustained by local capacities and organizations

Morocco

Actor analysis

Table 3 - Actor Analysis in Marocco

Organization	Role in WH/SWC	Technologies	Interventions/Projects
Ministry of Agriculture and Fisheries (MAF)	Financing, Implementation, Regulation, Advisory/Extension	1 2 3	MENARID (HCEFLCD, MAF, GEF, UNIDO, ICARDA); Millennium Challenge Account (US Gov); IRRE (FAO, HCEFLCD); CBA-Morocco Programme (UNDP, GEF, JICA, CTB), PREM (USAID), DERRO (1960s-1970s)
Department in charge of water resources	Financing, Implementation, Planning, Regulation	2 4	Programme AGIRE-GIZ (Appui à la Gestion Integrée des Resources en Eau); River Basin Plans (PDAIRE)
High Commission for Water, Forests and Combating Desertification (HCEFLCD)	Financing, Implementation, Regulation	1	National Action Plan is supported by GM, UNDP, and GTZ and desertification control was mainstreamed into priorities of several development partners (Japan, Belgium, Spain, WB, IFAD); watershed management plans (PNABV), CBA-Morocco Programme (UNDP, GEF)
INRA/ ENAM/IAV	Education/Research/ Training	1 2 3	Undergraduate and graduate educational programmes; Research Unit "Soil and Water Conservation"; capacity building of government staff and technicians; MCA project on SWC in mountains and oasis
ONCA	Extension/Advisory, Coordination	1 3	Established in 2013, it is in the process of developing Regional Agricultural Advisory Service Plans (PRCA)
International Cooperation	Funding, Technical Support, Co-implementation	1 2 3	Several interventions that include RWH/SWC components in natural resources management, desertification control, and climate change adaptation (see above)

Opportunities (gaps and needs) assessment

- Weak coordination between ministerial departments involved in WH.
- The current Agricultural Advisory Service is undergoing a substantial restructuring process. Accordingly, the National Office for Agricultural Advisory Services (ONCA) was recently established. However, preparedness of extension agents, farmers and their organizations is still an issue and Morocco needs support in this process. This could be also the timely stage to strengthen the focus and the capacity of extension/training services in WH and SWC.
- In discussions with ministries' departments and research institutes it emerged the need to enhance the link between WH, soil management, and groundwater recharge through small-scale, cost-effective structures and agronomic measures.
- Morocco has relevant experience in the field of Managed Aquifer Recharge (MAR), which needs to be enhanced in the future.

Uganda

State of the art

The characteristics of the agro-ecological zones of the country broadly determine the spread and typology of the adopted WH measures. In the banana growing regions in the west, mulching with crop residues, trash lines and planting pits are commonly used to boost agricultural production and manage fertility. In these areas, biological forms of WH are common and preferred because soil fertility is improved alongside with soil moisture retention. In these areas, WH in surface reservoirs for crop production was not deemed as an urgent necessity by farmers, but the lower reliability of the rainy season in the last years has raised interest in improved rain-fed farming.

Agro-pastoral and pastoral areas mostly occupy the cattle corridor that stretches from the south-west to the northeast. Rainfall is more scattered and communities learnt to cope with recurrent shocks, by adopting a pastoral lifestyle. Traditionally, people move with their herds from seasonal to perennial water sources to allow pasture regeneration and decrease the risk of overgrazing.

In agro-pastoral regions, the government as well as international cooperation organizations are building medium-sized WH ponds (Valley tanks) for livestock watering (e.g. KaLiP, Adoption to Climate Change in Uganda). Some of these initiatives try to couple livestock production with horticulture development with mixed results.

Many WH ponds are being built in Uganda by the government and international organizations

At the national level the Ministry of agriculture has recently started small pilots where WH ponds are coupled with small-scale irrigation to sustain agricultural production. National and international NGOs are also working on programs that include WH as a key component (OXFAM, World Vision, Care, Welthungerhilfe, RAIN).

In parallel, the private sector is developing the skills and the services to support water-harvesting development. Several companies are already producing and commercializing components for rooftop WH. Consulting companies are instead active in providing technical advice on a project base.

Throughout the country there are successful examples of WH practices and approaches (FFS, PFS, ISWC), but that had little follow-up. Farmer Field Schools (FFS) were conducive in triggering farming communities to invest in WH for crop production (FAO). Efforts to promote and ameliorate indigenous WH technologies also showed how higher acceptance is fostered when starting from the local knowledge base that is deeply rooted in the local context.

It is time to take stock of local initiatives that were successful in promoting WH at community level (ISWC, FFS, PFS)

*Farmer Field Schools (FFS), Pastoralist Field Schools (PFS), Indigenous Soil and Water Conservation (ISWC)

Main Findings per Country

UGANDA

Actor analysis

Table 4 - Actor Analysis in Uganda

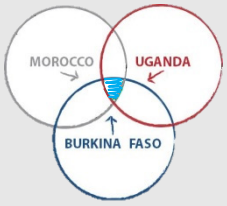
Organization	Role in WH/SWC	Technologies	Interventions/Projects
Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)	Financing, Implementation, Regulation, Advisory Extension	1 2 3	WH/SSI Demonstrations, Climate Change Unit (FAO), Integrated Landscape Management for Improved Livelihoods and Ecosystem Resilience on MT. Elgon (GEF-UNDP)
Ministry of Water and Environment (MWE)	Financing, Implementation, Planning, Resource Allocation	2	Water Atlas developed, Valley Tanks (Kalip), Climate Change Unit (FAO), Water Management and Development Project (WB)
International cooperation	Funding, Technical Support, Co-implementation	1 2 3	Karamoja Livelihood Program (EU), Adaptation to Climate Change in Uganda (FAO, DANIDA, UNDP, EU, BTC) Uganda Sustainable Land Management Country Program (WB, GEF)
Extension System	Extension/Advisory, Coordination	3	Momentarily not clear what will happen to the partly privatized system after recent issues
Universities/ Research institutes (Makerere, NARO)	Education, Research, Training	1 2 3	Undergraduate and Graduate programs. Provision of technical advice and counselling

Opportunities (gaps and needs) assessment

- MAAIF and MWE share stakes in the WH sub-sector, nevertheless coordination is lacking and often the result is a misguided effort in implementation. The newly created Climate Change Unit brings together the two ministries, but is still at an early stage.
- MAAIF is trying to push WH for smallholder production, but the effort is painstakingly advancing by trial and error and there is a lack of national guidelines for practitioners.
- The role of the extension services in WH is only marginal and the recent development of the sector makes their role weak in the short term).
- Research highlighted the importance of integrating WH within a wider strategy that promotes all aspects of production and most importantly, takes into account the needs of the communities.
- There is a lack of studies that evaluate available WH technologies and their benefit (short- and long-term).
- Many valley tanks are failing because of poor management of the reservoirs and of the upper catchment. The development of the tanks is not always followed by irrigation development initiatives.

Water Harvesting

COMPARATIVE ANALYSIS



BURKINA FASO	MOROCCO	UGANDA
Precipitation		
300-600 mm/year in the North, Sahelian Regions, 600-900 mm/year in the Central Plateau, 900-1200 mm/year in the South	Mostly arid and semi-arid with precipitation ranging from 750 mm/year in the North to 150 mm/year in the Sahara desert fringes	Precipitation varies from 750 mm/year in the Karamajong pastoral areas in the northeast to 1 500 mm/year in the high rainfall areas on the shores of Lake Victoria
Screening of initiatives and options		
MASA recently commissioned the mapping of WH in the country and of the potential for the future (INERA)	Many studies and recent mapping has been carried out. Technical guidelines in form of fact sheets almost finalized (GIZ-MEMWE)	Scattered information and lack of guidelines for practitioners. Lack of studies at national scale
Political willingness		
WH high up in the political agenda	WH and SWC high up in the political agenda	WH is promoted (DSIP), but only some technologies are well embed in the political agenda (Valley tanks)
Pastoralist areas		
Move towards sedentarization of pastoral communities	Special efforts to support pastoral communities	Pressure towards settling pastoral communities
WH practice and documentation		
Extensive in-situ WH as well as traditional ponds. Good documentation in the years	Extensive experience in all regions. Many experiences have been documented	Lower formal knowledge base on WH, but many experiences have not been documented properly
Agricultural Extension Services		
AES is active at municipality level, but need strengthening	AES is being restructured and may profit of tailor made trainings to strengthen capacities	The Agricultural extension system is in havoc and it is not clear how it will develop in the near future. At the moment other channels are advised to promote WH technologies
Universities and Research		
Higher university course include WH as a subject, but a revision of curricula could strengthen future expert at the source	The universities (IAV) have programs on SWC and are updating their programs on a constant basis	The universities may benefit from curricula strengthening

- Weak coordination between Agriculture and Water development - Need to work across sectors
- Lack of information of effects of WH on downstream communities
- Excellent potential to support supplementary irrigation, decrease erosion risk
- Pressures and actions to settle pastoral and agro-pastoral communities

Project Development

RECOMMENDATIONS

BURKINA FASO

1. Develop national guidelines on WH and use for practitioners. The guidelines must include technical aspects as well as the participatory tools needed to develop technologies jointly with the beneficiaries.
2. Build upon the collaboration between MASA and research centres and stimulate Participatory Action Research.
3. Update/strengthen curricula of higher education institutes as well as the Polyvalent Agriculture Centre of Matourkou (CAP-M).
4. Engage the civil society in a dialogue on constant basis by supporting the platforms recently launched by MASA.
5. Measures are not well accepted by communities if their primary water needs are not first satisfied (e.g. in pastoralist areas agriculture is secondary to livestock production).
6. Poor access to organic matter is often curbing the efficiency of WH structures (e.g. Zai). Enhanced FYM and composting may greatly benefit agricultural productivity.

MOROCCO

1. Foster cooperation and coordination between different ministerial departments and other key stakeholders involved in WH and promote integration and coherency between their actions.
2. Enhance capacity building on WH and SWC within the Agricultural Extension Service (AES) by introducing specific training programmes directed particularly at field technicians that deal with farmers and local communities on a daily basis.
3. More interdisciplinary and Participatory Action Research is needed for the improvement and adaptation of locally suitable WH and SWC for multiple benefits (food, feed, income, land, water, biodiversity etc.).
4. Further studies are needed that evaluate the effectiveness of past approaches such as the *lacs collinaires*, for which mixed results emerged from the discussions with local actors.
5. Saline intrusion is becoming an issue in the southern, coastal regions. WH might contribute in curbing the problem when couple with Managed Aquifer Recharge (MAR) systems.

UGANDA

1. In the more humid areas, it is important to work with measures that combine physical WH with biological measures. Experiments showed how trash lines to retain runoff were much preferred to simple bunds on contour lines.
2. MAAIF needs technical guidelines to guide practitioners in their advisory functions and implementation AIF needs technical guidelines to guide practitioners in their advisory functions.
3. The extension system is being reformed and at the moment the trend is not clear. The program must rely on other channels to reach communities. The FFS, PFS and ISWC approaches showed good results in the past;
4. In agricultural areas valley tanks construction must be followed by knowledge transfer initiatives for small scale irrigation.
5. In Pastoralist areas, valley tanks must be located in locations where overgrazing risk is minimal.

All 3 countries

1. Integration of physical measures with biological measures is advised especially for in-situ WH. Biological measures in these cases not only help stabilizing the structures, but usually bring additional secondary, short-term benefits that make interventions more accepted.
2. In all countries, there are local WH measures in place. These measures offer an excellent base for innovation by using a Participatory Action Research approach.
3. WH reservoirs must be developed jointly with the irrigation management skills of the final users.
4. WH must be part of a comprehensive, trans-sectorial and landscape approach that pays equal consideration to socio-economic, socio-cultural and ecological, and bio-physical aspects of agriculture and rural development. Fertility management, Infrastructure development, Erosion control, Market access, Water uses and safety must all be considered to properly address local needs.