CUVE integrated water resources management waters

## Policy Brief

# Rainwater harvesting in southern Africa and potentials for knowledge transfer from CuveWaters research results in central-northern Namibia

As part of a multi-resource mix within an integrated water resources management (IWRM), CuveWaters implemented rainwater harvesting (RWH) at several pilot sites in central-northern Namibia. The concept of harvesting and storing rainwater for irrigation purpose creates capacities to buffer water fluctuations and allow for longer periods of horticultural production on household or communal level. The participatory demand-responsive approach followed at CuveWaters project sites, led to a successful and sustainable operation of RWH for horticulture. Application of easy-to-use technologies embedded in the participatory project approach ensured that capacities were generated at local level and thus independent operation of RWH is possible. CuveWaters proofed RWH for horticulture use as an adequate solution to tackle temporary water scarcity in semi-arid regions. The broad knowledge base on RWH project planning and implementation, which was generated on local and institutional level in Namibia, provides the opportunity to promote intensified use of RWH in other countries of the southern African region as well. Thereby, technological, social and organisational, as well as economic and policy related learning from CuveWaters can be transferred to support the implementation of RWH and reduce risks for decision makers and future RWH users.

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IN COOPERATION WITH

INDUSTRY PARTNERS

## *Findings and recommendations*

- **RWH for horticulture improves the irrigation water availability on household and communal level and thus increases local food production.**
- **Small-scale food production increases self-sufficiency and allows for additional income, hence improving local economies in rural areas.**
- **The participatory demand-responsive approach of CuveWaters RWH projects ensured local needs were met and RWH facilities are operated sustainably.**
- **RWH for horticulture is an adaptation strategy to high seasonal and interannual variation of precipitation as projected in consequence of climate change. Thus RWH increases resilience of rural communities to climate variability and climate change.**
- **CuveWaters training activities generated a broad RWH knowledge base on local and institutional level. Thus independent operation and dissemination of RWH is possible.**
- **Economies of RWH for horticulture pilot sites were positive, neglecting high initial invest for RWH structures. As a consequence, subsidisation of RWH structures could accelerate dissemination of RWH for horticulture and consequently stimulate rural development.**

## Introduction

The project CuveWaters supported the efforts of the Namibian government in regard to the implementation of an Integrated Water Resource Management (IWRM). Part of this was the introduction of Rainwater Harvesting (RWH) for horticulture in central-northern Namibia beginning in 2009 and the extension of knowledge about planning, construction, operation, and financing of RWH facilities and related horticulture activities in Namibia between 2009 and 2015.

CuveWaters was not only looking on technical aspects of RWH, but integrated technical, social, and economic aspects in a transdisciplinary and participatory demand-responsive approach which allowed for a close linkage of project activities with local and administrative stakeholders. First, pilot sites were used to gain knowledge on different types of catchments and water reservoirs and for training of local experts on RWH. Later on, extension of RWH was reached by implementation of RWH facilities to more sites. In doing so, the most suitable technologies, which are ferrocement tanks for RWH on household level and greenhouses and ponds for RWH on communal level, were used. In addition, training a larger number of people generated a broad base of knowledge in the water related ministry and among the Namibian population.

This Policy Brief will have a closer look on IWRM and RWH in other countries of the southern African region. Furthermore, it will discuss the potentials to transfer acquired knowledge from CuveWaters project in central-northern Namibia to other countries or regions in Southern Africa.

## Benefits of RWH

The CuveWaters project showed that RWH – if implemented participatory as well as in response and adjusted to the local demand – has many positive effects on regions with low average annual rainfall and a high seasonal and interannual variation of precipitation. RWH for irrigation purposes enables users to become more independent from piped water supply and to start or intensify horticulture on their property or within the community. Horticulture on household level increases the food security of the residents, leads to a healthier diet, and – in case yields lead to a surplus – allows for income generation by selling vegetables on local markets. Implementation of community farming facilities, furthermore, may lead to reduction of social exclusion and a reduction of poverty. In addition, community based approaches ensure cohesion in rural communities. Thus, RWH is not associated with poverty, but with improvement of living standard regardless of economic status.

The benefits on user level are accompanied by benefits on administrative level and from the perspective of infrastructure service provision. RWH facilities lower dependency from water supply infrastructures for irrigation purposes and hence reduce the water stresses during dry periods. As a consequence, water supply may fall short less often and RWH relieves pressure from administration and operators of water supply infrastructure.

## Boundary conditions for RWH

CuveWaters showed that RWH and horticulture on household level requires a minimum precipitation of 300mm per year. Investment in RWH facilities especially makes sense, when seasonal variability of mean annual rainfall is high. This means, rainfall occurs during few months only and water is scarce during the rest of the year. Other boundary conditions of high importance for success of RWH are the participation of local stakeholders from the beginning of the project. Early involvement in the planning process and the possibility to decide major aspects of the RWH implementation from the beginning are a key element to create awareness for later ownership and achieve sustainable operation of facilities.

Furthermore, successful RWH requires promoting legislation on national as well as on community level. Also, capacity development for construction and horticulture on local level has to be promoted. At the same time institutional capacity has to be developed on national and regional level and among water authorities. Finally, financing options for construction and renovation of RWH facilities have to be implemented. Appropriate financing schemes may range from support of local table banking communities to payment of construction cost by governmental or non-governmental organizations. Nevertheless, each of the financing options has to be clear regarding the extent and the duration of support and finally lead to a self-sustained operation of RWH and horticulture.

## Status quo of water supply and RWH in southern African regions

Taking a look at the neighbouring countries of Namibia in southern African, it becomes obvious, that RWH is an approach that is not limited to central-northern Namibia. Climatic boundary conditions, mainly an average precipitation of more than 300mm per year and a large variation of rainfall in the course of the year, are typical for large parts of southern Africa. Depending on the existing legislative framework and technical infrastructure in the water sector, as well as on specific socio-economic and socio-cultural aspects, RWH is a promising option to improve living conditions in other countries of the southern African region as well. In the following South Africa, Botswana, Lesotho, and Swaziland will be discussed in the light of RWH. Nevertheless, other countries of the Southern African Development Community (SADC) may face similar climatic conditions and could profit of RWH as well.

### *South Africa*

South Africa names the right to have access to sufficient food and water a fundamental right by the constitution. As a consequence, water related legislation puts emphasis on provision of potable water. Storage and use of run-off water from roofs, which is RWH, is explicitly mentioned in the National Water Resources Strategy (NWRS) and other policies. Water Management Institutions (WMI) shall implement a decentralized water resource management on local level. Catchment Management Agencies (CMA) coordinate the water resources at larger scale focusing on sustainable water use. The responsibility for water and sanitation sector holds the Department for Water and Sanitation (DWS) and its minister, respectively. Provision of water and water related infrastructure is part of the responsibilities of the Department of Water Affairs (DWA). The South African Water Research Commission (WRC) is an institution to promote research in the water and sanitation sector. The WRC is the main platform for knowledge transfer between the different stakeholders in South Africa. Research papers and project reports on RWH and horticulture are available amongst other WRC's publications. During the last decades intense efforts have been undertaken to promote RWH as an additional source of water in South Africa, mainly for small-scale agriculture. Within the national rainwater harvesting program a policy on financial assistance to resource poor irrigation farmers was introduced to subsidise initial investments for irrigation infrastructure. Many studies underlined the positive socio-economic effects of RWH in South Africa and annual reports and strategic plans of DWA show implementation of thousands of RWH tanks during the last decade. Nevertheless, other studies identified risks and shortfalls of demonstration projects. Learning from these projects, a continuous improvement of the process of RWH dissemination in South Africa took place. One of the NGOs, which is working on the dissemination and implementation of RWH for agriculture in rural and peri-urban towns in South Africa is 'The Mvula Trust'. Having learned from obstacles of past RWH projects, South African DWA goes on with the establishment of RWH facilities for horticulture. Thereby, the diverse technologies are used, such as polyethylene tanks, as well as brick and ferrocement tanks in above or underground position.

### Botswana

Botswana's water sector administration was in transition during the last decade to ensure efficiency and sustainability as well as transparency and accountability on national, regional, and local level. The Department of Water Affairs (DWA), as part of the Ministry of Minerals, Energy, and Water Resources, is responsible for the development and implementation of an IWRM Plan, as a part of their overall responsibility on water related policies. The infrastructure development and water supply function is shared between the DWA and other stakeholders, such as the Water Utilities Corporation, District Councils and other Ministries.

A "National Scoping Study for the Botswana IWRM WE Programme" (WE = Water Efficiency) of May 2010 investigated Botswana's water sector and the results of the sector's reform at that time. This study identified RWH as a beneficial supplement to the piped water supply. Nevertheless, the study describes factors that interfere with the diffusion of RWH technology in Botswana. Firstly, a high level of subsidies for piped water is mentioned, which reduces the benefit of RWH facilities for individuals. Secondly, the high investment for RWH is describes as hindrance for RWH dissemination and points out the necessity for subsidies or tax incentives to promote RWH for horticulture. The latest report on "IWRM WE" Plan of 2013 still comes to similar conclusions. In addition, RWH was implemented at many communal buildings, but the operation and maintenance of these RWH facilities is inadequate. Furthermore, Botswana National Water Policy from 2012 puts emphasis on the promotion of RWH and other non-conventional water sources. Nevertheless, support schemes of Botswana's Ministry of Agriculture and other institutions do not include approaches which stimulate RWH in general and RWH for horticulture in particular.

### Lesotho

Water related legislation in Lesotho describes the resources of water belonging to the nation. However, for domestic use of water resources there is no permit needed. Water sector improvements were initiated with the development of the "Water and Sanitation Policy" in 2007 and the passing of the "Water Act" of 2008. The legal framework promotes the introduction of an effective IWRM and sustainable utilization of water. Furthermore, the "National Strategic Development Plan 2012/13 – 2016/17" names the expansion of RWH on household and communal level as a suitable possibility for irrigation and other uses. Unfortunately, no further actions measures are defined in the plan for implementation of RWH for horticulture.

The leading water related institutions are the Department of Water Affairs and the Department of Rural Water Supply as part of the Ministry of Natural Resources. The Lesotho Water Partnership was created to advise on issues related to IWRM and to harmonize the efforts for sustainable water use of all stakeholders.

Implementation of RWH in Lesotho was promoted mainly from non-governmental side or done by individuals, who could afford the investment for a RWH facility. NGOs started to provide RWH and irrigation systems to households, to improve water availability and as a consequence of small-scale farming activities to improve their nutrition.

### *Swaziland*

During the last decade, several policies were developed and water related laws were passed to promote a sustainable use of water and to implement IWRM principles. Furthermore, capabilities and financial resources were increased in the water sector to improve coverage of water provision and its efficiency.

The governmental institution in Swaziland responsible for water issues is the Department for Water Affairs, which is divided into the Water Resources Section, the Rural Water Supply Section, and the Hydrogeology and Drilling Section. Other water related branches and boards hold additional responsibilities on rural water supply, pollution control, etc. The Swaziland Water Service Corporation is the national public water utility.

RWH in Swaziland is mentioned e.g. in the National Food Security Policy and the Swaziland National Irrigation Policy (both of 2005) as a complementary technology to secure water availability. Nevertheless, currently there is no national RWH initiative in place. Some stand-alone projects exist, which focused on drought stressed communities or on the equipment of schools to promote RWH techniques in the society. Finally, the "Ministries' Action Plans to 2018 and 2022" in response to "His Majesty's Government Programme of Action 2013-2018" includes the dissemination of RWH in Swaziland. Whether RWH will be implemented scattered and stand-alone only or a RWH initiative with policy framework and support schemes will be introduced is not formulated in the ministries' action plans.

## Potentials for knowledge transfer

The description of the Status Quo of RWH in southern African countries shows exemplarily, that the knowledge gained during the CuveWaters project can be helpful for stakeholders in other countries as well. Main problems which arose in other southern African countries were, amongst others, insufficient durability of tanks and other RWH components, inadequate or late inclusion of communities and later users, as well as misleading information regarding subsidization and financing of RWH operations. The transdisciplinary and participatory demand-responsive approach followed by CuveWaters as well as easy to implement, operate and maintain technologies used for RWH sites are key elements which may be transferred from Namibia to other countries of the southern African region. The knowledge from RWH projects in central-northern Namibia is documented in the CuveWaters "Technology Toolkit for Rain- and Floodwater Harvesting (RFWH)" (RFWH Toolkit) and can easily be used to promote RWH in neighbouring countries (see http://www.cuvewaters.net/Toolkits.112.0.html).

## 1.1 Technology

From a technology perspective the ferrocement tanks used for household RWH and the ponds for community gardens are stable solutions with long lifetimes. Ferrocement tank construction is an easy to implement technology which can be done by local labour under the lead of an experienced instructor. Same is valid for construction of greenhouses and ponds. Furthermore, communities and later users were included in planning as intended in the participatory demand-responsive approach of CuveWaters. Participation during construction processes consequently trained the manual skills of local stakeholders as well. The trained capabilities go along with detailed description of construction and maintenance as well as with documentation of material and tools required. This ensures a long term operation of RWH facilities and can be an example for others where focus lies on polyethylene (plastic) or steel tanks. Besides the advantages of durability and maintainability, construction of ferrocement tanks furthermore promotes the use of local labour and construction materials and thus stimulates local economy.

## 1.2 Social aspects and organisation

The socio-cultural setting of RWH projects in central-northern Namibia were paid special attention during project planning and implementation. Early inclusion and many possibilities for participation of all stakeholders (users, local authorities, regional and national institutions, etc.) led to a demand focused project development – as intended using a participatory demand-responsive approach. Balancing of interests of different stakeholders was achieved by realization of several community workshops which enabled discussion and understanding of other's positions. In addition, the early and close involvement of stakeholders ensured that the scope of the project regarding timing, financial and personal support was clear and disappointments could be avoided. The learning from RWH project sites in central-northern Namibia can be transferred to other countries of the southern African region as well. "RFWH Information Sheets" are part of the "RFHW Toolkit" and include all decision steps required for implementation and sustainable operation of a RWH and horticulture facilities. With the experience gained and supportive documentation at hand, Namibian experts may support participative and demand-responsive RWH and horticulture activities in other countries of the southern African region.

## 1.3 Economies and policy adjustments

The RWH pilot sites, as part of CuveWaters research project, showed the positive economies of RWH linked to horticulture on household or communal level under favourable circumstances. Initial investment for horticulture facilities and supplies pays back comparatively quick which allows for self-sufficiency and running a business in the best case. Detailed calculations as part of the RFWH Toolkit allow for determining the real need for RWH facilities and estimate costs and benefits of RHW and horticulture activities. Beside the economies of horticulture, the financing of initial investments for RWH facilities (i.e. pond or ferrocement tank) is a crucial point for implementation of RWH. Since income levels in rural areas usually are comparatively low, mostly the initial investment cannot be funded by the local population. This situation requires the adjustment of national policies for water provision and rural development. The design of subsidy schemes and incentives should promote initiatives on household level and encourage for RWH and small-scale horticulture.

Besides the non-market benefits (which e.g. are the stimulation of local economies and the adaptation to climate change) subsidisation of RWH and horticulture on household or communal level may be advantageous compared to other support schemes aiming on rural or agricultural development. While top-down support schemes may focus on a limited number of beneficiaries only, RWH and small-scale horticulture offers the chance to improve economic situation and livelihoods of many. First hand experiences in the pilot project region created awareness in the water related ministry. Based on the experiences and the CuveWaters research findings[1], key elements of water policy aiming on RWH subsidisation can be used as demonstration for other countries of the southern African region.

## Conclusion

CuveWaters promoted RWH in central-northern Namibia and developed a participatory demand-responsive approach of project planning, implementation, and operation for RWH. Technologies used are easy to construct, durable, and allow for long term use with minimum effort for maintenance. Economies of pilot sites showed that RWH in combination with horticulture on household or communal level are positive for the users and – beside the fact of improved water and food security – allow for income generation in rural areas. National, regional and local water related institutions were included in the process of RWH roll out and high awareness was reached for the topic. Nevertheless, long-term success of RWH in Namibia requires an extension of policies taking into account RWH as solution for promotion of small-scale horticulture in rural and peri-urban areas.

Community workshops and other elements for early and continuing participation of community members as well as other stakeholders ensured the RWH projects were aiming on the need of the people on site. Participation in planning and construction and regular exchange of information and views strengthened the idea of ownership and responsibility for long term operation of RWH facilities. Finally, the organizational concept of inclusion and social cohesion of communities ensured that RFWH improved livelihoods of all community members, neither excluding the poor nor focusing on the poor only and causing a stigmatization of community members.

CuveWaters showed that economies of RWH are positive, when RWH is rolled out. Nevertheless, the financing of initial investments yet was done from specific projects funds. Roll out of RWH has to come with certain subsidies, incentives or table banking initiatives to promote the start of RWH and horticulture activities in communities.

In all of the three above mentioned subareas of CuveWaters, knowledge was generated in the course of the project which is helpful for RWH initiatives in other southern African countries to overcome certain problems during implementation of IWRM and RWH. Furthermore, trained RWH experts from Namibia could promote RWH abroad and give trainings on planning, construction, operation and management of RWH and horticulture facilities.

[1] An overview on CuveWaters research findings is published on and in the RFWH Toolkit: http://www.cuvewaters.net/Publications.111.0.html http://www.cuvewaters.net/Toolkits.112.0.html

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## Credits


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## CuveWaters “RFWH Toolkit”

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| **For Information Sheets and Manuals on RFWH please take a look at the CuveWaters “RFWH Toolkit”:** http://www.cuvewaters.net/Toolkits.112.0.html | |
| Part A - RFWH Information Sheets: | |
| *1.* | *Introduction* |
| *2.* | *Introduction to the Technology* |
| *3.* | *RFWH Technology Toolkit: Decision Steps and Tank Design* |
| *4.* | *RFWH Technology Toolkit: Gardening and Irrigation* |
| Part B - Construction Manuals | |
| *5.* | *Construction Manual 1 – Ferrocement Tank (with Factsheet)* |
| *6.* | *Construction Manual 2 – Rectangular Underground Tank* |
| *7.* | *Construction Manual 3 – Pond* |
| *8.* | *Construction Manual 4 – Greenhouse* |
| *9.* | *Construction Manual 5 – Drip irrigation* |
| *10.* | *Horticulture Manual of the Water Research Commission South-Africa* |
| *11* | *Manual 7 - Proposal for a Rainwater Harvesting Builder’s Yard* |
| *12* | *Manual 8 – Manual on Training in “Extension services in horticulture and irrigation with special reference to rainwater harvesting in Namibia”* |
| *13* | *Manual 9 - Cost Sheets for Rain- and Floodwater Harvesting* |