Figure 9 Modified bench terraces and connected waterways, Rwanda.

IMPROVED WATER USE IN RAIN-FED AND IRRIGATED PRODUCTION SYSTEMS IN RWANDA

Given Rwanda's dependence on rain-fed agriculture, efficient water retention, recharge and reuse is crucial in order to reduce the' vulnerability of farmers to climatic variation. Better buffer management creates a solid base for agriculture intensification. It reorients the thinking towards improving the efficiency of utilizing rainwater by improving catchment characteristics, manipulating and managing the drainage systems, surface water run-off and the re-use of water in a watershed context.

The major national scale programme devoted to implementation of this approach is the Land-husbandry, Water-harvesting and Hillside-irrigation (LWH) project. The project envisions the production of high-valued agricultural and horticultural crops with the strongest marketing potential on irrigated portions of hillsides. Moreover, it aims at the improved productivity and commercialization of rain-fed food and export crops on the remaining majority of the site catchment. Major emphasis of the project is put on building the capacity of smallholder farmers and technicians, training them in water retention, recharge and re-use structures and mechanisms.

In this project, 3R technologies are being effectively put into practice in all agroclimatic zones in Rwanda, with technologies adapted to each agroclimatic and soil condition. Waterways are for instance connected to reservoirs in the valley, retaining rainwater to irrigate crops in dry seasons. Modified bench terraces on hills are treated with compost and lime, exhibiting effective water retention and recharging success, even after rainfall has stopped. A good example of this approach can be found in the Rwamagana district.

Besides boosting agricultural production, the measures bring about additional benefits, such as the provision of safe water for domestic use by rural communities, the watering for livestock and the prevention of landslides and flooding.

Figure 10 Modified bench terraces treated with compost and lime. Rwamagana, dry agroclimatic zone, Rwanda.

Figure 11 Waterways drain water to the valley dam reservoirs. It is used in dry seasons for hillside irrigation of crops, Rwanda.

Figure 12 Healthy crops after improvement of the water retention and recharge characteristic of the land in Rwamagana district, Rwanda.

3R APPROACH AND 3R WATER SECRETARIAT

Several organizations have joined forces in their attempts to contribute in climate change adaptation and pro poor development aid and developed the 3R approach. The 3R approach of retaining, recharging and re-using water, aims at promoting sustainable management of water buffers, tackling both increasing uncertainty in water availability and land degradation.

Within this decade, the mission is:

- to promote 3R globally, within the framework of integrated water resource management (IWRM), at local, national and international levels;
- to increase co-funding for implementation, research and capacity building;
- to integrate 3R practices into policies, strategies, budgets and plans of national and local governments;
- to demonstrate and advocate the added value of buffer management in securing water for rural and urban livelihood throughout the year, today and in the future.

The 3R Water secretariat has been set up recently to act as a central point, where partners can meet, where smart alliances are constructed, where knowledge about 3R solutions is shared among the large network of enthusiasts. The secretariat consists of a front office (for matchmaking and project development) and a support office (for data and information management and support services, available to 3R members).

We want to invite you to join our efforts and connect to our expanding network, share your ideas through this free publication and explore collaboration in new or ongoing projects. Conditions and guidelines for joining the 3R network are published on our website www.bebuffered.com.

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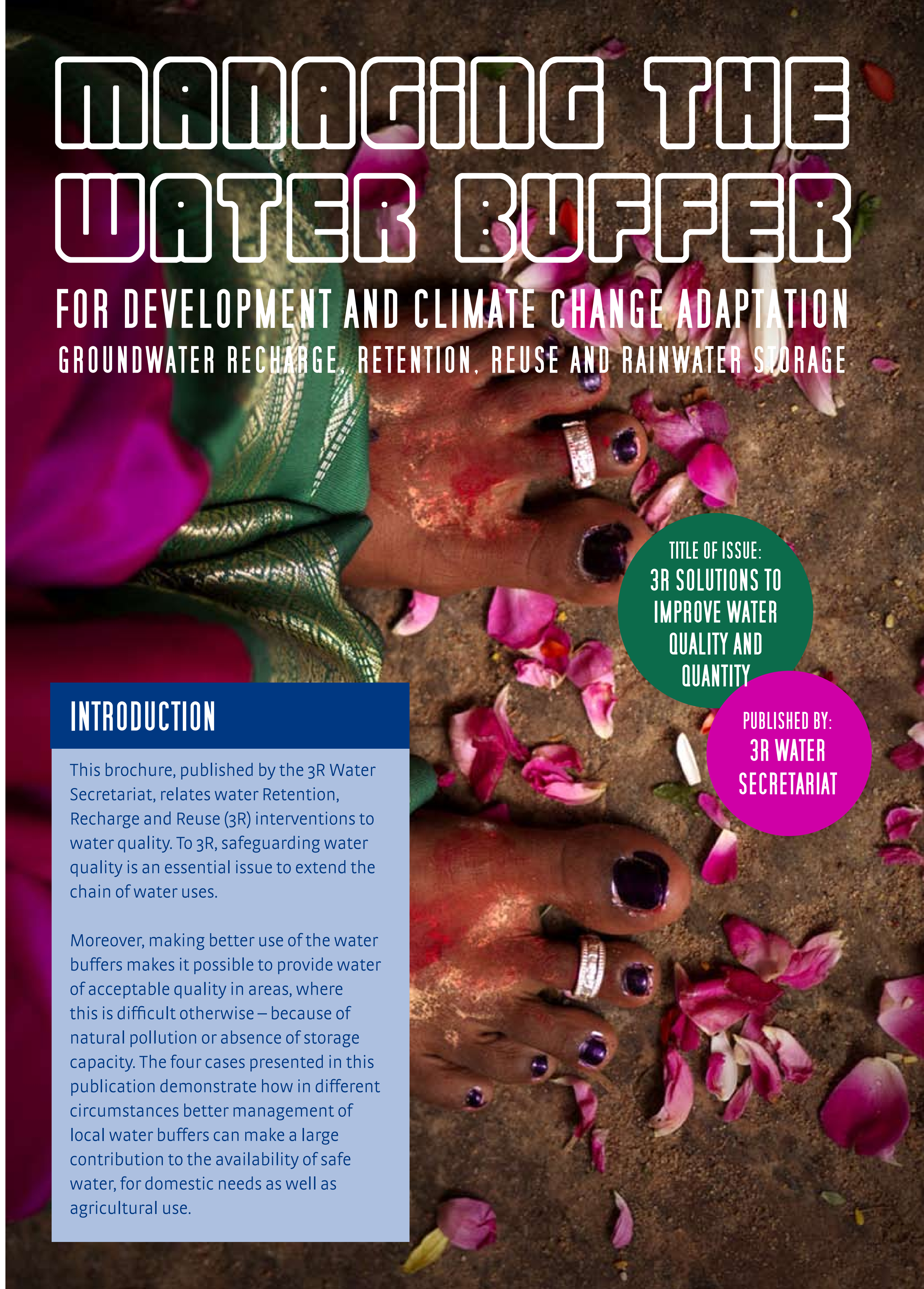


MANAGING THE WATER BUFFER

FOR DEVELOPMENT AND CLIMATE CHANGE ADAPTATION

GROUNDWATER RECHARGE, RETENTION, REUSE AND RAINWATER STORAGE

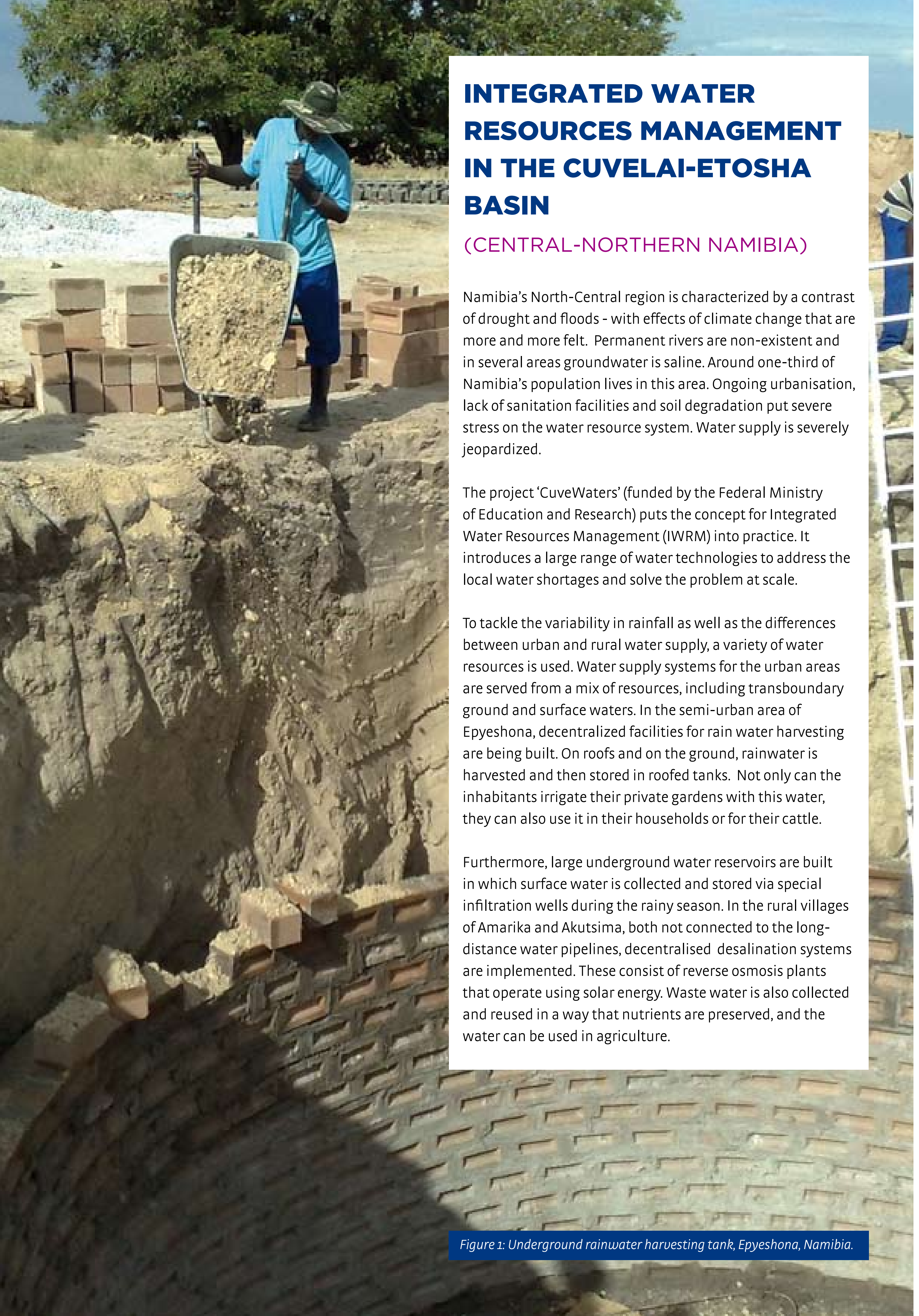
TITLE OF ISSUE: 3R SOLUTIONS TO IMPROVE WATER QUALITY AND QUANTITY

PUBLISHED BY: 3R WATER SECRETARIAT

INTRODUCTION

This brochure, published by the 3R Water Secretariat, relates water Retention, Recharge and Reuse (3R) interventions to water quality. To 3R, safeguarding water quality is an essential issue to extend the chain of water uses.

Moreover, making better use of the water buffers makes it possible to provide water of acceptable quality in areas, where this is difficult otherwise – because of natural pollution or absence of storage capacity. The four cases presented in this publication demonstrate how in different circumstances better management of local water buffers can make a large contribution to the availability of safe water, for domestic needs as well as agricultural use.



INTEGRATED WATER RESOURCES MANAGEMENT IN THE CUVELAI-ETOSHA BASIN

(CENTRAL-NORTHERN NAMIBIA)

Namibia's North-Central region is characterized by a contrast of drought and floods - with effects of climate change that are more and more felt. Permanent rivers are non-existent and in several areas groundwater is saline. Around one-third of Namibia's population lives in this area. Ongoing urbanisation, lack of sanitation facilities and soil degradation put severe stress on the water resource system. Water supply is severely jeopardized.

The project 'CuveWaters' (funded by the Federal Ministry of Education and Research) puts the concept for Integrated Water Resources Management (IWRM) into practice. It introduces a large range of water technologies to address the local water shortages and solve the problem at scale.

To tackle the variability in rainfall as well as the differences between urban and rural water supply, a variety of water resources is used. Water supply systems for the urban areas are served from a mix of resources, including transboundary ground and surface waters. In the semi-urban area of Epyeshona, decentralized facilities for rain water harvesting are being built. On roofs and on the ground, rainwater is harvested and then stored in roofed tanks. Not only can the inhabitants irrigate their private gardens with this water, they can also use it in their households or for their cattle.

Furthermore, large underground water reservoirs are built in which surface water is collected and stored via special infiltration wells during the rainy season. In the rural villages of Amarika and Akutsima, both not connected to the long-distance water pipelines, decentralised desalination systems are implemented. These consist of reverse osmosis plants that operate using solar energy. Waste water is also collected and reused in a way that nutrients are preserved, and the water can be used in agriculture.

Figure 1: Underground rainwater harvesting tank, Epyeshona, Namibia.

CONJUNCTIVE MANAGEMENT FOR WATER SUPPLY AND AGRICULTURE

(SINDH, PAKISTAN)

In the Kotri Left Bank command in Sindh (Pakistan), at the far end of world's largest irrigation system, saline groundwater and water logging have created a water management problem of humanitarian proportions. In this area more than two million people depend on saline and polluted drinking water. The cause of the problem is a lack of conjunctive management.

The Kotri Left Bank area is supplied by three large irrigation canals. After the construction of the Tarbela and Mangla dams the hydrological regime has changed, but the water allocations have never been officially adjusted. The water duties in three canal commands are surprisingly high - but being at the tail of the system canal water supplies often come erratically and at the wrong time. Hence the result of the high duties is not ample farming yields but, instead, low agricultural production. Water logging and natural saline groundwater have caused groundwater tables to rise. The effect on drinking water supply is dramatic. For semi-brackish water lenses there is hardly any storage capacity that can be formed. Instead, the saline groundwater stays at ground level. Rural water supply systems depend on surface water - but none of them have working treatment facilities. Water is taken from the three irrigation canals, but upstream these are used to discharge untreated sewer and industrial effluent.

Figure 3: Using one of the few fresh water lenses in Thatta Districts, Pakistan.

The way to go to create viable water buffers in Kotri Left Bank is conjunctive water management: surface water supplies and groundwater supplies need to be dovetailed. The aim should be to lower the currently high saline water tables in order to:

- create enough room in the upper soil layers to allow the formation in the upper layer of sweet/ brackish water lenses that can then be used for water supply;
- improve crop production by reducing water logging and bring down the massive non-beneficial evaporation that is there at present.

This can be done by reducing and improving water deliveries into the area from the surface canals and by constructing drainage facilities in selected places. An impediment remains to be the general lack of expertise in conjunctive water management, although using both ground and surface water in this tail-end of the Kotri left bank system is required to tackle water logging as well as the saline water.

Figure 2: Mismanaged buffers: water logging and surface salinity, Pakistan.

GROUNDWATER BUFFERING IN BANGLADESH

Population growth in combination with groundwater depletion and the occurrence of natural toxic elements like arsenic are threatening access to safe drinking water in Bangladesh. An integrated approach in the management of fresh water resources is needed. Unicef, in collaboration with the Department of Public Health Engineering, has contracted services for the development and implementation of a series of operational research projects to study the feasibility of recharge and storage of (rain)water.

Using the abundance of rainwater in the wet seasons, the intention is to augment fresh water storage in depletion areas. This is done to counteract salinization and curb the exposure to arsenic in groundwater. Known as Aquifer Storage and Recovery (ARS), shallow aquifers are fed with rainfall which is captured in reservoirs during the monsoon. The impact of ARS is illustrated by figures 5 to 8, showing the development of chloride concentration in groundwater

Figure 4: Source for infiltration in Bangladesh

during two years in the vicinity (i.e.100 meters on either side) of the infiltration wells. The infiltration creates an areas of useable non-saline (=blue) water (figure 5) which is slowly used during the dry season (figure 6). Successive years of infiltration increase the fresh water lense and improve the availability of useable water (figure 7 and 8). This new source of water presents itself as a viable alternative for often problematic supply of water for rural communities in coastal Bangladesh.

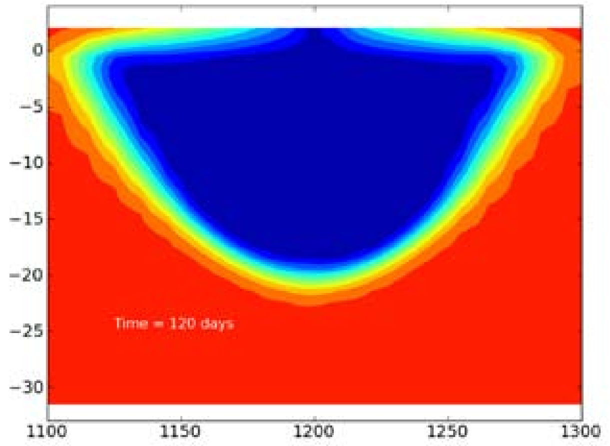


Figure 5 : Situation after 4 months infiltration (year 1)

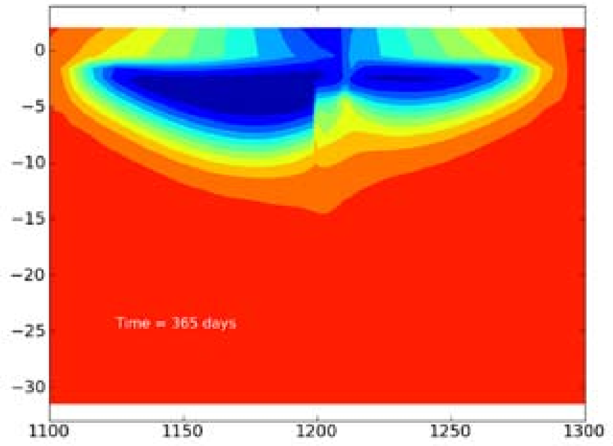


Figure 6: Situation at the end of the dry period (year 1)

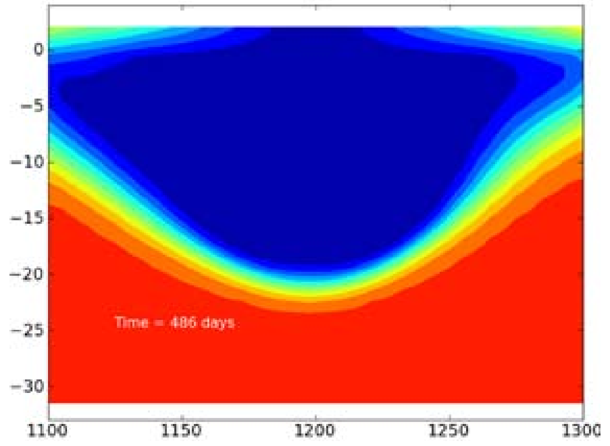


Figure 7: Situation after 4 months infiltration (year 2)

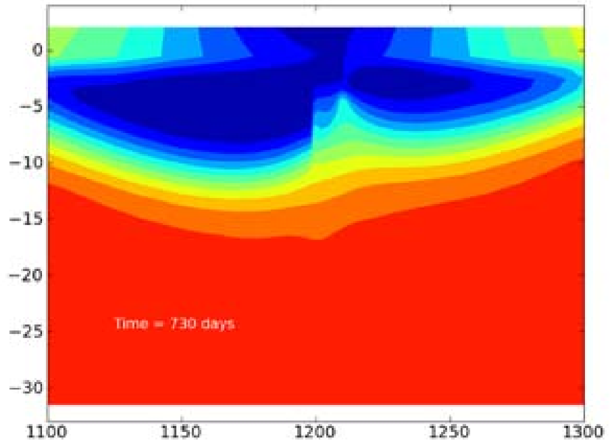


Figure 8: Situation at the end of the dry season (year 2)