Water Harvesting Experiences from the SearNet (2003-2012)

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**Abstract**

The main objective of this paper is to share experiences of the Southern and Eastern Africa Rainwater Network (SearNet) on water harvesting. SearNet argues that governments in Sub-Saharan Africa (SSA) have not adequately considered rainwater as a viable water supply option for domestic, industrial, agricultural and environmental use. Consequently planners and engineers only consider blue water or one third of rainwater (in the rivers, lakes, dams and groundwater) leaving out productive rainwater that could boost water supply and food production in the region. The paper therefore challenges the unique focus of government investments on large dams and boreholes or conventional water supply systems due to their limited impact on rural populations. In order to address these concerns, ICRAF[1] has been hosting the SearNet, a regional network that focuses on reviving the ancient practice of water harvesting. The paper shares lessons drawn from policy research and evaluation, awareness creation and networking, building of national networks and assessment of promising water harvesting technologies in Sub-Saharan Africa. The paper concludes that diligent land and water management is necessary for yielding the highest benefits from rainwater. There is need to continuously educate people so as to promote integrated management of land and water resources. In addition to enabling policies and institutions, there is a need for ample budgetary support to increase adoption of the technology.

**Key words:** *Rainwater Harvesting, Blue water, Water scarcity, Policy, Water harvesting techniques.*

[1] The Regional Land Management Unit (RELMA) initiated the SearNet programme in 2002 with support from The Netherlands Ministry of Foreign Affairs and Swedish International Development Agency (Sida). In 2007, ICRAF took over the programme after RELMA project ended.

## Introduction

Water scarcity is an undisputable reality that is rapidly affecting millions, especially the poorest people. Developing countries are particularly vulnerable because their economies are closely linked to agriculture, and a large proportion of their populations depend directly on agriculture and natural ecosystems for their livelihoods. Water harvesting is an ancient practice that has the potential of cushioning the effects of water scarcity and climate change. However, most governments, in preference of more lucrative conventional interventions such as dams and boreholes, have ignored this practice. Yet investments in these conventional techniques have limited impact on populations living in rural areas where piping water supply is very expensive to install.

The picture is not all gloomy because efforts have been made to revive water harvesting in Africa and the world over. The World Agroforestry Centre (ICRAF) has been hosting the Southern and Eastern Africa Rainwater network – SearNet - that has been promoting water harvesting in 12 African countries since 2002. During this period SearNet has generated immense knowledge and experiences, which will be shared in this paper. Important lessons on policy, research and development will be presented.

## What is the Problem?

The population of Sub-Saharan stood at 800 million in 2007 and 894 million in 2011[i]. This rapidly (2.3%) increasing population is reducing gains the region is making towards increasing access to water especially amongst 64% of the people living in rural areas. Governments base their planning of water resources only on the blue water, which results in a gross underestimation of the available water. Take for instance the estimates computed by the United Nations Economic Commission for Africa (UNECA, 1999). The water availability estimates that are based on blue water calculations indicate that most sub-Saharan African countries will suffer increasing fresh water stress and scarcity by 2025. This picture is very gloomy. However, when water availability is computed taking into account the total rainwater received, the scenario changes significantly. When one accounts for total rainfall and carefully considers the contribution of land management to rainwater partitioning, you realize that water availability for productive uses is double or even three times the amount computed using blue water[ii]. How then can one harness this huge rainwater potential given the existing policy and institutional arrangements in SSA?

## Creating Conducive Policy and Institutional Environment for Promoting Water harvesting

As mentioned at the outset of this paper, governments in SSA are bent on promoting large dams and boreholes for community water supply and irrigation. Although rainwater harvesting could increase water availability across the region, existing policies generally limit the widespread uptake of the technique. Inadequate policies also limited budgetary allocations for supporting rainwater harvesting. During the period 2002-2008, the World Agroforestry Centre with support from Netherlands Ministry of Foreign Affairs (DGIS) and Swedish International Development Cooperation Agency (SIDA) and in partnership with The Centre for Science and Environment (CSE) based in New Delhi, India, set out to implement a project entitled, 'A Network for Green water harvesting in Eastern and Southern Africa and South Asia'. The project targeted 12 African and 6 South Asian countries.

In Africa, the project supported the establishment of the Southern and Eastern Africa Rainwater Network (SearNet). SearNet is a regional network comprised of twelve legally registered national rainwater-harvesting associations. The mission of SearNet is to network among its member associations within the region for the promotion of rainwater harvesting and utilization. The vision is to improve the livelihoods of the people living in these regions through the contribution of sustainable management, utilization of rainwater and encouraging community based water harvesting.

SearNet has conducted several policy research studies aimed at identifying policy gaps and making recommendations for improvements. From these studies SearNet has conducted advocacy at several fora including the annual SearNet conferences, the African Water Week, the Stockholm Water Week and the World Water Forum. At the Africa level the following shifts in policy have been observed:

**Examples of Policy Breakthroughs Across the Region**

From as early as November 2006, the African Water Facility granted the government of Rwanda €450,000 for introducing rainwater harvesting techniques in the district of Bugesera with the aim of increasing soil productivity and improving agricultural production as well as enhancing the availability of portable water supply. In 2009, the World Bank approved a loan and grant of US$ 47 million for a project on Land Husbandry, Water Harvesting and Hillside Irrigation. This project has significantly enhanced the scaling-up of water harvesting and irrigation activities using a detailed irrigation master plan jointly developed by ICRAF, Ebony Enterprises based in Israel, and Rwanda's Ministry of Agriculture and Animal Resources - MINAGRI[iii].

The Government of Ethiopia has recognized water harvesting since 2003 when the Regional Land Management Unit (RELMA) and other stakeholders conducted a number of demonstrations across the country. When the government appreciated the importance of water harvesting, staff was sent to the Far East, especially to China where a number of techniques were adopted. Techniques such as the underground water harvesting systems were constructed across the country. However, most interventions failed due to poor technological adaptation. Scaling-up took place hurriedly without carrying out capacity building. What followed was a massive training of all government officials. Although such training has resulted in improvement in the performance of structures, more investment is needed to increase the benefits across the poorer communities.

Zambia continues to be the champion of conservation agriculture (CA) in Africa since its introduction over ten years ago. According to the Ministry of Agriculture, at least 250,000 smallholder farmers have so far adopted CA tenets of minimal soil disturbance, permanent soil cover and crop rotation, which enhance in-situ rainwater harvesting, through the use of low-cost tools and traditional crop varieties that are either herbicide-tolerant or require no herbicides at all. The Ministry of Agriculture now recognizes a National Platform spearheaded by various stakeholders.

**Awareness creation and Networking**

It is very encouraging to note that several years of concerted advocacy work on water harvesting in the region has resulted in significant growth in the awareness level amongst all key target groups. The demand for technical and financial support is overwhelming - putting great strain not only on the SearNet secretariat and water management team at ICRAF - but also on the limited capacity of the member rainwater harvesting associations. This momentum should be captured and directed towards individuals and institutions that can quickly respond and provide the capacity building. Consequently current awareness messages focus mainly on highlighting successful projects in the region, identification of possible sources of funding for such projects, showcasing successful approaches and technologies and spreading tested planning tools for sustainable management of land and water resources. This has been achieved through dissemination of information such as those on the SearNet website and convening thematic conferences for knowledge sharing and networking.

The SearNet website (http://worldagroforestry.org/projects/SearNet/) continues to inform the general public on news and events taking place in the field of Rainwater Harvesting within and outside the region. Visitors to the site have been cyber-commuting with SearNet representatives to the various subject platforms and viewing the many projects SearNet and its partners are implementing. Journals, publications and brochures produced by SearNet are publicized on the website. The site has helped many visitors gain a deeper understanding of water harvesting, as attested by the feedback and letters received that express appreciation of the site or seeks advice on particular topics.

SearNet also organizes annual conferences at which its members and those interested in sharing its vision meet and exchange information and network on water harvesting. So far, SearNet has conducted fifteen conferences on various thematic areas. The most recent conference held in November 2012 focused on financing of water harvesting activities in the region. The gathering concluded that there is need to lobby governments for more funding aimed at enhancing the capacity of stakeholders to implement various water harvesting technologies. The involvement of the private sector will be critical for increasing investments that are supported by viable water harvesting business models. In order to assess which techniques could be up-scaled, SearNet and partners concluded an assessment of water harvesting in 15 countries across Africa.

**Assessment of Water harvesting Technologies (WHT) in selected African countries**

The assessment builds on previous water harvesting studies by the WHaTeR2 partners within Sub-Saharan Africa but with a special focus on "Sub-Saharan Water Harvesting" carried out by Critchley and colleagues of Amsterdam Free University for the World Bank between 1987 and 1989 (Critchley et al 1992iv). This assessment comprised visits to countries in Sub-Saharan Africa, and documented experiences with newly introduced, as well as indigenous systems of water harvesting. The results and recommendations of the revisits to selected water harvesting techniques are presented herein as synthesized by Dr. William Critchely and John Gowingv, the leaders of this study under and EU funded project: Water Harvesting Technologies Revisited3 (WHaTeR).

- In the 1980s government and external support agencies carried out a number of trials on water harvesting techniques in Burkina Faso. However, during the revisit studies in 2012, scientists confirmed that a combination of stone lines and zai planting pit (Figure 1) had been widely adopted in the country. However, due to inadequate data, the extent and the performance of these technologies is hard to determine.

**Figure 1: Zai planting pit (Photo by W. Critchley)**

- Before the 1980s the focus in Kenya in soil and water conservation was largely on erosion control. However, from the mid 1980s onwards, the country experienced a resurgence of interest in water harvesting techniques such as the "trapezoidal bund", road run-off ponds and more recently the zai planting pits. Neighboring countries such as Rwanda (Figure 2) and Uganda have also emulated from Kenya the concept of road runoff harvesting which is based on conveyance of water into ponds and ditches for crop production.

[2] WHaTeR is a four-year collaborative project funded by the European Commission through the 7th Framework Programme (FP7) for Research and Technological Development (RTD).

[3] The project is coordinated by the Centre for International Cooperation, VU University Amsterdam (Netherlands) and involves two other European and five African organizations, namely Newcastle University (United Kingdom), Stockholm Resilience Centre (Sweden), University of Kwazulu Natal (South Africa), Sokoine University (Tanzania), Southern and Eastern Africa Rainwater Network (Kenya), National Institute for Environment and Agricultural Research (Burkina Faso) and Arba Minch University (Ethiopia)

**Figure 2: Plastic lined runoff-harvesting pond in Rwanda (Photo M. M. Malesu)**

- Since the 1980s Ethiopia has implemented large government driven initiatives aiming at micro-watershed interventions with emphasis on soil and water conservation. Communities are investing in multi-purpose communal and household ponds, underground tanks (Figure 3) and spate irrigation schemes. In parts of the country sand dams are also being tested.

**Figure 3: Underground runoff tank in Ethiopia (Photo by M.Malesu)**

- The revisit to Niger established that mechanized structures from the 1980s had generally failed. However, demi-lunes or semi-circular bunds (Figure 4) and tassa or planting pits

similar to zai in Burkina Faso has taken root in Niger. This country also has no reliable and robust data on extent and performance of the techniques assessed.

**Figure 4: Demi-lunes in Niger (Photo by W. Critchely)**

- Although South Africa was not studied in the past and has little history of water harvesting, the team conducted an exploratory study of runoff harvesting tanks from household compounds for irrigation of vegetables. The notable finding was that the high level of initial subsidies threatened the sustainability of these investments.
- The two important types of water harvesting techniques studied in Sudan are the teras systems, which capture runoff in field bunded on three sides, and water spreading schemes from khors in the drier region. Both techniques of traditional origin have survived and are expanding with support from development programmes.
- In Tanzania, the revisit focused on micro-dams locally known as "ndiva" and spate irrigation schemes. It is clear that for Tanzania, a sustained research and communication effort during the 1990s has changed people's perceptions on water harvesting. There are obvious bright spots such as the majaruba rice production system that is spreading with little or no outside support.
- Due to political instability in Zimbabwe, agricultural development has generally suffered setback. This has also taken backwards gains made on water harvesting initiatives. There is however, hope in the 'dead-level contour' system, a practice of capturing and retaining runoff from within and outside the field.

**Upscaling of Water harvesting through Capacity building**

Enhancing the capacity of communities to implement water harvesting generate knowledge and develop skills has been a major thrust of the SearNet. The programme achieved its capacity building objective by linking SearNet members, communities and other stakeholders to relevant courses conducted by partners such as the Centre for Science and Environment (CSE), the Government of China, the RAIN Foundation, The United Nations Environment Programme UNEP, The International Rainwater Catchment Systems Association and the International Rainwater Harvesting Alliance. At community level numerous artisans or local community technicians have been trained on construction and maintenance of water harvesting infrastructure. This pool of artisans had continued to grown across regions through exchange programme facilitated by SearNet. For instance in 2007, Kenyan artisans were hired by ICRAF to train and introduce water harvesting ponds in Rwanda and Burundi. In addition, SearNet has trained government decision and policy makers on several topics including application of GIS tools for the planning of water harvesting and rangeland management intervention.

There is need for further capacity building especially for implementing agencies through out the region.

**Conclusions**

In order to increase water supply through rainwater harvesting, good land husbandry practices should be promoted so as to improve rainwater partitioning. The current trend of cutting down trees for crop and livestock production results in huge rainwater losses through increased runoff. The runoff also causes serious erosion problems and reduces the productivity of land. The work of SearNet has increased awareness and appreciation of green water management as one solution for increasing the utilization of rainwater.

As shown in this paper, governments in Sub Saharan Africa and even the World Bank are now starting to support water harvesting as reflected in the budgetary commitments towards implementation of water harvesting although some countries have progressed faster than others.
The Government of Rwanda is a classic example of how a systematic approach to upscaling water harvesting can be achieved through a carefully prepared master plan, strategy and national programmes. The government of Kenya, under the support the National Agriculture and livestock Programme (NALEP II financed by SIDA) has opted for showcasing of mechanized best practices on water harvesting and rangeland rehabilitation within the arid and semi-arid regions in nine sites with minimum of 200 ha to encourage interest for up-scaling. This has fit well with the value chains for poultry, pasture and sorghum. Linking water harvesting to such business models is very critical for sustainability. It has been observed that the practice of linking subsidies to water harvesting complicates the concept of sustainability. From the revisits, many mechanized water-harvesting techniques have failed and therefore future efforts, such as this case of Kenya, should take stock of the lessons learnt.

The various national rainwater harvesting associations have also proved effective in championing water harvesting at national and also regional levels. The Kenya Rainwater Association is the oldest of the national associations and has continued to implement several projects funded by donors including the Africa Development Bank through the Africa Water Facility, the USAID and the European Union. The annual SearNet conference has proved an effective platform for knowledge exchange and networking amongst key stakeholders in Africa and beyond.

In future there will be need to address some of the key challenges of the promotion of water harvesting through research and development platforms. The more important challenges include: quantifying the performance of water harvesting systems; establishing livelihood impacts of rainwater harvesting; estimating the distribution and spatial extent of specific techniques; understanding the impact of water harvesting subsidies and assessing the policy and institutional arrangements that favor spread of water harvesting (Critchley et. al. 2012).

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[i] http://data.worldbank.org/region/sub-saharan-africa

[ii] Mati, B, Malesu M. M., Khaka E., Oduor A. R., 2006. Mapping the Potential for Rainwater Harvesting Technologies in Africa: A GIS overview on development domains for the continent and nine selected countries. Technical Manual No. 7 Nairobi, Kenya: World Agroforestry Centre (ICRAF). ISBN: 92 9059 2117

[iii] Malesu M. M., Oduor A.R., Cherogony K., Nyolei D., Gachene C.K.K., Biamah E. K., O'Neil M., Ilyama M. and Mogoi J. (2010). Rwanda Irrigation Master Plan. The Government of Rwanda, Ministry of Agriculture and Animal Resources, Ebony Company Limited and World Agroforestry Centre (ICRAF). Nairobi, Kenya.

[iv] Critchley, W., Reij, C. and Seznec, A. (1992). Water Harvesting for Plant Production. Volume II: Case Studies and Conclusions for Sub-Saharan Africa. World Bank Technical Paper Number 157. Africa Technical Department Series. World Bank: Washington D.C. Pp. 134.

[v] Water Harvesting in Sub-Saharan Africa. Edited by William Critchley, John Gowing

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