

Water harvesting experiences from the southern and eastern Africa rainwater network

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Abstract: This paper shares experiences of the southern and eastern Africa rainwater network on rainwater harvesting. It also shares the lessons drawn from policy research, awareness creation and networking, building of national networks and assessment of promising water harvesting techniques in the Sub-Saharan Africa. The concerted promotional effort of the southern and eastern Africa rainwater network has resulted in the general acceptance of rainwater harvesting as a viable option for boosting domestic water supply, agricultural production and environmental sustainability. To date twelve nationally registered rainwater harvesting associations have been established, which are providing leadership and capacity building in rainwater harvesting. Governments and donors are also aligning their policies towards providing increased financial, institutional and technical support for upscaling rainwater-harvesting techniques. This paper concludes that diligent land and water management is necessary for yielding the highest benefits from rainwater. In addition to enabling policies and institutions, there must be ample budgetary support to increase adoption of the technology.

Key words: rainwater harvesting; blue water; water scarcity; policy; water harvesting techniques; SearNet; green water
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Water scarcity is an undisputable reality affecting millions of, 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 variability. 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.

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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 twelve African countries since 2002. During this period SearNet has generated immense knowledge and experiences, which are shared in this paper. Important lessons on policy, research and development are presented.

The population of Sub-Saharan Africa stood at 800 million in 2007 and 894 million in 2011^[1]. This rapid population growth of 2.3% is reducing gains, the region is making towards increasing access to water especially amongst the 64% of the continent's population, which lives in rural areas. Governments base their planning of development 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, the water availability estimates that are based on blue water calculations indicate that most Sub-Saharan African countries shall suffer from increasing fresh water stress and scarcity by 2025^[2]. Many other authors have also made the same suggestion that the world would face water stress^[3-5]. 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, one can realize that water availability for productive uses is double to three times or even more the amount computed using blue water^[6]. How then can one harness this huge rainwater potential given the existing policy and institutional arrangements in SSA?

The objective of the SearNet programme is to influence the policy and practice on water management to include decentralized, participatory and locale-specific water harvesting systems through creating a movement for wide water harvesting in Eastern and Southern Africa. The specific objectives of the programme include the following four issues:

- Awareness creation of the potential of green water harvesting amongst policy-makers, administrators, NGOs and community groups;
- Build up local, national and regional networks to spread water harvesting in the form of a movement to

augment present water management systems;

- Capacity building among extension agencies, NGOs, community based organizations and farmers on green water harvesting systems for different agro-ecological zones; and

- Cross regional sharing of knowledge between Eastern and Southern Africa and South Asia.

The experiences gained through SearNet have been documented in several SearNet reports^[7]. Yet, to date no formal synthesis of these experiences is available. This paper aims to address this gap.

1 Methods

For each of the four above-mentioned specific objectives, the ICRAF used the following methods to achieve the results.

1.1 Policy research and evaluation

In order to gain broader understanding of the policy situation with regards to water harvesting within the SearNet, ICRAF commissioned several policy research studies aimed at assessing its inclusion in national policies, reviewing strategies for promoting RWH, identifying gaps and making recommendations either for its inclusion where absent or strengthening where the policy exists. The notable studies undertaken between 2002 and 2007 were those conducted in Ethiopia, Kenya, Uganda, Tanzania, Zanzibar, Malawi and Zambia. After the policy results were peer-reviewed and presented at SearNet annual conferences, the members present dedicated policy declarations, which were packaged and presented to target regional and international meetings such as the Pan African Conference (2003) held in Ethiopia, several sessions of the African Ministerial Conferences on Water (AMCOW), the African Water Week, the Stockholm Water Week and The World Water Forum. During these meetings SearNet held seminars, workshops and poster presentations to raise awareness amongst policy makers and donors. SearNet worked closely with the rainwater partnership comprised of the UNEP, the International Rainwater Catchment Systems Association and the International Rainwater Harvesting Alliance. The Chairperson of AMCOW patronized this partnership and participated in lobbying for policy change. SearNet also facilitated several policy makers study tours to India.

1.2 Awareness creation and networking

The methods used for awareness creation include documentation and dissemination of successful water harvesting cases in the region using print and electronic multimedia. The programme produced the SearNet Briefs, a monthly newsletter that was widely circulated to all target groups. In addition to this, the programme established two websites in Africa and India (www.searnet.net and www.rainwaterharvesting.org). The SearNet also en-

couraged the establishment of several national rainwater harvesting associations in the region. As legal entities, the associations were to take the lead in awareness creation from national to the grass roots levels. These national networks subsequently met annually during the SearNet annual conferences to exchange information and report on their progress. In addition to print media SearNet also produced a series of television and radio programmes that were aired on national television stations in the region.

1.3 Upscaling and capacity building

The SearNet achieved capacity needs by developing training needs assessments and conducting trainings at all levels. This included networking with key institutions of higher learning so as to encourage both undergraduate and graduate students to undertake thesis work on water harvesting. For international NGOs such as the World Vision International, the Red Cross and the World Food Programme as well as government agencies, SearNet designed and conducted specialized regional and national courses for managers and technical staff so that they are able to mainstream water-harvesting plans into ongoing programmes and projects for upscaling interventions across Africa. SearNet also facilitated exchange visits for practitioners and communities within the region and to India and China.

Groups of outstanding artisans were taken from Kenya to Ghana, Namibia, Rwanda, Uganda, and Zambia to train others on hands on construction of water harvesting infrastructure. Several tools for mapping water harvesting potential were also developed and used to assess potentials at continental and national levels. Rwanda and Kenya are good examples where SearNet developed an Irrigation master plan and a Food Security master plan respectively using a GIS based approach through a multi-criteria approach^[8-9]. This approach developed by ICRAF and UNEP in 2005^[6] was also used to assess rainwater-harvesting potentials for the continent of Africa and nine selected countries that included Botswana, Ethiopia, Kenya, Malawi, Mozambique, Tanzania, Uganda, Zambia and Zimbabwe^[6]. This is in addition to assessment of rainwater potentials in Zanzibar^[10] and Somalia^[11].

The assessment builds on previous water harvesting studies by the WHaTeR (a four-year collaborative project funded by the European Commission through the 7th Framework Programme (FP7) for Research and Technological Development (RTD)) 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^[12]. This assessment comprised revisits to countries in Sub-Saharan Africa, and documentation of experiences with newly introduced, as well as indigenous systems of water harvesting.

2 Results and Discussion

In this section, we will discuss the results obtained over a decade of work in the SearNet region and beyond.

2.1 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 ignore or even frustrate the widespread uptake of the technique. Inadequate policies also limit budgetary allocations for supporting rainwater harvesting. During the period 2002 to 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 SearNet, which 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.

The 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 forums including the annual SearNet conferences, the African Water Week, the Stockholm Water Week and the World Water Forum.

2.2 Examples of policy breakthroughs across region

At the Africa level the following shifts in policy have been observed. 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 47 million US dollars 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.

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 of rainwater harvesting 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 implementation and adaptation to local conditions. Scaling-up took place hurriedly without carrying out appropriate 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 principles 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.

2.3 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 the 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 techniques 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 2012 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.

2. 4 Assessment of water harvesting techniques (WHT) in selected African countries

The results and recommendations of the revisits to selected water harvesting techniques are presented herein as synthesized by Critchley and Gowing^[13], the leaders of this study and EU-funded project: water harvesting technologies revisited (WHaTeR) (Note: The project is coordinated by the Centre for International Cooperation, Free 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 INERA (Burkina Faso) and Arba Minch University (Ethiopia)).

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

- 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



Fig. 1 Zai planting pit (Photo by W. Critchley)

ues such as the “trapezoidal bund”, road run-off ponds and more recently the zai planting pits^[14]. Neighboring countries such as Rwanda (see Fig. 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.



Fig. 2 Plastic lined runoff-harvesting pond in Rwanda (Photo by 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 (see Fig. 3) and spate irrigation schemes. In parts of the country sand dams are also being tested.



Fig. 3 Underground runoff tank in Ethiopia (photo by M. M. Malesu)

- The revisit to Niger established that mechanized structures from the 1980s had generally failed. However, demi-lunes or semi-circular bunds (see Fig. 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 the extent and performance of the techniques assessed.



Fig. 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 setbacks. This has also taken backward 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.

2.5 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. International NGOs such as World Vision International received training from SearNet^[15]. 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 grow across regions through exchange programmes 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 throughout the region.

3 Conclusion

In order to increase water supply through rainwater harvesting, good land husbandry practices should be promoted so as to create an enabling environment conducive for rainwater harvesting. 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 the land. The work of SearNet has increased awareness and appreciation of green water management as one solution for increasing the utilization of rainwater.

As described 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 of 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 a minimum of 200 ha to encourage interest for up-scaling. This has allowed increasing productivity of farming and 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 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 (AfDB) 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 be-

yond.

In the future some of the key challenges of promoting water harvesting through research and development platforms will need to be addressed. 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^[12, 16].

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非洲东部及南部雨水管网中的雨水回用实践

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摘要:介绍了非洲东部和南部雨水管网系统中雨水回用的实践与经验,并介绍了在 Sub-Saharan Africa 开展的雨水回用工程实践情况,包括国家政策的调研、回用理念的构建、雨水系统的建设和回用技术的评估。雨水回用技术在非洲东南部地区被大力推广,并被普遍接受,应用于生活用水及农业用水的补充以及环境可持续发展建设的各个方面。截止目前,已有 12 个国家级的雨水回用机构建成,他们为雨水回用系统的建设提供整体规划和技术指导。政府和投资商也逐渐转变态度,为推进雨水回用技术在经济、制度和技术上提供了优惠政策。合理的土地与水体管理是雨水资源利用最大化的关键。除了政策和制度的协调外,还需要充足的预算支持来推动技术的广泛应用。

关键词:雨水回用;蓝水;水资源短缺;政策;回用水技术;SearNet;绿水

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