

Rainwater harvesting: a lifeline to human well-being

Key Findings

- **Ecosystem services are fundamental for human well-being, and are the basis of rural livelihoods, in particular for the poor. Rainwater harvesting can serve as an opportunity to enhance ecosystem productivity, thereby improving livelihoods, human well-being and economies.**
- **Rainwater harvesting has been shown to create synergies in landscape management and human well-being. These synergies are particularly obvious when rainwater harvesting improves rainfed agriculture, is applied in watershed management, and when rainwater harvesting interventions address household water supply in urban and rural areas.**
- **Rainwater harvesting has often been a neglected opportunity in water resource management: only water in surface and groundwater sources are conventionally considered. Managing rainfall also presents new management opportunities, including rainwater harvesting.**
- **Improved water supply, enhanced agricultural production and ecosystem services through adoption of rainwater harvesting can be attained with relatively low investments in fairly short time spans (5-10 years).**
- **Rainwater harvesting is a coping strategy for variable rainfall. In the future climate change will increase rainfall variability and evaporation, and population growth will increase demand on ecosystem services, in particular for water. Rainwater harvesting will become a key intervention in adaptation and reduced vulnerability.**
- **Awareness of ecosystem services must be increased by practitioners and policy makers alike, to realise the potential of rainwater harvesting and ecosystem benefits for human well-being.**

Rainfall, ecosystems, and human well-being

Rainfall and soil water are fundamental parts of all terrestrial and aquatic ecosystems which supply goods and services for human well-being. Availability and quality of water determine ecosystem productivity, both for agricultural and natural systems. There is increasing demand on water resources for development but at the same time a desire to maintain healthy ecosystems. This puts water resources under pressure. Ecosystem services suffer when rain and soil water become scarce due to changes from wet to dry season, or during dry spells. Climate change, demand for development and the already deteriorating state of ecosystems add to these pressures, so that future challenges to sustain our ecosystems are escalating.

There is an immediate need to find innovative opportunities that enable development and improve human well-being without undermining ecosystem services. Among such opportunities one can ask: what potential can rainwater harvesting offer to enable increased human well-being whilst protecting our environment? What role can small-scale decentralised rainfall harvesting and storage play in integrated water resource management? And in which specific contexts may rainwater harvesting create synergies between good ecosystem management and human well-being?



Photo: Jennie Barron



Photo: Klaus W. König

Rainwater harvesting: an old approach in landscape management

Rainwater harvesting is the collective term for a wide variety of interventions that use rainfall through collection and storage, either using the soil as storage, or man-made dams, tanks or containers, bridging dry spells and droughts. The effect is to increase retention of water in the landscape, and improve the management water for multiple purposes.

Rainwater harvesting is as old as human settlement. It is practised in many different forms both in rural and urban landscapes, often in small-scale decentralised ways. A growing number of cases that describe the multiple benefits of rainwater harvesting are emerging. Evidence of increased human well-being, and sustained or enhanced ecosystem services by rainwater harvesting intervention range from developing countries (India, various sub-Sahara African), transition countries (China, Brazil) to developed countries (Australia, USA).



Photo: Patrick Fox

Rainwater harvesting creates synergies by improving rainfed agriculture and enhancing productive landscapes

Farms are indisputably the most important ecosystems for human welfare. Rainfed agriculture provides nearly 60% of global food value on 72% of harvested land. Rainfall variability is an inherent challenge for farming in tropical and sub-tropical agricultural systems. These areas also coincide with many rural smallholder (semi-)subsistence farming systems, with high incidence of poverty and limited opportunity to cope with ecosystem changes. Water for domestic supply and livestock is irregular through temporal water flows and lowering ground water in the landscape. Variable rainfall also results in poor crop water availability, reducing rainfed yields to 25-50% of potential, often less than 1 tonne of cereal per hectare in South Asia and sub-Sahara Africa. The low agricultural productivity often aggravates a negative spiral in landscape productivity,



Photo: Nils Andersson

with degradation of ecosystem services through soil erosion, reduced vegetation cover, and species decline.

In India, rainwater harvesting has been a successful starting point to put development on a positive track addressing both improved human well-being and re-generation of degraded landscapes, in particularly semi-arid and sub-humid zones. Through national watershed programs, key interventions in rainwater harvesting on farmland have increased household food supply and incomes. Rainwater harvesting in common areas of the landscape has improved ecosystem productivity of biomass, infiltration of rainfall to recharge shallow groundwater, and reduced soil erosion. In many cases, additional effects have been observed, including gender equality improvements, and general community strengthening and organisation.

One of the most extensive rainwater harvesting programmes to date has been implemented in the Ganzu province in China. Through promoting small-scale storage at the household level, 15 million people now have an improved water supply. The water has also generated extra income through small-scale horticulture and increased livestock and poultry keeping. Because people's health and income have improved the ecosystem services have also been improved. Due to agricultural intensification, through rainwater harvesting, less land needs to be put into crop production despite population growth. Having more landscape variety has enhanced flora and fauna biodiversity. The degradation of the fragile loess soil has been reduced, having positive impacts on downstream dam lifespan. There are two main arguments are in favour of

Table: Linking Millennium Development Goals with benefits from rainwater harvesting

Millennium Development Goal	Relevance of rainwater harvesting intervention
1. End poverty and hunger	Primary: restoring and enhancing ecosystems productivity of food and other biomass produce
2. Universal education	Secondary
3. Gender equality	Primary; improving women's health, time saving and income generation
4. Child health	Primary: improving health and sanitation
5. Maternal health	Secondary
6. Combat HIV/AIDS	Secondary
7. Environmental sustainability	Primary: improving ecosystem services in landscape, enhance provision of water supply and sanitation conditions
8. Global partnership	Secondary

implementing rainwater harvesting. One is that the cost of decentralised harvesting and storage of rainfall is much lower than cost of public water infra-structure in a hilly landscape with scattered homesteads. Secondly, rainwater harvesting reduces pressure to withdraw water from existing groundwater and/or surface water sources which could negatively impact ecosystems habitats and services.

All vegetation uses rainwater, whether it is managed (crops or tree plantations) or natural (forests, grasslands and shrubs). Often the livelihood support provided by ecosystem services from natural vegetation is not fully appreciated until it is severely degraded or has disappeared entirely through, for example, deforestation. Natural and permanent crop cover has the same effect as many rainwater harvesting interventions. By retaining landscape water flows, increased rainfall infiltration increases growth of vegetation and decreases soil erosion, surface runoff and the incidence of flooding. Managing water resources in the landscape can thus mean management of the permanent vegetation cover to enhance biomass production for fibres and energy, to harvest non-timber forest products and to enrich landscape biodiversity. Although forest and trees 'consume' rainfall, they also safe-guard and generate many ecosystem services for livelihoods and economic good.

Mitigating floods and reducing pressures on water resources around urban areas

Today, globally, more people live in urban areas than in rural areas. Cities can be considered as "artificial ecosystems" where controlled flows of water and energy provide a habitat for the urban population, so the principles of ecosystem management apply just as much to sustainable urban water management. Rainwater harvesting is increasingly being promoted and

implemented in urban areas for a variety of reasons. In Australia, recurrent droughts have caused diminishing water resources and reduced supply to urban areas. This has spurred private, commercial and public establishment owners to invest in rainwater harvesting for their own needs. The increased use of rainwater harvesting provides additional water supplies and reduces pressure of demand on surrounding surface and groundwater resources. In parts of Japan and South Korea, rainwater harvesting with storage has also been implemented as a way to reduce vulnerability in emergencies, such as earthquakes or severe flooding which can disrupt public water supplies. The effect of multiple rainwater harvesting interventions on ecosystem services in urban areas are two-fold. Firstly, the increased use of rainwater harvesting provides additional water supply and reduces pressures of demand on surrounding surface and groundwater resources. Secondly, rainwater harvesting can reduce storm flow, decreasing incidence of flooding and short peak flows. In addition, rainwater harvesting has saved consumer spending on water, helped create green oases and reduced vulnerability in the event of disrupted supplies. As urban water use is mostly for non-consumption use, 80-90% of the harvested water is returned to the landscape water cycle.

Climate change adaptation and the role of rainwater harvesting

Climate change will affect rainfall and increase evaporation, which will put increasing pressure on our ecosystem services. At the same time, development by a growing population will affect our ecosystems as we increase our demands for services, including reliable and clean water. Rainwater harvesting will continue to be an adaptation strategy for people living with high rainfall variability, both for domestic supply and to enhance crop, livestock and other forms of agriculture.

Enabling the benefits of rainwater harvesting

Rainwater use by crops and natural vegetation is in many cases by-passed in integrated water resource management (IWRM), which primarily focuses on streamflow or groundwater resources. Consequently, rainwater harvesting interventions are not widely recognised in water policy or in investment plans, despite the broad base of cases identifying multiple benefits for development and sustainability. By introducing policies recognising the value of ecosystem services and the role of rainfall to support these systems, rainwater harvesting



Photo: Klaus W König

emerges as a set of interventions addressing multiple issues of human well-being and improved ecosystem services. The extensive interventions of rainwater harvesting in, for example, India, China, Brazil, and Australia have occurred where governments and communities have made joint efforts to enable policies and legislation, and there have been cost-sharing and subsidies.

Rainwater harvesting will affect landscape water flows, and subsequently landscape ecosystem services. If the collected water is used solely for consumption, for example by crops and trees, the trade-off of alternative water use has to be considered. If the water is mostly used as domestic supply, most water will re-enter the landscape at some stage, possibly in need of purification

Rainwater harvesting has in many cases not only increased human well-being and ecosystem services, but also acted as a way of improving equality and gender balance and of strengthening social capital in a community. Improving domestic water supply by rainwater harvesting saves women

and children from the tedious work of fetching water. It also improves household sanitation and health. In many instances women have benefitted from having water for a small kitchen garden, thus improving diets and incomes. The value of community organisation empowered by the implementation of rainwater harvesting has strengthened communities and allowed them to address other issues related to development, health, and knowledge of their livelihoods and environment. These are important benefits which can further help individuals and communities to improve both ecosystem management as well as human well-being.

The content of this publication has been drawn from the UNEP-SEI publication: *"Rainwater harvesting: a lifeline for human wellbeing"*, Stockholm Environment Institute (SEI) and United Nations Environment Programme (UNEP) (2009)

Recommendations

Consider rainfall as an important manageable resource in water management policies, strategies and plans. Then rainwater harvesting interventions are included as a potential option in land and water resource management for human well-being and ecosystem productivity.

Realise that rainwater harvesting is not a 'magic bullet', but can be effective as a complementary and viable alternative to large-scale water withdrawals, and as a way of reducing the negative impacts on ecosystems services, not least in emerging water-stressed basins.

Rainwater harvesting is a local intervention with primarily local benefits on ecosystems and human livelihoods. Stakeholder consultation and public participation are key to the balancing of positive and negative trade-offs that may emerge. Rainwater harvesting interventions should always be compared with alternative water management interventions and infrastructure investments.

Access and the right to land can be a first step to rainwater harvesting interventions. Special measures should be in place so rainwater harvesting interventions also benefit the land-poor and the landless in a community

Establish enabling policies and cost –sharing strategies, (including subsidies) to be provided together with technical know-how and capacity building.

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