Rubagano rooftop rainwater harvesting system (with concrete/brick tank)

Uganda - Okwombeka tanka z'amaizi ahamaju (Runyankore)

Rain-water from all corrugated iron roof structures in one compound is harvested and stored in underground tanks.

Despite high precipitation (>1200 mm), Rubagano still experiences water shortage. It is hilly, with steep (>30%) to very steep (>58%) slopes. Rain water runs off to the valleys below, causing erosion and damaging infrastructure such as roads along its course. There is little rain water infiltration and the ground water level low. The few boreholes that government constructed in the area are often dry. Therefore women and children normally walk distances of up to 4 km to fetch water which, in many cases, is actually runoff dammed behind a concrete wall built across an open rock patch. To alleviate water scarcity, farmers have been mobilized by Kagera TAMP project to harvest the rain water from their own roofs. Because water sources are far from most households, rooftop water harvesting has a very high utility for the farmers. Adoption is high.
The primary goal of the technology is to increase household water availability. It also reduces runoff, produces water for the tree nursery and backyard gardens..
Requirements for harvesting water on an iron roof are water collection gutters and an underground tank. Rain falling on the roof flows into collection gutters constructed around the roof which angle gently away from the house and end at one or more underground tanks. Excavation and construction of the storage tank is costly and requires well qualified artisans. These are trained locally and are available within the community to minimize costs. The underground tank is constructed by excavating the ground between 3.0 m and 3.5 m deep and 2.0 m to 2.5 m diameter. Thus, a small tank will have a capacity of 38,000 litres (38 cubic metres). The bottom and walls of the pit is then built up throughout with brick and mortar. The top is a concrete slab with 2 openings of 0.3 m diameter, one connected to the gutters and the other through which a plastic container is lowered to fetch water. Though establishment costs appear high for farmers, the longer term benefits outweigh the original cost. Once established the maintenance costs are limited to periodic cleaning.
Heavy rainstorms may blow the gutters out of position.

left: The water harvesting system with 3 components: the corrugated iron roof, the gutters and the storage tank (Photo: Charles L Malingu)
right: Th storage tank capacity determines how long, during a dry spell, the farm household will stay water secure. A typical tank is 3m to 4m deep and 2.5m to 3.0m in diameter (Photo: Charles L Mlingu)

Location: Uganda
Region: Mbarara District (Rubagano, Mwizi)
Technology area: 0.001 km^2
Conservation measure: structural
Stage of intervention: mitigation / reduction of land degradation
Origin: Developed externally / introduced through project, recent (<10 years ago)
Land use type:
Other: Waterways, drainage lines, ponds, dams
Climate: subhumid, tropics
WOCAT database reference: T_UGA027en
Related approach: Community water security ()
Compiled by: Wilson Bamwerinde, Kabare district Uganda
Date: 2013-12-05
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Classification

Land use problems:

- Loss of vegetation, soil erosion and very low ground water level. Difficulty in finding access to water for domestic use, livestock and crop irrigation. (expert's point of view)
Women and children walk very long distances in search of water from permanent natural wells. (land user's point of view)

Land use

Waterways, drainage lines, ponds, dams
rainfed

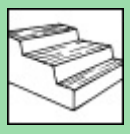
Climate

subhumid

Degradation

Water degradation: change in quantity of surface water, decline of surface water quality

Conservation measure



structural: Dams / pans: store excessive water

Stage of intervention

- Prevention
- Mitigation / Reduction
- Rehabilitation

Origin

- Land users initiative
- Experiments / Research
- Externally introduced: recent (<10 years ago)

Level of technical knowledge

- Agricultural advisor
- Land user

Main causes of land degradation:
Direct causes - Human induced: soil management, deforestation / removal of natural vegetation (incl. forest fires)
Direct causes - Natural: other natural causes, Steep slopes increase the speed of runoff and soil erosion

Main technical functions:
- water harvesting / increase water supply

Secondary technical functions:
- control of concentrated runoff: retain / trap
- control of concentrated runoff: drain / divert
- water spreading

Environment

Natural Environment

Average annual rainfall (mm)

- > 4000 mm
- 3000-4000 mm
- 2000-3000 mm
- 1500-2000 mm
- 1000-1500 mm
- 750-1000 mm
- 500-750 mm
- 250-500 mm
- < 250 mm

Altitude (m a.s.l.)

- > 4000
- 3000-4000
- 2500-3000
- 2000-2500
- 1500-2000
- 1000-1500
- 500-1000
- 100-500
- <100

Landform

- plateau / plains
- ridges
- mountain slopes
- hill slopes
- footslopes
- valley floors

Slope (%)

- flat
- gentle
- moderate
- rolling
- hilly
- steep
- very steep

Soil depth (cm)

- 0-20
- 20-50
- 50-80
- 80-120
- >120

Growing season(s): 120 days (September to December), 90 days (February to May)
Soil texture: medium (loam)
Soil fertility: low
Topsoil organic matter: low (<1%)
Soil drainage/infiltration: medium

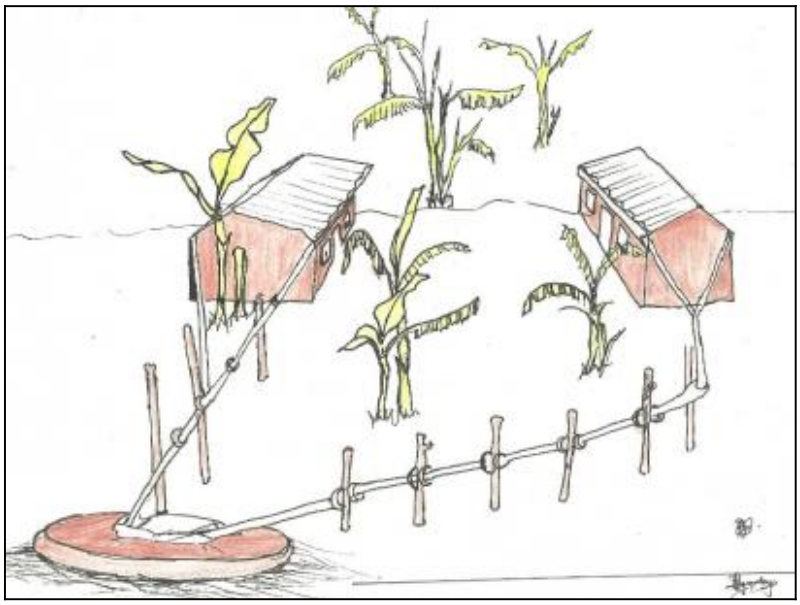
Soil water storage capacity: medium
Ground water table: > 50 m
Availability of surface water: poor / none
Water quality: poor drinking water
Biodiversity: low

Tolerant of climatic extremes: temperature increase, seasonal rainfall increase, heavy rainfall events (intensities and amount), wind storms / dust storms, floods, decreasing length of growing period
Sensitive to climatic extremes: seasonal rainfall decrease, droughts / dry spells

Human Environment

Land user: Individual / household, Small scale land users, common / average land users, men and women
Population density: 50-100 persons/km2
Annual population growth: 2% - 3%
Land ownership: individual, not titled
Land use rights: individual
Water use rights: open access (unorganised)
Relative level of wealth: average, which represents 80% of the land users; 65% of the total area is owned by average land users

Importance of off-farm income: less than 10% of all income: Similar statistics for all types of land users as far as off-farm income is concerned
Access to service and infrastructure: low: technical assistance, employment (eg off-farm), drinking water and sanitation, financial services; moderate: health, education, energy, roads & transport; high: market
Types of other land:



Technical drawing

Details of rainwater harvesting system: roof catchment, gutters and underground storage tank (Byonabye Proscovia)

Implementation activities, inputs and costs

Establishment activities

- Tank construction
- Procurement and raising of collection gutters
- Wooden poles

Establishment inputs and costs per ha

Inputs	Costs (US$)	% met by land user
Labour	500.00	100%
Equipment		
- tools	30.00	100%
Construction material		
- wood	16.00	100%
- Bricks	400.00	100%
- Cement	420.00	100%
- Sand	160.00	100%
TOTAL	**1526.00**	**100.00%**

Maintenance/recurrent activities

- Tank maintenance (above ground)
- Gutter replacement
- Wooden poles

Maintenance/recurrent inputs and costs per ha per year

Inputs	Costs (US$)	% met by land user
Labour	80.00	100%
Equipment		
- tools	10.00	100%
Construction material		
- wood	4.00	100%
- Bricks	40.00	100%
- Cement	42.00	100%
- Sand	40.00	100%
TOTAL	**216.00**	**100.00%**

Remarks:
Skilled labor for the construction of the underground tank
The calculations were done for a 38.0 cubic meter tank constructed in September 2013

Assessment

Impacts of the Technology

Production and socio-economic benefits	Production and socio-economic disadvantages
+++ increased drinking water availability	
+++ increased water availability / quality	
+++ increased farm income	
+++ decreased workload	
++ increased crop yield	
++ increased wood production	
++ increased irrigation water availability quality	
++ reduced expenses on agricultural inputs	

Socio-cultural benefits	Socio-cultural disadvantages
++ conflict mitigation	
++ improved situation of disadvantaged groups	
++ improved food security / self sufficiency	
++ improved health	

Ecological benefits	Ecological disadvantages
+++ increased water quantity	
++ increased water quality	
++ improved harvesting / collection of water	
++ reduced evaporation	
++ reduced surface runoff	
+ increased soil moisture	
+ increased plant diversity	

Off-site benefits	Off-site disadvantages
++ reduced damage on public / private infrastructure	
+ increased water availability	
+ reduced downstream flooding	

Contribution to human well-being / livelihoods

+++ Women and children no longer have to walk long distances in search of water.

Benefits /costs according to land user

Benefits compared with costs	short-term:	long-term:
Establishment	negative	very positive
Maintenance / recurrent	neutral / balanced	very positive

The technology may appear expensive to the farmer at the time of establishment but it is cost-effective in the long-term.

Acceptance / adoption:

20% of land user families (5 families; 20% of area) have implemented the technology with external material support.
80% of land user families (20 families; 80% of area) have implemented the technology voluntary.
There is moderate trend towards (growing) spontaneous adoption of the technology. Regardless of the high costs involved, improved water security has encouraged farmers to adapt the technology.

Concluding statements

Strengths and → how to sustain/improve	Weaknesses and → how to overcome
Makes water for drinking and domestic use more readily available to the household → Encourage adoption and maintenance through farmer-to-farmer information	Technology is expensive to establish → Support government and private sector to subsidize tanking systems for farmers
Saves women and children from walking long distances in search of clean water → Empower women and children to demand and obtain rooftop water harvesting at home	Requires technical expertise especially in concrete preparation to prevent cracks and leakages → Ensure farmers who express the need to adapt get access to construction technicians
Rooftop harvested water is cleaner than trapped runoff used by many members of the community → Help households to acquire materials for rooftop water harvesting	