

Road Water Harvesting in Kenya:

What Farmers Can Do Themselves

Kitui County is classified as semi-arid to arid, where most farmers are agro-pastoralists and rely on rainfall for farming. There is a bimodal rain pattern, however rains are often unreliable and insufficient. As a result farmers face crop failures. The relevance of water harvesting, retention and storage is profound, as this can extend their growing season. So farmers can survive and thrive in times of drought.

In this research farmers who practice road water harvesting, were asked about how they harvest road runoff and how this helps them in their farm. Also information on their income was gathered and compared with the costs of construction of road water harvesting, so to compute a cost-benefit analysis. This was done in order to learn about the practices of road water harvesting and on how this can benefit the farmers and their roads and environment. On average farmers are cultivating 2-5 acres, mainly growing maize, beans, vegetables and fruits.

The Farmers

30 farmers in Kitui County who have initiated road water harvesting in their farms have been visited. Contacts of the farmers were retrieved from the Department of Agriculture within Kitui County. They were selected based on the sub-counties in Kitui County. At least four respondents were selected out of the 6 sub-counties within Kitui, as representatives.

An important and positive aspect is that 70% of all farmers indicate they have trained other people on road water harvesting. At the same time they indicate that they themselves have been trained also, or they have seen it and learned from other farmers who use road water harvesting. In this way the chain of trainers will continue to train others and spread this practice. Almost all farmers are part of groups, also this provides ample opportunity to share knowledge with each other, and spread and improve their road water harvesting techniques

The practices

The vast majority of farmers use a combination of techniques. These mostly include diversion cut-offs/ditches, trenches, furrows, terraces and on-farm storage ponds, taking water from road drainage. Depending on the topography and local conditions, farmers focus on farm ponds to store water, while in other sub-counties they use terraces due to the hilly landscape.

When it comes to the amount of water that can be harvested, all farmers say the runoff water is sufficient for them during the dry season. In many cases this water is used in a complimentary fashion combined with other water harvesting and conservation techniques. This shows the potential of using road water as alternative water source in enabling farmers to extend their growing season, also when the rains fail.

Siltation control is mainly done by manual removal. Sometimes vegetation and a series of small holes is used. Farmers indicate they like to improve siltation techniques on their farm.

The people

Edward Ndolo is farmer in Kitui Central. He harvests road runoff to enhance agriculture and water supply for domestic purposes. He learnt about water harvesting techniques through training and observations. He grows maize, beans, cowpeas, pigeon peas, millet, mangoes, oranges, pawpaw, white supportors, lemons and avocados. He also rears livestock on his farm.

The major water harvesting techniques include use of furrows and earth bunds to direct the water from roads to the farm. On the farm he uses retention ditches together with terraces to store the harvested road runoff.

This technique means that during the rainy season he is diverting the runoff from surrounding roads to his *shamba*. What is special is that Edwards' *shamba* is not directly connected to a road, but the road water first has to pass the land of his neighbour. By explaining this neighbour the destructive effects of the rains to the road, Edward was allowed to make a channel across the mans' land. *"The place here, we have very little shambas. So we cannot contain all the water on that shamba"* Edward explains.

Inspiration to do road water harvesting came from his visits to places elsewhere in the country where he was exposed to the technique. *"I saw other farmers do it, so I thought it would be good for my shamba"* he explains. It is nonetheless practiced by only a few farmers in the area, despite his effort to inform others about the benefits.

Jackson Muendo learnt on water harvesting techniques through observation training and education from farm groups. Last year he received certificate for the best onion farmer in Kitui County. Also from the year 2012 up-to-date he has been receiving awards for being the best farmer.

Being in an area which receive very little amount of rainfall he depends on road runoff to water his crops. The harvested road runoff is stored in lined on farm ponds to reduce water loss through infiltration and percolation. He uses both household and hired labour to cultivate and construct water storage systems. After he stores the water in the ponds, he uses drop irrigation systems to water the crops. In order to control siltation, he applies manual removal, filtering ditches, check dams and vegetative control.

Lois Musyoka does road water harvesting to water the crops and the pasture for her cows. She learnt about water harvesting techniques from observations. The water gets to her farm through furrows, ditches and trenches. It is stored in on farm ponds and terraces. Since the water she harvests is not sufficient for her agricultural and domestic needs, she is willing to increase the amount of the harvested water.

Road runoff harvesting is highly profitable to her because since she adopted the technology, she has been getting triple of what she was getting before.

Munywoki Musya uses terraces, retention ditches, roof water harvesting and on farm ponds to divert and store the runoff on his farm. Terracing is the main water harvesting technique on his farm. He gains skills on water harvesting techniques through observation and trainings. Being a member and a chairman of a farmers group, he also learns a lot from fellow farmers about water harvesting techniques and sustainable farming practices.



Figure 1 Munywoki Musya is harvesting road runoff which is stored in a pond within the farm

The numbers

In Table 1 the outputs of the cost-benefit analysis are shown. The *construction* costs of road water harvesting include all costs adhered to it. This can for instance be: hired labour, tools, materials, lining, hours of working, etc. The total costs for road water harvesting structures are taken into account. The average total costs for road water harvesting among these farmers is 42.274 KSH.

The average increase of income of the farmers is 105.107 KSH, this increase is derived from the increase in crop yields after 1 cropping season. In the survey farmers were asked for their crop yields before and after road water harvesting. The difference between before and after was computed and valued in terms of income. The main crops harvested were maize, beans, pigeon peas, cow peas, green grams and fruits like mangoes, oranges, passion fruits and lemons.



Figure 2 Mrs Mwova proudly showing a strawberry which is produced on their farm

Richard Mwova is an active member of farm groups, he shares the ideas on better agricultural practices with his fellow farmers which make his farm to attract his neighbours and even foreigners. Students from South Eastern Kenya University (Seku) use his farm to learn modern farming techniques.

He gets water for his agricultural activities from roof harvest, shallow well and road runoff. Water from roof harvest is majorly used for fish farming and for domestic purposes. The harvested road runoff is used to irrigate pasture for his dairy cows and to recharge the shallow well.

This indicates a major increase in income for the farmers. And it also indicates that the *initial investment has been regained within 1 season*. Looking at the possibility of 2 growing seasons in 1 year, the farmer's income can increase with lower ongoing investments. The comparative benefits for farmers will increase over time. It should be noted that a number of farmers also has other harvesting and irrigation structures that are already in place. And at the same time benefits are also derived from non-road water harvesting structures. In the survey a distinction in structures has been made, though *different water harvesting structures are used complimentary*. Therefore the exact benefits from the road water harvesting can in some cases overlap.

Table 1 Results of Cost-benefit analysis among farmers in Kitui County, Kenya (These farmers had not yet invested in road water harvesting and are therefore left out of the calculated average and benefit)*

No.	Farmer	Total Crop Income Per Farmer (KSH)	Total Construction Cost Per Farmer (KSH)	Benefit Per Farmer (KSH)
1	Edward Ndolo	245200	4400	240800
2	Richard Mwova	297950	67000	230950
3*	Goerge Moki Nzou	0	0	0
4	Elizabeth Ngei	100240	40000	60240
5	Maluki Munyalo	26900	39000	-12100
6	Lydia Mueni Mumo	208300	55000	153300
7*	Stephene Mwangagi	0	0	0
8	Monicah Mueni	0	2000	-2000
9	Kathini Kitili	65450	30000	35450
10	Elizabeth Syombua	40000	15000	25000
11	Lois Musyoka	113400	40000	73400
12	Mwendwa Isika	65700	20000	45700
13	Lois Musyoka	128600	70000	58600
14	Ann Ndunge Peter	37200	90000	-52800
15	Mwende Robert Kiswili	70560	30000	40560
16	Ruth Munuve	21500	25000	-3500
17	Ben K Mutemi	76800	0	76800
18	Jackson T Kinyili	242100	4000	238100
19	Munywoki Musya	143700	70000	73700
20	Geofry Mwaniki	120600	60000	60600
21*	Nzambi Musyoka	0	0	0
22	Josphine Nduku	76000	38000	38000
23	Jackson Muendo Muthoka	166900	140000	26900
24	Kyele Kivunzi	61200	40000	21200
25	Solomon Kiusya Katula	117100	120000	-29000
26	Geofry Muuki	69500	20000	49500
27	Joseph Musili Kioko	144000	54000	90000
28	Philip Kilonzi	29700	18000	11700
29	Christine Kathi Mwenga	57600	46000	11600
30	Paul Muema Kimanzi	111700	4000	107700
	Average (over 27 farmers)	105.107	42.274	62.833
Benefit				62.833 KSH

The costs of construction compared with the return on investment after 1 growing season.

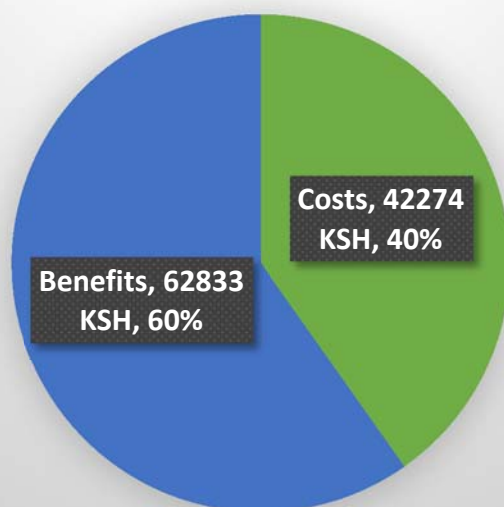


Figure 3 Overview of the costs of construction compared with the return on investment of farmers practicing road water harvesting

The benefits

More than 50% of farmers have indicated they see road water harvesting as something which is highly profitable to them. And they are right, the results indicate an average *positive benefit* of 62.833 KSH. It can be presumed that the benefit is likely to increase considerably over time, because the initial investment is often higher compared to ongoing costs. Also because a number of farmers had indicated they had recently constructed road water harvesting. Therefore they not yet had the chance to harvest and utilize the water harvested from the roads.

Considering the results of this cost-benefit analysis it can be seen how much *added value* it gives to these farmers. Household income has considerably increased due to efforts in road water harvesting. In some cases there are very little investment costs, resulting in a major increase in income generation. *This road runoff as a free alternative source of water can make big changes happen.* 4 in 5 farmers indicate that their food security has improved in the last 5 years due to road water harvesting techniques.

Furthermore, these farmers are providing additional benefits by safeguarding roads and landscapes, *at no cost.* *Non-measured benefits* include reduced erosion to road drainage structures, because water was taken into the farms and utilized. Especially because almost all farmers live along feeder roads, there is a reduction in maintenance costs of these roads being damaged by concentrated water flows. Besides this gulley formation is reduced and soil fertility in the top soils can be retained.

Overall the benefits are striking, and livelihoods can thrive.

www.roadsforwater.org

Contact: lbosma@metameta.nl; marta@metameta.nl

