

Rain Water Harvesting and Its Impacts on Water Resources and Farm Productivity

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1. Introduction

The water resources of Kenya are consistently affected by increasing demand due to the increasing population, industrialisation and changing lifestyles. To this end, Kenya has been described as a water-scarce country, with rapidly dropping freshwater availability. In 1992, the annual per capita water availability was about 647 m³. This dropped to 534 m³ per capita by 2011 and is projected to decline to 235 m³ by 2025 which implies that the country will be severely water-stressed.

The total water demand for domestic, industrial irrigation, livestock, wildlife, and inland fisheries will increase from 3,218 million m³/year in 2010 to 21,468 million m³/year in 2030 and growing to 23,141 million m³/year in 2050. Generally, current developed water infrastructure in the country is often inadequate across all services, including for industrial, commercial, domestic as well as for irrigation, livestock, and wildlife use. In addition, the excessive abstraction of surface and groundwater, cultivation in water catchment areas, thus causing soil erosion, have increased pollution of water sources, by increasing the eutrophication and siltation of lakes, dams and pans and pollution from toxic chemicals, including agricultural pesticides and heavy metals. Thus, the increasing water demand will continue to intensify competition among users and uses. Meeting the growing demand for water faces major challenges particularly due to rapid urbanization, prevailing land use, and climate variability.

Tana River is Kenya's largest river and stretches 1,000 km (620 miles) from the Aberdare Ranges to the Indian Ocean. At least one in four Kenyan's live near the Tana River or its tributaries. The river is powered by the twin 'water towers' of Kenya: the Aberdare Mountains and Mount Kenya. The water towers themselves are protected areas that exclude development, and thus the headwaters of Tana are relatively well protected. Downstream of the protected areas is where the water issues begin, impacting the lives of millions of people as well as the wildlife that depends on the river.

The Upper Tana Watershed provides more than 90% of the water for Nairobi, Kenya's largest city with 5 million people, and 100 % supply to all the other towns within the Upper Tana.

The upper Tana also provides the water that feeds a cascade of five hydropower dams on the Tana. These dams supply 66% of the electricity in Kenya. Sediment loads from upstream of the Masinga Dam are decreasing its capacity faster than expected. This reduces water storage capacity and power production during the dry season, which is when Kenya most needs power.

Increasing dry-season water flow in the tributaries of the Tana and reducing the sediment loads in the river would improve the well-being of millions of people by increasing the

availability of water and electricity. It would also benefit aquatic biodiversity and the wildlife it supports.

The baseline survey conducted in 2014 demonstrated that the average irrigated crops within Thika-Chania and Maragua sub-catchments of the upper Tana was 32%. The water was either from the streams or from the domestic water schemes thus increasing competition for water use with the downstream users.

2. Interventions

In 2014, the Water Fund started a pilot project on rainwater harvesting technology using the household water pans in the lower Maragua sub-watershed which had a higher percentage of the irrigated crops from the baseline in 2014. The Water Fund partnered with Frigoken, which is a food processing company and had contracted more than 60,000 farmers in Upper Tana catchment, to implement rainwater harvesting for irrigation. Frigoken designed their water pans in multiples of 8,000 liters which was enough to irrigate their designed minimum plot measuring 180 m² and a farmer could implement up to 8 times, while the Water Fund Waterpans were designed to hold 50,000 liters or 100,000 liters of water harvested either from the roof or surface runoff and used for irrigation.

This partnership was in an attempt to reduce the water pumped from the rivers, drawn from the domestic water schemes, providing an alternative water source for farmers cultivating within the riparian lands.

With intensive capacity building and awareness, 5608 waterpans had been excavated by 2016. The waterpans were lined with UVI treated liners that addressed the destruction by sunlight and provide a longer lifespan.

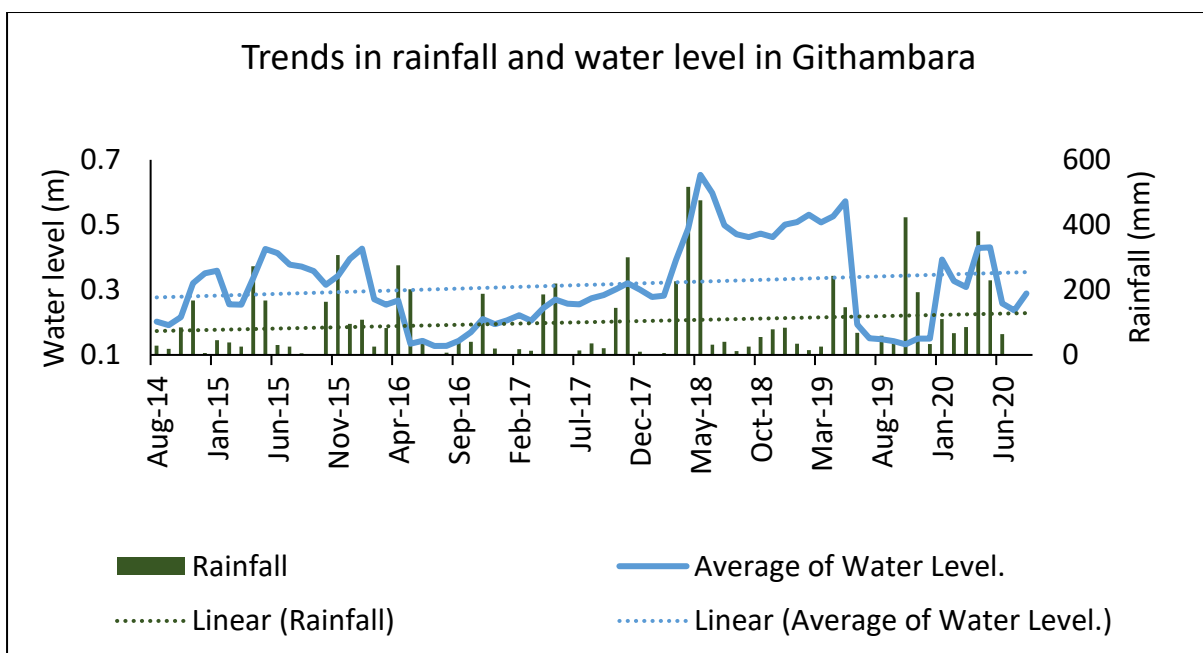
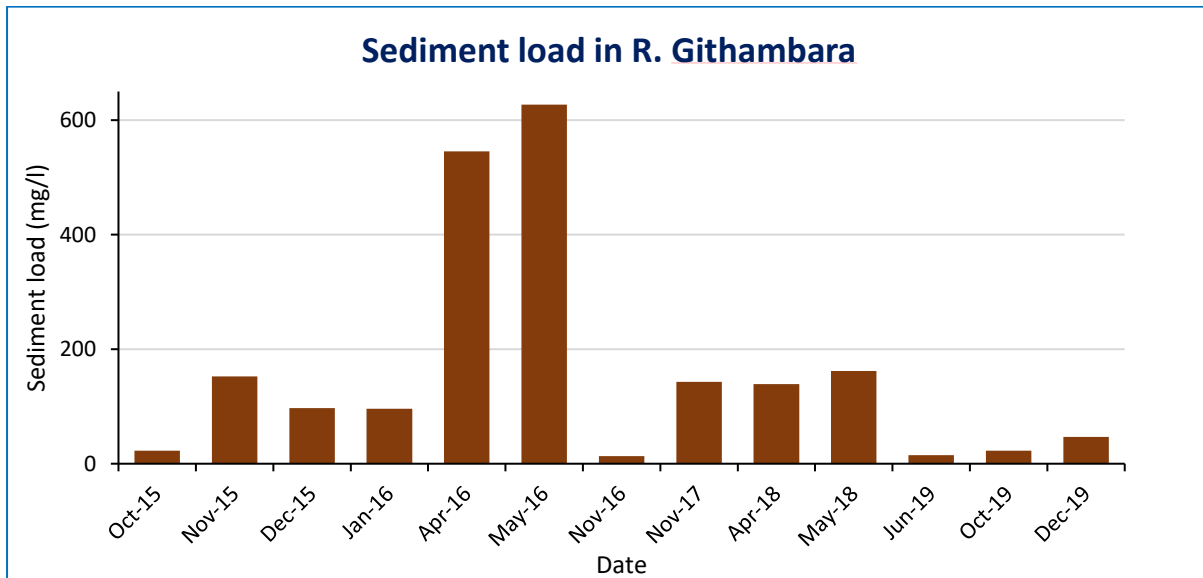
This project was upscaled through IFAD in 2017 with more focus on the Water Fund priority sub-watersheds. The water pan designs were reviewed to the standard designs implemented by partners including Frigoken. The water pans were designed to fit the different needs of the farmers as well as considering the existing land sizes and land use. All water pans have a standard design of 3 sizes, 24, 50, and 100 m³, and lined with UVI treated polythene liners of 250 microns thickness.

The Water Fund trained and engaged 15 youths to promote the rainwater harvesting within the priority areas, and also contracted SACDEP and CARITAS to assist in reaching out to more farmers to undertake soil and water conservation activities. By June 2020, a total of 8,297 water pans with 1,405 completed in the FY 19/20 were implemented bringing a total of 13,905 water pans from 2014.

3. Impacts

The 8,297 waterpans implemented from 2017 with the support of the IFAD grant have a total capacity of harvesting 1,196,523 m³ of water per season which is enough to irrigate 2,688 acres of a diverse mix of horticultural crops within a 3 months dry season. This is demonstrated by the high level of crop diversification and increase in food productivity by 30% of the farmers who adopted the technology as per the survey on food productivity in August 2020.

Preliminary analysis in Githambara micro-catchment within the Maragua sub-watershed with 143 waterpans and harvesting 8,118 m³ of water per season shows that the water quality (TSS) has also improved. TSS in Githambara has reduced by 42.3% in 2019 compared to 2015 despite rainfall increasing by 8.5%. The water level during the dry seasons also increased by 23.91% over the same period. These hydrological impacts can be attributed to the intensive activities being implemented in the areas including rain water harvesting in water pans, terracing, retention ditches, and riparian areas conservation among others.



Frigoken has demonstrated that a standard plot of 180 m² of irrigated French beans has an average production of 85 kg per season. A 50 m³ of water irrigates 384 m² of french beans for 75 days during the dry season with a production of 182 kg. This means 1 kg of French beans produced requires 0.275 m³ of water to maturity. Currently, Frigoken is buying 1 Kg at Ksh 30 after deducting all the inputs they have provided to a farmer. With the 1,196,523 m³ of water harvested per season, it is enough to produce 4,350 tons of French beans which is equivalent to Ksh. 130.53 million that translates to Ksh. 261 million annually.

The Water Fund has further rehabilitated 2 communal water pans i.e. Kwa Musa community water pan in Njabini Ward and Wachira Heni community water pan in Nyakio Ward through the partnership with Nyandarua County Government. The two water pans have a capacity of 22,500 and 16,000 m³ of water respectively. These areas have no piped water supply and so people used to walk for long distances to fetch water or buy from vendors in Jerricans. The water is now being used by 1500 people and 5000 cattle for Kwa Musa Community and 700 people and 3000 cattle for Wachira Heni Community.

4. Conclusion

Among Kenya's big 4 agenda is on food security and nutrition and the government has allocated a lot of resources for irrigation water schemes from the rivers. With the intensification of Rainwater harvesting through water pans in all areas, the country can reduce the impacts that will be caused in the rivers during the dry seasons, develop the spirit of water conservation to all as well as increasing the food productivity.