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Water retention landscape: mini catchment approach

G. N. Wambugu (Kenya)

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In arid and semi-arid lands (ASALs) in Kenya, where rainfall is low with scarce fodder for animals, vegetal cover and shooting trees are destroyed early by grazing animals leaving the soil bare and susceptible to soil erosion resulting in deep and wide gullies. The situation is exacerbated by human activities (charcoal burning, animal and human tracks/roads etc.). The ASALs make up over 80% of the country. Gulley head treatment is a simple low cost and effective method of stopping gulley advancement. It can be managed by the technical capacities of the local communities with basic financial support in capacity building. Construction of some water and soil retaining structures may be required as well. This paper looks at efforts of a Community in Kitui, an ASAL area to de-silt their earth dam and mitigate its future rapid silting with gulley head treatment and intensive soil and water conservation through a mini catchment approach.

Introduction

In 2012, Caritas Kitui, with CAFOD and DFID funding embarked on environmental conservations project in Muvitha Kitui, Kenya which after completion in two and a half years managed to bring great impact of water retention and vegetal growth within a catchment measuring about 15km2. Kitui County is a semi-arid area with an annual rainfall of 500mm to 1050mm (Kenya information guide 2015). Muvitha area falls within the lower range of 500mm rainfall. 1100 stone check dams were installed healing a network of gullies. 46 Km of 'fanya juu' trenches were made to facilitate formation of bench terraces by trapping silt and storm water. Fanya juu trench is where the soil from the trench is heaped on the upper side of the slope while in Fanya chini the soil is heaped on the lower side of the slope. 6 major rubble masonry check dams were installed on the major catchment stream. 7629 trees among 10,000 trees that had been planted survived. The catchment divide line had been precisely mapped and the overall goal was to conserve most of the rainwater falling on the catchment. 1440 people from the households within the catchment benefited from the soil and water conservation activities especially with access to water at a shorter distance (within 1 km) as opposed to 3.5 km to the nearby perennial Athi River which was their previous closest water point.

The water retention landscape concept

The Muvitha project was modelled on Tamera's Water Retention Landscape concept whose objective is to restore the water cycle in a catchment and reduce vulnerability to droughts (Tameera WRL 2015) Tamera, a farm of 154 ha, is located in the most arid region of Portugal (Alentejo). This area has shown significant trends of increasing erosion and desertification and climate change will most probably exacerbate these issues. Tamera has managed to counteract such trends of increasing erosion and desertification through the creation of a "Water Retention Landscape" (WRL) comprised of a system of lakes, ponds and of other retention systems, and also including other structures such as terraces, swales and rotational grazing ponds. This approach to water management has created a regenerative basis for autonomous water supply, the regeneration of topsoil, forest, pasture and food production, and greater diversity of wild species.

Project inception

The community of Muvitha had requested assistance from CAFOD's partner for de-silting their dam (Musosya dam) that had been previously funded by an international donor. The dam had silted up in a period of 11 years. During the assessment, it was clear that there was huge soil erosion within the earth dam catchment and the upstream water shed was bringing in unimpeded sediments through the seasonal stream and also eroding it causing it to widen and deepen. Many wide gullies were also observed entering the main stream of the catchment, the origin being a network of many small gullies from the farms and from road and animal track network. The earth dam was observed to have a relatively small catchment and this provided a good opportunity to apply the Tamera WRL concept. After several meetings to mobilise and prepare the community for the work ahead, the conservation work was started. Only farmers whose land contributed to the storm water drainage into the dam reservoir were involved as primary beneficiaries.

The catchment conservation work

To begin with, the farmers were trained on how to carry out soil conservation work on their farms as well as good agronomic practices. All farmers were inducted on how to make stone check dams, terracing and capturing storm water from the road/path network. A selected group of farmers were also trained on how to mark contour lines for terracing. This was a basic training which involved construction of an A frame and calibration of the vertical plumb line on the cross bar of the A-frame. They learned how to peg the contours by moving the A-frame and marking the 90 degree plumb line/cross bar mark. They were trained to space the trenches as intervals of 20m for gentle slopes and 1.5 m drop for steeper slopes. They also learned how to make cut off drains (Fanya Chini) by heaping soil on the lower side of the slope (Infonet biovision 2018).

A rain gauge was installed at one of the farmers homestead and another rain gauge was installed at a nearby school where a conservation club had been formed. The farmer and club members received training on rain gauge reading and keeping record. Apart from collecting data for meteorological department, the farmer and school club also provided rainfall data to the project members and school community respectively.

The major work on the catchment included tree planting, construction of 6 major masonry check dams on the main seasonal Musosya stream and construction of 1100 stone check dams on small gullies. Masonry check dams were constructed with rubble stones and mortar while stone check dams were made of simple pile of rocks arranged across small gullies and buttressed on downstream side with planted vegetative tree branches. Gabions were used for medium sized gullies. All the 6 rubble masonry check dams were installed with a 4 inch (10cm) vertical drain pipe to enable farmers to observe water levels and how long it lasted after the rains, this being an indicator of the success of protection work that had been carried out. Work was done on the local road and path/animal track network by making diversion trenches to nearby farms. These networks are usually a big source of soil erosion since a significant amount of storm water run through them. The road water runoff that was directed to private farms was made to spread on relatively flat land or was directed to a series of pits (Zai Pits) that were later planted with bananas, pawpaw's, or other crops. Zai is a term used in Burkina Faso and refers to planting pits 20-30 cm filled with organic material/dry plant biomass for planting seeds/seedlings (Motis et al 2013). Apart from the project requirement for contour trenches in private farms for terraces, strategic locations were identified where communal terrace work was done amounting to a total 46km communally made terraces. The conservation work at public locations and some major trench work on private farms was carried out communally by the community members who received a cash for work stipend. Tree seedlings were planted on some strategic areas near to the reservoir. They were planted on communal areas and on some private farms adjacent to the reservoir. To ensure the trees survived, cluster leaders and community members planned for a guarding rota especially when the trees were very young. They also made a rota for watering the trees after the rains subsided. For additional security, each tree seedling was protected with a circular stick mesh about 80 cm high. This prevented any goat or other animal that may have escaped the eyes of the guard from harming the young trees.

The cut off trenches were made with soil being heaped on the lower side of the contour (Fanya Chini) while the trenches for forming bench terraces were made with soil being heaped on the upper side of the trench. (Fanya juu). This formed a bund and a small ledge between the trench and the bud prevented the soil from sliding back. This leads to flattening of the space between trenches forming a terrace. The de-silting of the dam reservoir in the catchment was the climax of the project activities. It was rehabilitated by removing the silt with earth moving machines. The spillway that had been badly eroded by storm water was also installed.

Project management

The project area had been divided into 7 clusters. The cluster leaders together with other three elected leaders from the community (Chairman, Secretary and Treasurer) made up the project committee. This team composed of both men and women underwent training on management, environmental conservation and Community Lead Total Sanitation (CLTS) process. The cluster leaders mobilized the cluster households in planting trees at household level, storm water diversion to Zai pits and managing gully head treatment. They also mobilized the community to work in the communal areas. They were charged with monitoring the work in their clusters and brought the data for recording to the weekly group meetings. The project was handed over to the committee on completion.

The immediate results

As a result of the massive conservation work, most of the small gullies were healed (filled up with silt) and the vegetative tree branch buttresses sprouted making the stone check dams permanent. There was also substantial 'healing' in the major gullies and the seasonal stream though much less than the small gullies. Two lined hand dug wells constructed on the downstream of reservoir provided adequate water to serve the community throughout the year. One of the wells provided a yield of more than 2m3/hr and was equipped with solar water pumping system and community uses the water at their demonstration farm as well as for drinking purpose. Water recharge in the wells has improved greatly due to increased water retention in the catchment and currently there is adequate and sustained water flow into the wells being experienced. The project reached 1440 beneficiaries and the per capita cost was $143 per person and good water conservation results are visible. This could not have been achieved if the project funding was pegged on a low per capita funding.

Due to the success of the project in water conservation, it was possible to later support the community with a joint bee keeping project that was funded by CAFOD/ICIPE and implemented by CAFOD Partner, Caritas Kitui. Each of the 20 community members' targeted (15 women, 5 Men) was supported with 5 bee hives (three Langstroth and two Jumbo hives) and harvesting gear. The group was communally provided with a manual centrifuge honey extractor. The honey extractor helps to remove honey without breaking the honey combs hence re-filling of honey by the bees is quick unlike in the traditional bee hives where honey combs are removed by cutting them out and bees have to make honey combs again in order to store honey. The farmers were further linked up with the local government and there is a potential of support with extension services and linkages with honey market.

Areas for learning

- Simple soil and water conservation technologies like stone check dams buttressed with vegetative tree branches makes a permanent check dam to check soil erosion. This is appropriate for gulley head treatment and will heal a small gulley before it gets worse.
- To experience a significant impact of water retention, scale of soil and water conservation work plays a big role and it is important to consider all susceptible areas including the road network, paths and animal tracks.
- To make a good impact on healing of gullies and eroded streams, majority of the work need to be carried out on the upstream of the gullies/streams, starting from the source.
- In order for the community to understand the concept of water retention landscape, it is important to provide facilities where they can make observations or collect data e.g. rain gauge and vertical observation pipes at check dams (sand dams).
- By forming an environmental club in the school within the project location, and providing them with a rain gauge and inducting the group to environmental conservation an opportunity was provided for the students to practically learn from an on-going project.
- The rehabilitation of the dam had been planned as the last activity in the project. This however became a challenge since a lot of water was retained due to the conservation efforts (subsurface flow) and it was a challenge to de-silt the reservoir. This order should be reversed de-silting coming first and conservation work to follow (if new dam, it should be constructed first). A 3 m deep well had been dug on the reservoir in the first year of the project in September and no water was encountered, however, water was encountered above 3 m while de-silting the reservoir in the second year in the same month though the annual rainfall was similar in both years.

- The availability of water throughout the year within the catchment provided an opportunity for the bee keeping project to be introduced to the Muvitha community and it also provided a further opportunity for scaling up.

Map and photographs illustrating conservation work carried out

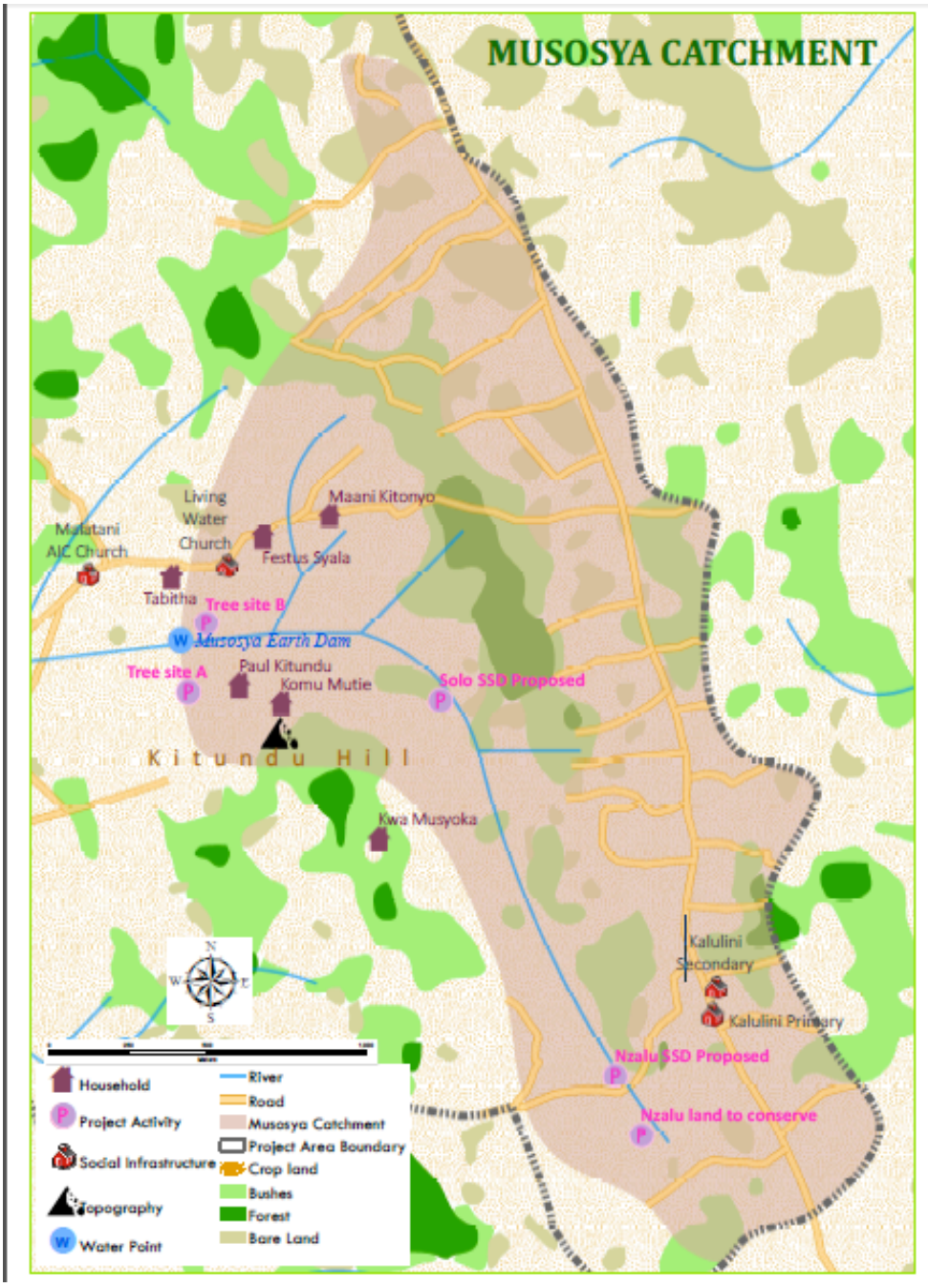

Figure 1. Musosya Dam Water Shed
1° 37' 29.5'' S 37° 49' 21.1''E (-1.624848, 37.822527)

Photograph 1.
Series of Stone Check dams

Photograph 2. Check dam:
note sprouting vegetative buttresses

Photograph 3. TEST WELL at reservoir before desilting:
note reservoir in background

Photograph 4. Reservoir after desilting

Photograph 5. No water at 3M deep WELL prior to desilting

Photograph 6. Water trapped behind masonry check dam allowing slow seepage

Photograph 7. Tree planting

Photograph 8. Surviving trees

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Contact details

George Wambugu Works as an Emergency Response officer with CAFOD based in Nairobi. Apart from his WASH focused Humanitarian role, George has a special interest in intensive long term water resource management in particular in the area of establishing Water Retention Landscapes and also Environmental Impact Assessments and their role in supporting Water Resource Management.

George Wambugu
CAFOD, Kileleshwa.
Vihiga Rd Off Makueni Rd Off Othaya Rd
P.O.Box 66153-00800 Nairobi.
Tel: +254720009172
Email: gwambugu@cafod.org.uk
www: cafod.org.uk