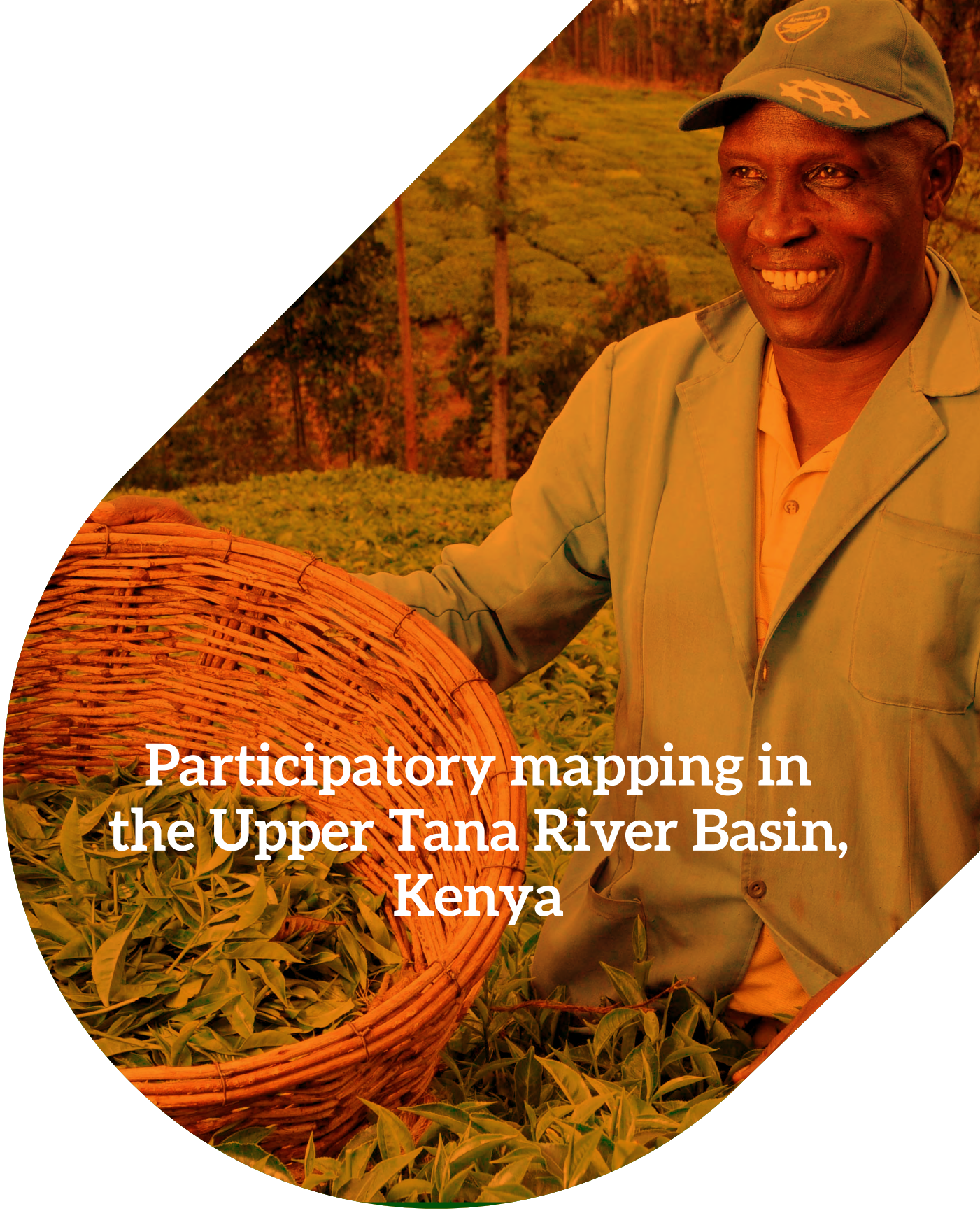

Participatory mapping in the Upper Tana River Basin, Kenya

CIAT
International Center for Tropical Agriculture
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RESEARCH PROGRAM ON
Water, Land and Ecosystems

Background

The Upper Tana River Basin covers approximately 17,000 km^2 and is home to 5.3 million people (TNC, 2015). The basin covers Mount Kenya and the Aberdare highlands with elevations ranging from 4,500 m at Mount Kenya to about 400 m above sea level in the east of the catchment (Dijkshoorn et al., 2011). There are two rainy seasons and rainfall is relatively high with average annual rainfall of about 2,000 mm at higher altitudes (Hunink et al., 2013). The water this area provides is of critical importance to the Kenyan economy. It fuels one of Kenya's most important agricultural areas, provides half of the country's hydropower output, supplies 95% of Nairobi's water and is home to national parks and reserves which are important areas of biodiversity (TNC, 2015).

Derived from volcanic parent material, the soils were relatively fertile; this area has been intensively farmed since before the 1960s due to the combination of fertile soils and high rainfall. Important cash crops are tea, which is grown in the higher elevation areas, and coffee, which is grown in lower elevations but has become less important as a cash crop as market prices have fallen. Avocadoes and macadamias are other important cash crops. In most areas, farmers grow a mix of food and cash crops. Landholdings are not scattered and extend in strips from the crest of hills down into the valley bottoms to the rivers and so nearly all farms have access to rivers. In the tea zone, tea is grown on hillsides and covers about 75% of the farm while vegetables and trees are grown on the crest of the hills near the homesteads and along the river valleys. Food crops (maize, beans) are planted on the upper part of farms in rotation in the rainy season, and in the dry season English potatoes, sweet potatoes and vegetables (cabbages, green vegetables ('sukuma wiki'), arrowroot, green capsicum, pumpkins, courgettes) are irrigated on the lower part of farms along the rivers.

One of the major challenges in the Upper Tana is that upstream human activities are causing increased sedimentation in the basin's rivers, reducing the capacity of reservoirs and increasing the costs for water treatment (TNC, 2015). To address this, the Upper Tana-Nairobi Water Fund was created to help protect and restore the quality and supply of water in one of Kenya's most productive and economically important regions (TNC, 2015). Spearheaded by The Nature Conservancy (TNC), the Water Fund will establish a revolving fund, where a public-private partnership of donors and major water consumers 'at the tap' contribute to the endowment, which generates funds to support land conservation measures upstream (TNC, 2015). Water funds are founded on the principle that it is cheaper to prevent water problems at the source than it is to address them further downstream (TNC, 2015). Whilst the Water Fund is aimed at providing benefits to downstream users, ensuring that land users benefit from land conservation measures upstream is important to the long-term viability of the fund. CIAT and partners are working to better understand the benefits and beneficiaries of land conservation measures on multiuse agricultural lands.

The Upper Tana-Nairobi Water Fund activities are currently focused in three priority sub-watersheds (Figure 1). Rivers from these sub-watersheds are critical to Nairobi's water supply and Kenya's power supply. This work was focused in one of the sub-watersheds, Thika-Chania. Participatory mapping was conducted in this case to gain a broad understanding of the context within which farmers live in this agroecosystem.

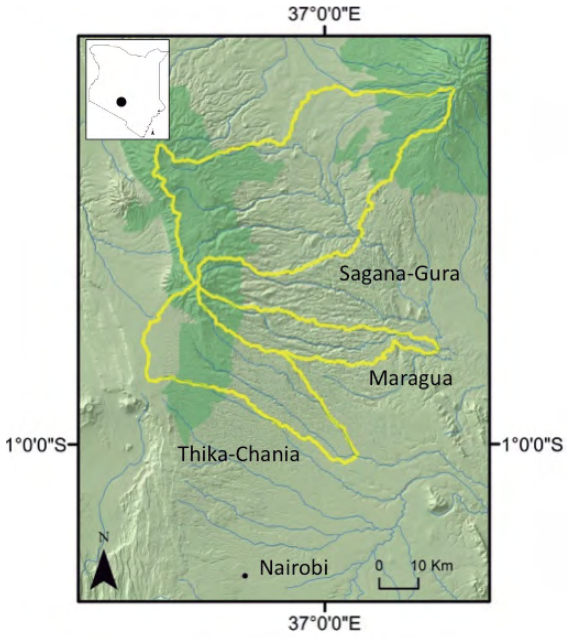

Figure 1. A map of the Upper Tana in Kenya showing the location of the three priority sub-watersheds (Thika-Chania, Maragua, Sagana-Gura) in relation to Nairobi. The green shaded areas are national parks.

Approach

Focus group discussions (FGDs), development of seasonal calendars and participatory mapping of ecosystem services were carried out with three communities (Karangi, Mbugiti and Gatunyu) in July 2015 in one of the priority sub-watersheds (Thika-Chania) identified by the Upper Tana-Nairobi Water Fund as critical for improving water quality and quantity in the basin (TNC, 2015). In each community, every activity was carried out with a group of men and a group of women. Two communities are situated in the tea zone on the edge of a forested national park (Figures 1 and 2). The third community is in the lower part of the watershed in the coffee zone.

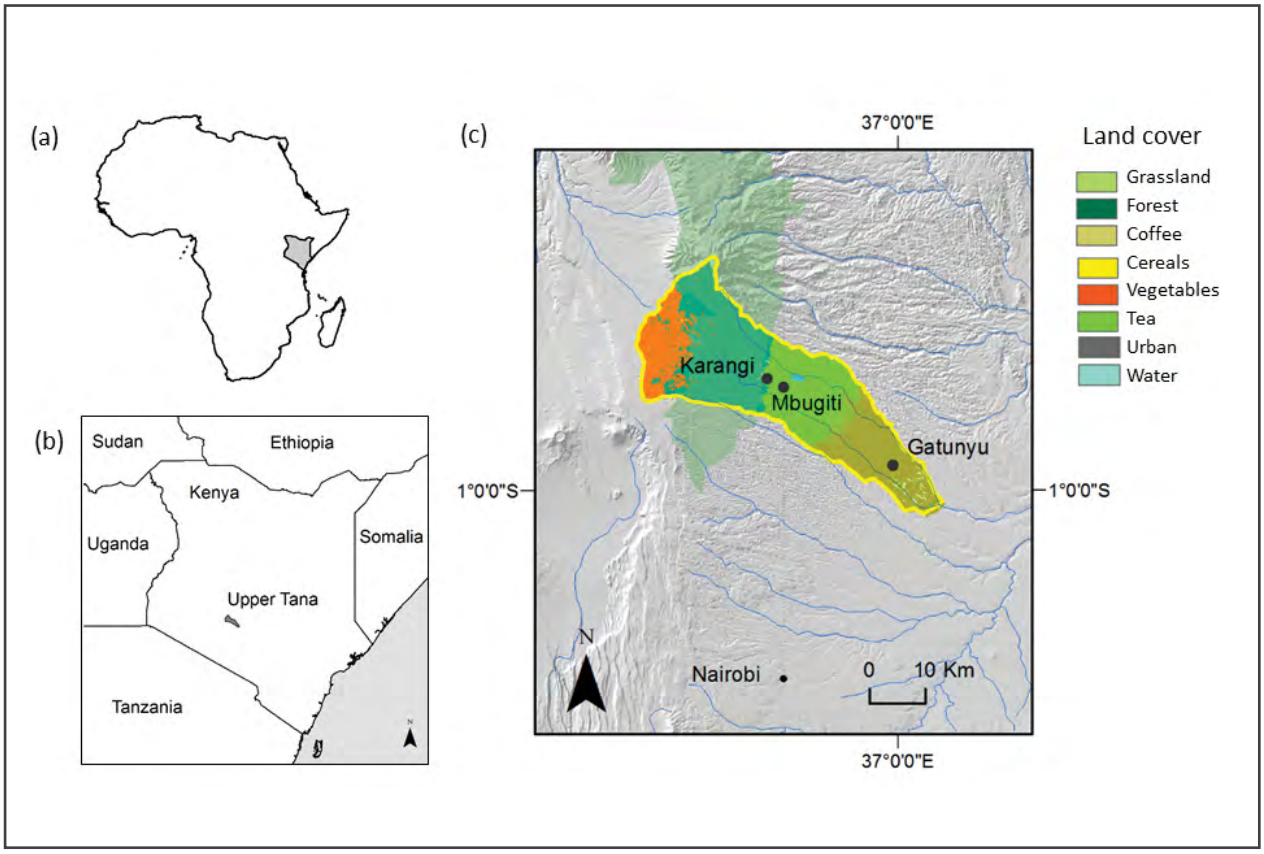

Figure 2. Schematic map with the study sub-locations showing the sites where participatory mapping was conducted in Kenya (Karangi in area 1, Mbugiti in area 2, Gatunyu in area 3). The schematic shows how water is funneled from Ndakaini Dam into the Kimakia River and then into the Chania River for intake into the water company that provides Nairobi with water.

Aims

Participatory mapping of ecosystem services was used in this research project to acquire a broad view of the local agricultural, economic, social and biophysical context of these areas and to get a sense of any differentiation in land use and access among communities and groups (men and women) that may exist and the implications this has for implementation of land conservation measures.

How the mapping was adapted for this case

- Maps showing the extent of the area within 3 and 5 km of each community were used together. In one community a map of the whole sub-watershed was also used.
- Taping the maps on to walls or on to the side of cars allowed maps to be displayed side by side so all participants in a group could view them. The legend was also taped beside the maps for easy viewing.
- The legend was simplified so that all information associated with cultivated areas was written on a white, square sticker and all information related to natural resources was written on a green, square sticker (Figures 3 and 4). This meant that communities could easily write what they were marking directly onto the sticker – all they needed to be told was the corresponding color. However, this might not work with communities where some individuals were not comfortable writing the resources on to the stickers.

Two maps showing the extent of the area within 3 and 5 km were used in each group. Here a women's group discuss the outcome of the mapping activity.

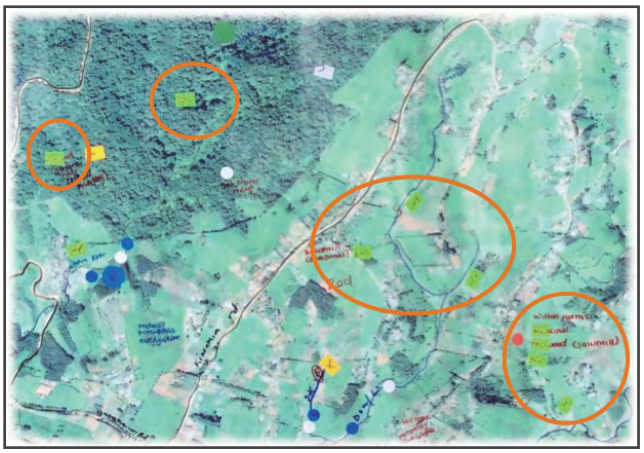

Figure 3. This map shows the green stickers (highlighted with red circles) with the related natural resources written on them using a simplified legend.

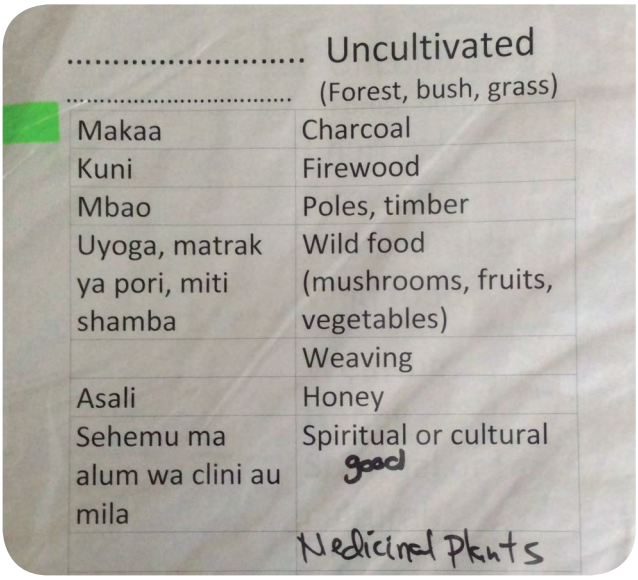

Figure 4. This simplified legend meant that participants used green stickers for all uncultivated goods and wrote the specific good on the sticker before placing it on the map (see above). This legend shows that additional items were added during the mapping activity (medicinal plants).

Tip

The facilitator should check that they understand what all the stickers say as some information may be in the local language. It is also important that the meaning of any new symbols adopted during the mapping process is recorded. This is especially important if the map is to be digitized as the person using GIS to digitize the map will need to know what all the symbols mean and may not have been present during the mapping process.

Process
How the step should be implemented

Results

Challenges

- Due to time constraints, all activities (FGDs and participatory mapping) were conducted within a day or less of each other and this limited the extent to which we could use the FGDs to adapt the mapping questions. Asking similar questions in the FGD and mapping activities can be one way of triangulating the information that is collected. However, if the activities are done within a small time frame, the questions can seem repetitive to the participants.

- It was challenging at times to get everyone involved in the mapping process. This can be overcome with good facilitation that engages all participants.

- The participants were selected by the assistant chief in charge of the sub-locations, with a criterion of representativeness across different socioeconomic backgrounds. It was difficult to ascertain whether this criterion was respected, but it is likely the villagers belonged to the medium-income group in the area.

- In this region of Kenya we found that there are few common pool resources available for use. Within the agricultural areas almost all land was privately owned, either by individual or company farms. The nearby forested area is under the control of either the Kenyan Wildlife Service or the Kenyan Forestry Service. There is restricted access to these areas, but most participants in the two communities we talked to near the forest said it was too far away for them to use. The participants said they obtain almost everything they need from their farms or they buy it. For example, they either grow or buy grass fodder for zero-grazing livestock and firewood. This means that many of the questions on the use of uncultivated areas and uncultivated products were not relevant and this part of the mapping process did not add value to the information gained in the FGDs. In this type of farming system, FGDs could be used to assess whether a mapping activity will significantly add value in terms of new information learned.

What worked well

- Sticking maps on to the wall allowed maps at different scales to be displayed side by side to help the discussion regarding the wider landscape. In all the communities, maps showing the extent of the area within 3 and 5 km of the communities were shown. In Gatunyu, an additional map showing the whole sub-watershed was shown, which elicited new conversations on water pollution within the area.

- Participants reported that they found it comfortable to be seated in chairs around a map stuck on to the wall, while sitting on the ground for 3 hours was too long and made them uncomfortable.

- Within the Gatunyu community numerous 'hot spots' were identified; these hot spots were perceived as being more prone to soil erosion.

Participants marking resources on the map. Chairs are more comfortable for the participants and good facilitation is required to draw all the individuals in the group into the conversation.

Key learning points

Differences and perspectives of women and men on resource use and access

- Both men and women tended trees although the men received the cash benefits when they sold any derived products.

- In all communities, men agreed that no crops were considered to be men or women's because both worked on the farm. However, women said that the cash crops (e.g. tea in the case of Karangi and Mbugiti and coffee in the case of Gatunyu) were considered to be men's crops because they generated higher income than other farming activities.

Water

- Both the men and women felt that their most important resource was water, for growing crops and watering livestock.

- Lack of water was highlighted as the biggest challenges faced by communities.

- River water quality decreased downstream due to farming and river water quantity has steadily declined for the past 10 years in certain rivers in the communities.

- During the dry season, the women went to the river early in the morning to fetch water. Competition was high as the river water level was very low at that time of the year. When the streams and rivers dried up, women dug holes up to 5 m deep to reach water in the riverbed.

- At the junctions of streams and where the valley was eroded, short-term flooding occurred during the heavy rains in April and May. Flooding damaged crops planted along the rivers.

Uncultivated areas and goods

- There were very few uncultivated areas within these farming communities because nearly all of the areas were cultivated or under plantation forestry. Natural areas were protected and their use was regulated.

- In the tea communities, the men said that the forest within the protected areas are used for collecting fuelwood, timber, poles, fodder and honey and for grazing and farming (using the 'shamba' system) for those who were licensed. There were restrictions however on the harvesting of these goods. Access to the forest was restricted to the dry season, but farming in the forest was allowed whenever the Kenya Forest Service cleared part of the forest. The women said that they did not collect products from the forest because it was regulated and it was far away, although they knew some people collected fodder from the forest.

- The only uncultivated area outside the forest were small grazing areas for livestock. Most products found in the forest were available on farms and the community rarely went to the forest because it was so far away.

- Most people (half of the households in Karangi) had access to electricity, but it was used for lighting only. The other main sources of energy were: kerosene, paraffin, charcoal, fuelwood and sawdust (the latter in Gatunyu only). Fuelwood was the most common source of energy due to its availability (i.e. it could be sourced from farms by pruning trees) and affordability (i.e. it was cheaper than the other sources of energy). Not many people used charcoal, as it was expensive. Fuelwood was a scarce resource due to a combination of decreased tree cover and increased population pressure. All communities used to collect fuelwood from common areas or from the forest but there are now few common areas. In Gatunyu, the community used to collect fuelwood from the coffee estates but they are now fenced off.

- Timber was usually taken from the felled trees in the farmers' compounds or bought from the sawmills.

Cultivated areas

- No areas were more productive than others – productivity depended on how the land was managed and how inputs were used.

Livestock

- Common grazing land was largely converted to agriculture in the 1980s and since that time cattle have been reared in zero-grazing systems.

- Zero-grazing systems have driven farmers to allocate areas of their farm to growing fodder crops instead of food crops (mostly Napier grass). However, dairy farming can contribute significantly to family incomes. During the dry season, farmers often had to resort to buying livestock feed. Cattle were watered from piped water supplies, but when these fail, water was obtained from rivers.

Soil

- Erosion was a major problem on all farmland and in the coffee zone. In the tea communities, soil erosion was not considered to be a major problem because the hillsides were covered in tea (which provides vegetation cover). Recently, terraces and strips of Napier grass were put in place to retain soil moisture, fertilizer and topsoil.

- In some places, erosion was so extreme that farmers could not cultivate anymore; instead they planted eucalyptus.

- Soil fertility decline was a major concern in all communities and participants attributed it to continuous cropping practices. Soil fertility decline led to a decline in yields.

Overall learning points

- Pressure on land was very intense and high population density put a strain on local resources such as farmland and rivers.

- There are currently no organizations implementing sustainable land management activities in any of the communities.

Who was involved?

The International Center for Tropical Agriculture (CIAT) through the EC-IFAD funded project *Restoring degraded landscapes through selective investments in soil quality in West, East, and Southern Africa* and the International Water Management Institute (IWMI) through the *Wise Up to Climate Change* project and its partners: the Basque Center for Climate Change (BC3), Jomo Kenyatta University and Moi University.

How was it funded?

European Commission (EC), International Fund for Agricultural Development (IFAD), CGIAR Research Program on Water, Land and Ecosystems (WLE), and the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).

Outputs

Comprehensive notetaking of the discussion generated by the mapping activity was essential for interpreting the map and capturing all the information that could not be easily mapped by the participants. A detailed report including notes and insights from all the discussions (FGDs, participatory mapping and seasonal calendars) was produced.

Finalised maps from participatory mapping

Maps can be useful tools for generating discussions even if they are not captured in a GIS. Comparing maps from male and female community members can help us to understand the role of gender and use of/access to natural resources. These maps can also be incorporated into land-use planning and used to help better characterize local farming systems (Figure 5).

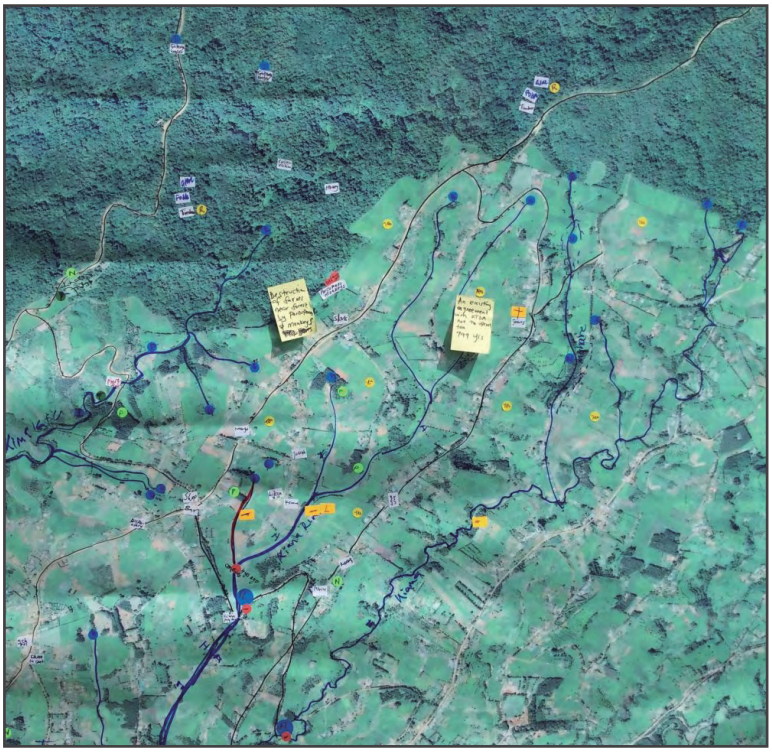

Figure 5. This map, identifying all the relevant resources and changes in their quality and quantity discussed during the mapping activity was completed by the community members in Karangi.

Identifying areas of degradation across the landscape

Once digitized, the maps could be used to identify areas of degradation across the landscape. A soil erosion hot spot map can be used to target areas for implementation of land conservation measures (Figure 6). A map showing the rivers with declining water quality can also be used to target areas for further monitoring and implementation of soil conservation measures (Figure 7). In the context of the Water Fund, the maps and insights from this activity can help incorporate farmers' perspectives in future integrated landscape planning and ensure that farmers benefit from land conservation measures upstream, helping in maintaining the long-term viability of the fund.

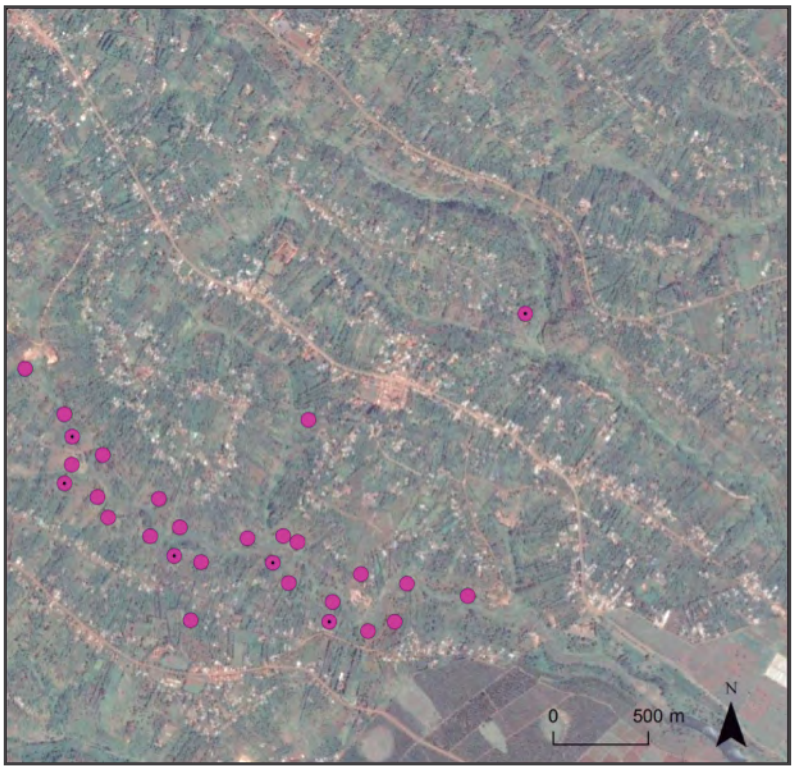

Figure 6. Soil erosion hot spots (pink circles) identified by both men (pink circles) and women (pink circles with black dots) in Gatunyu community based on the 3 km map, with a base map from Google Earth Pro.

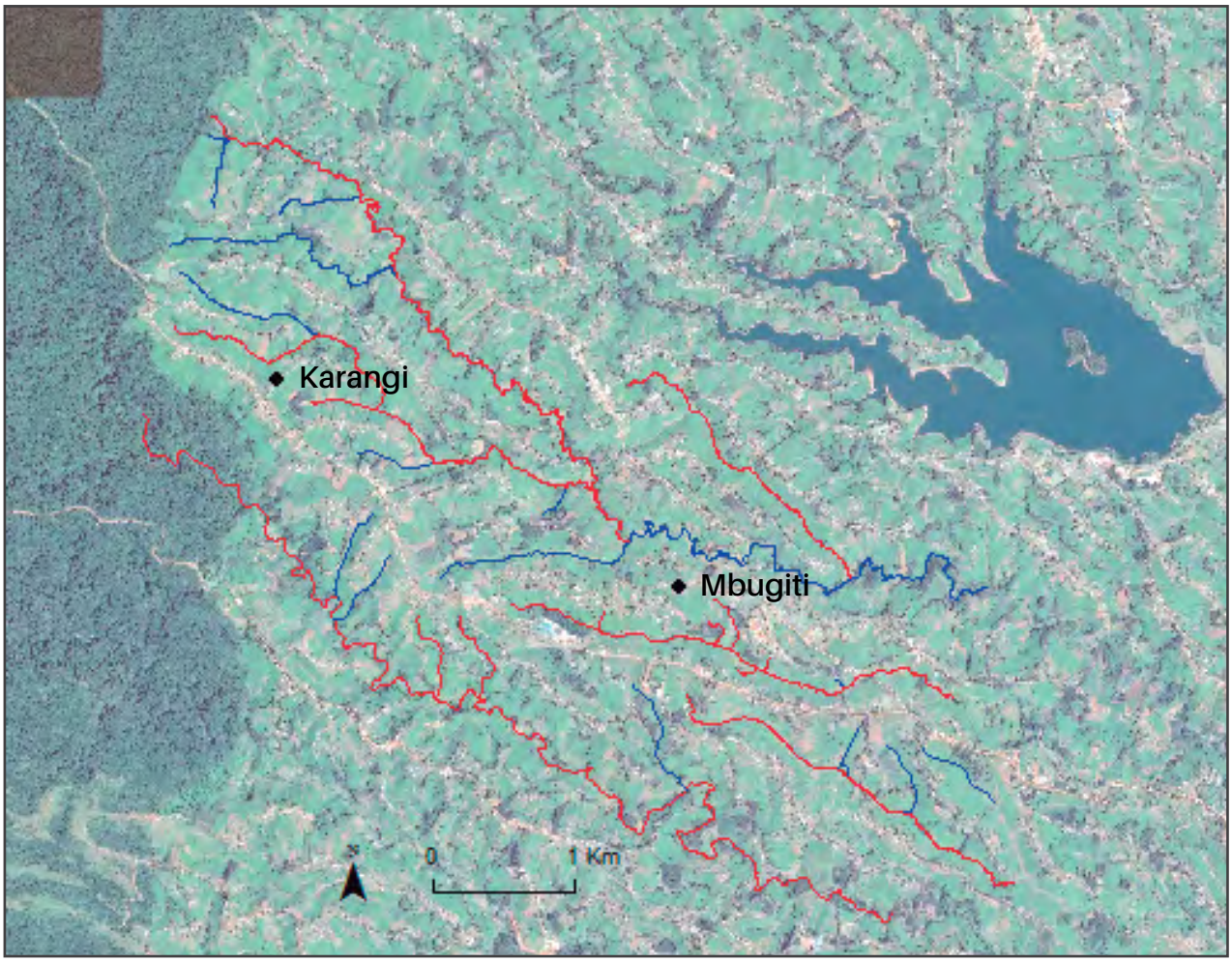

Figure 7. Rivers with declining water quality are shown in red for the two communities (Karangi and Mbugiti) in the tea zones, with a base map from Google Earth Pro. A wider area than was represented by the 3 km maps is shown to highlight proximity to the Aberdare Forest and Ndakaini Dam.

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