Tropentag 2009
University of Hamburg, October 6-8, 2009
Conference on International Research on Food Security, Natural Resource Management and Rural Development

On-farm Tree diversity Management for livelihood improvement and enhanced farm based diversity: Experiences from the East Mau Catchment, Nakuru, Kenya

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Key words: tree diversity, livelihood, agroforestry, multipurpose and soil fertility

Introduction

Many forest ecosystems of global value are often located in areas with high population densities, widespread poverty, and intensive agricultural land use. The two main objectives in such areas are sustainable livelihoods and biodiversity conservation, as the natural asset is the basis of small scale subsistence farming. Rapid population growth in the East Mau Catchment has led to expansion of cultivation, deforestation through logging, charcoal burning and firewood collection and overgrazing (Kenya Forest Working Group 2006). The forests cover remains paltry <2% against the UN recommendation of ≥10%. Economic and political reasons are increasingly limiting re-establishment of natural forests. Consequently, the agricultural landscapes become increasingly important frontiers for biodiversity conservation and livelihood provisioning.

The result of intensive cultivation of steep slopes without adequate soil conservation measures is soil impoverishment through soil erosion. The soil organic matter is reduced due to an absence of litter which is leading to low soil fertility, declining production and food insecurity (Krupnik and Jenkins 2006). Possibilities of increasing soil fertility by applying mineral fertilizers are limited for both ecological and economic reasons. There is therefore an urgent need to come up with alternative strategies to mitigate these problems. Although several technologies and management measures are in place, conservation programs in Kenya have produced only patchy and unsustainable conservation of soil and water resources.

Agroforestry has a high potential to prevent soil degradation and is increasingly becoming a vital tool for achieving the goal of biodiversity conservation and improving sustainable livelihoods (ICRAF 2009). However, its potential and limits of contribution are insufficiently documented. Understanding of farmer strategies in the management of on-farm tree diversity is critical for the successfully implementation of agroforestry programs.

In the East Mau Catchment five Ethnic groups live as small scale farmers with diverse cultural backgrounds, various farming systems and knowledge on plants. There has been little exploration of farmers' knowledge on tree and shrub species in the East Mau Catchment.

The aim of this study is to record the differences of preferred tree and shrub species among farmers of different agro-ecological zones and among three ethnic groups, settled in the East Mau Catchment and how these farmers maintain and cultivate their most important woody species.

Methodology

The Mau Forest complex is the largest remaining block of mountain indigenous forest in East Africa. It covers an approximate area of 350,000 hectares and is situated about 170 kilometers north west of Nairobi. The forest lies between 1,200 – 2,600 meters above sea level, with an annual bimodal rainfall of 2000 mm (Sang 2002). The mountain forest is one of the five main "water towers" in Kenya (Kenya Forest Working Group 2006).

Using a sample of 60 smallholder households an assessment of on-farm tree diversity was carried out, by conducting structured interviews with open ended questions. Three to six small scale farmers were interviewed per day between December 2008 and January 2009. The Interview took place in a casual situation on the farm and lasts between 30minutes and 1,5hours, depending on the number of tree and shrub species on the farm. The family decides who is qualified for doing the interview. Notes on participatory observations are taken between and during the interviews. The research team includes a translator.

The sample farms are selected along the cultural background and the location by multi-stage sampling in the upper zone and ad-hoc-sampling and snowball sampling in the lower zone (Table 0.1). The agro-ecological zones are related to the elevation. The upper zone is relatively close to the Mau Forest Complex.

Table 0.1 – Sample Selection

Agro-Eological Zone	Ethnic Group and Sample size (Number of Farms)		Villages
Upper Zone 2350 – 2640masl	Kalenjin (16)	Ogiek (14)	Nessuit, Sigotik
Lower Zone 2130 – 2250masl	Kalenjin (14)	Kikuyu (16)	Sosiot, Kamwaura

Source: Own data

The interview consists of three sections: the demographic information of the respondent, the plant identification and the farmers' knowledge, perceptions and constraints. Shrub and tree species, which are identified as useful by respondents themselves, are inventoried while walking around on the farm. Species under 50cm height and without specific purposes for the farmers were ignored. For data analysis and presentation SPSS 15.0 is used.

Results and Discussion

Interview situation and demographic analysis

Notes were taken, while interviewer and respondent circuit the farm for recording plant species of specific purposes. Although one respondent was identified, situational other family members or neighbors were involved for expertise. Afterwards the farmer's preferences and perceptions, constraints and knowledge were identified. The interview was finalized with an unconventional discussion, which can be regarded as narrative interview. As a result of participatory observation, mainly women are the first person to talk to. Although 56 of 60 households are lead by men, there are 41 women and 19 men responding the questionnaire. In average families live since 22 years at their farms (7 to 68 years). Age of the household head varies between 20 and 87 years.

Field walk – plant identification

The botanical inventory was made along farmers' choices on plants with a height above 50cm. Farmers identified the purposes of the selected plants and show the identified species on their farm. 194 different plant species were identified, whereof 52,7% are tree species. 62,4% of all mentioned species are indigenous.

On average each respondent identified 17,8 plant species (min and maximum are 8 and 31 respectively) which are used on the farm whereof 9,4 are tree species (min and maximum are 2 and 22). Considering the Agro-ecological zones slightly more species, 19,4, were mentioned by farmers in the upper zone. Considering Ethnic group it can be observed that most tree species11,9 on average, are mentioned by Kikuyu farmers. The least number of tree species, 6,7 on average, were identified by Kalenjin farmers, who are traditional pastoralists. Both groups are situated in the lower zone. This reflects the situation of land ownership, which is quite diffuse in the upper zone and planting trees is meant to help claiming property rights. In the upper zone Kalenjin farmers identified 11 tree species, while Ogiek farmers identified only 7,6 tree species on their

farm. It needs to be considered that Ogiek people have rights to use parts of the forest as their ancestral land.
57,6% of all mentioned plants are actively planted, while others are retained or found on the farm. 65,5% of the actively planted species are trees. The plant species originate mainly from nursery, seeds/own farm, neighbour and forest (32,2%, 28,8%, 20,3% and 15,3% respectively).
Only 16,9% of all plant species are bought in tree nurseries or at neighbours. The rest of the plants are obtained from own farm, neighbours, forest or riverbank. Regarding actively planted tree species 28,1% are bought. *Cupressus lusitanica, Grevillea robusta, Pinus patula, Eucalyptus camaldulensis, Persea americana* cover 50% of species received from a nursery. The most frequent mentioned purpose of these plant species are Building and Construction, Firewood and Food.

Table 0.2 Trees identified by farmers along Agro-ecological Zones

Upper Zone			**Lower Zone**		
Indigenous	*Dombeya torrida*	30	**Indigenous**	*Croton megalocarpus*	25
	Olea europaea ssp. africana	21		*Dombeya torrida*	11
	Acacia mearnsii	11		*Acacia mearnsii*	9
	Nuxia congesta	11		*Acacia xanthophloea*	9
	Juniperus procera	9		**Total**	**111**
	Maytenus senegalensis	9	**Exotic**	*Cupressus lusitanica*	25
	Polyscias fulva	9		*Persea americana*	24
	Total	**168**		*Eucalyptus camaldulensis*	22
Exotic	*Cupressus lusitanica*	25		*Grevillea robusta*	22
	Grevillea robusta	18		*Pinus patula*	15
	Pinus patula	13		*Citrus sinensis*	11
	Eucalyptus camaldulensis	11		*Eriobotrya japonica*	9
	Persea americana	10		*Callistemon sp.*	8
	Total	**111**		**Total**	**173**

Source: Own data

Error! Reference source not found. gives an idea of the differences, regarding trees grown on the farm, within the two agro-ecological Zones. The total numbers show more indigenous tree species are grown in the upper zone on the farms. *Dombeya torrida* is a very common tree, grown in the upper zone used for firewood, bee forage, medicine, building and construction. Ogiek people are famous for honey production, which is linked with their tradition and it is in general very common in the area around Nessuit (upper zone). *Olea europaea* is mainly used in the upper zone for firewood, medicine and for cultural purposes among Kalenjin and Ogiek people. *Cupressus lusitanica* is the most important exotic tree, used for building and construction and firewood. *Croton megalocarpus* is mainly used in the lower zone for firewood, charcoal and medicine. Farms in the lower zone are far away from the forest and it is important to supply firewood on the own farm. Fruits of *Persea americana* - mentioned only five times in the upper zone - is mainly used in the lower zone as food. A reason probably is the better connection to the local markets in the lower zone.

Farmers in the lower zone are more likely to actively plant trees and shrubs, actually 82,9% of the plants in the lower zone are actively planted compared to 39,6% in the upper zone. The close distance to the forest is a reason why more plants grow by themselves as seeds are easily spread naturally and more seeds remained in the soil since major deforestation activities for settlement.
Nearly half of the planted trees in the lower zone originate from own farm's nursery or seedbed. This terminate that farmers in the Lower zone are more likely to run an own tree nursery, which

concludes in their knowledge on seed harvesting and maintenance of seeds. In the upper zone it's easier for farmers to receive seedlings from the forest and transplant them on their own farm.

General constraints and farmer's perceptions

Almost all farmers are aware of the importance of the trees to conserve the Mau Water Catchment. The trees are strongly related to the climate in the area and further to the productivity of their fields, soil moisture and human health. Farmers value the environmental services of the forest. Trees "attract rain", "make a beautiful climate", "improve agricultural production on the farm" and conserve resources for "future generations" (farmers' answers).

Especially during the dry season the effects of drought are tremendous. Only 4 farmers out of 60 are not convinced that there is a positive relation of their trees with the water catchments area. One farmer mentioned a positive relation, but doesn't recognize enough effort by his neighbours, the government and other actors in the MauForest – His trees have the same effect like "a drop in the ocean".

A high biodiversity of species is important to all farmers, as it helps "to be self sufficient" and lowers the farms expenses. Most of the interviewees desire more trees on their farm. It is notable that the issue of cost is not mentioned as the main constraint to grow more trees, but accessibility to seedlings/seeds, especially fruit trees and some indigenous varieties of cultural value, and the lack of knowledge on maintaining trees. Often the next tree nursery is quite far away or doesn't supply farmers with preferred species.

40 out of 60 farmers mentioned drought next to disease/pest/fungus and destruction by people or animals as a reason why seedlings do not survive. Reasons like drought, diseases, climate or rocky ground can not be influenced by the farmers. Opposite to destruction, poor transplanting, immature seeds, and soil fertility could be improved with proper farming techniques like protection, knowledge on seed harvesting and transplanting, and composting as a measure to improve soil fertility. Farmers know about many techniques like pruning, weeding, watering, fencing/protection and manuring to maintain seed/seedlings on their farm, although they don't seem to use them. Often trees are meant to grow by themselves. For example fencing/protection is mentioned as an important measure for maintaining trees, while destruction by animals and people is mentioned as a main reason why seedlings do not survive.

Conclusion and Recommendations

In general all farmers were very interested in helping with the interview and seemed to be very honest and serious, as their trees and the deforested area are one of their major concerns. They are very curious to contribute for restoring the forest and their harmed environment. Especially within the Ogiek community, the farmers know a lot about the specific use and preparation of plants as medicine. But they often lack of knowledge about seed collection and maintaining of seedlings. Within the Kikuyu community knowledge on tree nursery and maintaining of seedlings is very common and widespread.

Most of the farmers see a positive relation of the trees on their own farm to the Mau Escarpment. Farmers are very strong aware of the negative effect of deforestation, but still they require to meet their needs. Farmers, especially in the upper zone seemed very likely to adopt new farming systems and techniques if they were shown to them. They are very keen to plant more trees on their farm, not only to support themselves with various products, but also to improve their environment and to reforest the area.

Although cultural heritage is a taboo in Kenyan society, especially since the post election violence in 2008, clanship needs consideration when implementing sustainable agricultural systems like agroforestry.

Acknowledgements

We are grateful to the Austrian Government through Organic Agriculture with Trees (OAT) project which facilitated the research work for this paper.

References

ICRAF 2009.World Agroforestry Centre. Reviewed 2009-09-06. http://www.worldagroforestry.org

Kenya Forest Working Group 2006. Changes in Forest Cover in Kenya's Five Water Towers 2003-2006. Reviewed 2009-09-06: http://www.kenyaforests.org/index.php?option=com_remository&Itemid=79&func=select&id=1

Krupnik Timothy J. and Jenkins Marion W. 2006. Linking Farmer, Forest and Watershed: Agricultural Systems and Natural Resources Management Along the Upper Njoro River, Kenya. University of California International and Area Studies Digital Collection.

Sang J. 2002. The Ogiek Land Question. Indigenous Rights in the Commonwealth Project Africa Regional Expert meeting. Indigenous Peoples of Africa Coorcingaing Conference Committee. Cape Town, South Africa. October 16-18. 2002.