Journal of Agricultural Economics and Development Vol. 4(3), pp. 030-036, March 2015
Available online at http://academeresearchjournals.org/journal/jaed
ISSN 2327-3151 ©2015 Academe Research Journals

Full Length Research Paper

Linking forest management and community livelihoods: The case of Pare and Usambara mountains ecosystems

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Accepted 18 March, 2015

This paper provides a critical review of the existing literature on livelihoods and forest ecosystem management for the Pare and Usambara Mountains. Disconnect in the scientific literature between community livelihoods and forest ecosystem management is what prompted this work. The paper was developed based on desk study by reviewing the existing literature of forest ecosystem management and community livelihoods focusing on Pare and Usambara Mountains. It is clear from the literature that forest ecosystems on the Pare and Usambara Mountains are undergoing various forms of degradation. Much of the destruction occurred in the period between 1975 and 1980s. Deforestation and forest degradation is associated with human activities as sources of livelihoods for the surrounding communities. Motivation being that communities have small plots for crop production due to land fragmentation and hence food produced cannot sustain their livelihoods. Community dependency between highland communities and lowland communities is among the livelihood strategies. Pockets of forest remnants left in the agricultural field seem to have high biodiversity richness (flora). However, these pockets do not have similar ecological integrity as an intact ecosystem. Degradation of the forests will also compromise ecosystems' goods and services accrued to the downstream communities of which the highland communities also depend on for their livelihoods. Integrated and landscape approach is the best way to sustainably manage the forests.

Key words: Forest, deforestation, community livelihoods.

INTRODUCTION

This paper provides a critical review of the existing literature on forest ecosystem management and livelihoods of surrounding communities in the Pare and Usambara Mountains. The mountains are part of the Eastern Arc Mountains (Figure 1). It is often the case that despite acknowledging community involvement in forest degradation, community livelihoods and forest management aspects are analyzed in isolation in most of the existing literature. It is this disconnect in the scientific discussion that prompted this review. The paper is mainly based on the review of the existing literature. The essence here is to establish the cause and effect relationships, so as to forge the best ways in which sustainable forest ecosystem management can be viewed in a manner that contribute to the enhancement of community livelihoods and vice versa.

Pare and Usambara Mountains Forest Reserves are part of the Eastern Arc mountains Forests (Figure 1 and Table 1). White (1983) describes the Eastern Arc as a sub-region of the Afromontane centre of endemism and points out that this is unique in its long-term stability and isolation, and shares affinities with both the East African Montane forests and South Malawi Montane forests – and to a lesser degree with the Albertine Rift Montane forests and Ethiopian Montane forests (Kingdon, 1989). Generally, the forest vegetation has been categorized into upper montane (1800 - 2900 m), montane (1250 - 1800 m) and submontane (800 - 1250 m) forest (Pócs, 1976). At higher altitudes, the forests become dwarfed and are covered with lichens (URT, 2006). These forests constitute what is probably one of the richest biological communities in Africa in terms of plant and animal species numbers and endemic taxa (Rodgers and Homewood, 1982). Endemic forest plants are reported to occur throughout the elevational range of forests (Burgess et al., 2002). Thus, loss of a forest cover will certainly lead to loss of species (URT, 2006; Burgess et al., 2002).

STATE OF FOREST ECOSYSTEMS

Studies have documented forest loss in the Pare and

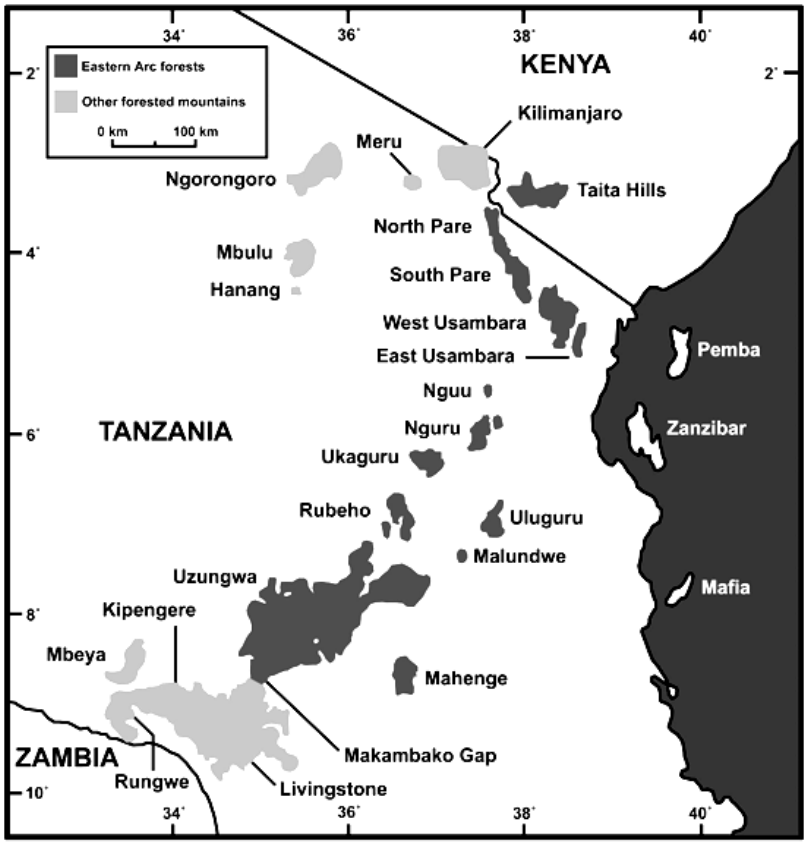

Figure 1. Eastern Arc Mountains.

Table 1. Size for Pare and Usambara Mountain blocks and coverage of forest and woodland.

S/N	Mountain Block	Size (Ha)	Forest Area (Ha)	Woodland (Ha)
1	North Pare	45,340	2,720	510
2	South Pare	157,810	13,850	3,590
3	West Usambara	244,780	31,890	14,460
4	East Usambara	108,200	26,270	6,040

Source: Extracted from URT (2006).

Usambara Mountains forest ecosystems (Tables 2 and 3). This is because these blocks are highly populated. Much of the forest and woodland destruction occurred in the period between 1975 and 1980s. Thus deforestation is due to a number of factors, including fire, clearance for new farmland, pit sawing, harvesting for building materials (timber and poles), medicine and fuel wood (Burgess et al., 2002; Malimbwi and Mugasha, 2001; Maliondo et al., 2000; Zahabu and Malimbwi, 1998; Kaoneka and Solberg, 1994; Bjørndalen, 1992). Air photograph analysis shows a forest decrease of some 50% in the vicinity of Amani from 1954 to 1976 (Rodgers and Homewood, 1982). Moreover, Kingazi et al. (2007) reported that the volume of timber resources harvested in Chome Forest Reserve (South Pare Mountains) is among the highest known for the Eastern Arc forests. Over 72% of this volume consists of high value timber species, making this resource an extremely desirable option for income generation (Kingazi et al., 2007). Ylhäisi (2004) further reports that the loss of indigenous forests in the North Pare Mountains during 1982 - 1997 was 31%, and the loss of all types of forest was about 37%. During the same period, the cultivated land area increased by 68%.

According to Kingazi et al. (2007), the main reason for such massive timber extraction is that those villages surrounding Chome Forest Reserve experience serious

Table 2. Summary of forest area changes over time in Pare and Usambara Mountain Blocks.

S/N	Mountain Block	Forest area in 1970s (ha)	Forest area in late 1980s/early 1990s (ha)	Forest area in 2000s (ha)	Forest area change 1970s-1980/90s (ha)	Forest area change 1980/90s-2000s (ha)	Forest area change 1970s-2000s (ha)	Proportion of forest loss 1970s-2000s (%)
1	North Pare	2880	2720	2720	160	0	160	6
2	South Pare	15220	13860	13850	1360	10	1370	9
3	West Usambara	35440	32110	31890	3330	220	3550	10
4	East Usambara	29890	26540	26270	3350	270	3620	12

Source: Extracted from URT (2006).

Table 3. Summary of woodland area changes over time in Pare and Usambara Mountain Blocks.

S/N	Mountain Block	Woodland area in 1970s (ha)	Woodland area in late 1980s/early 1990s (ha)	Woodland area in 2000s (ha)	Woodland area change 1970s-1980/90s (ha)	Woodland area change 1980/1990s-2000s (ha)	Woodland area change 1970s-2000s (ha)	Proportion of Woodland loss 1970s-2000s (%)
1	North Pare	940	560	510	380	50	430	46
2	South Pare	4710	4280	3590	430	690	1120	24
3	West Usambara	33650	23950	14460	9700	9490	19190	57
4	East Usambara	15550	12020	6040	3530	5980	9510	61

Source: Extracted from URT (2006).

land scarcity. In this regard, timber harvesting is the source of livelihood. Household agricultural plot sizes are as small as less than 0.44 ha. Here, population density is about 13 persons per hectare. This is partly due to land fragmentation through inheritance. Thus, limited livelihood options, high timber demands and poor resources accessibility are the major drivers of illegal timber harvesting in the reserve by adjacent communities. Illegal timber harvesting was estimated at 100.7 thousand m^3 per annum between 1998 and 2001 (*ibid.*). Lulandala (1998) argued that growing human populations, adjacent to the biodiversity centres and without alternatives, continue seeking their forest-based material needs from the forests, and some of the most sought-after products come from endemic species, thus contributing to biodiversity loss. Part of the reasons for forest degradation put forward by Kajembe et al. (2003) are that there had been institutional changes in management of forests, which had a negative impact on forest conservation. The presence of traditional institutions which included, among others, traditional healers, traditional leaders, traditional taboos, sacred species and sites, had active roles in conserving the forest.

COMMUNITY LIVELIHOOD OPTIONS

Communities surrounding forest reserves in the Pare and Usambara Mountains depend mainly on agriculture for their livelihoods (Sayula et al., 2011). A study conducted in Lushoto showed that the land available for each household includes both land that is owned by the household and land that is rented. About two-thirds of households have access to less than one hectare of land and one-third have between 1 and 5 ha. None of the surveyed households own more than 5 ha. But also much of the land has been experiencing declining soil fertility and severe soil erosion due to increased cultivation and other factors attributed to population pressure (Semgalawe and Folmer, 2000). As a result, communities also depend on off-farm activities as source of livelihood.

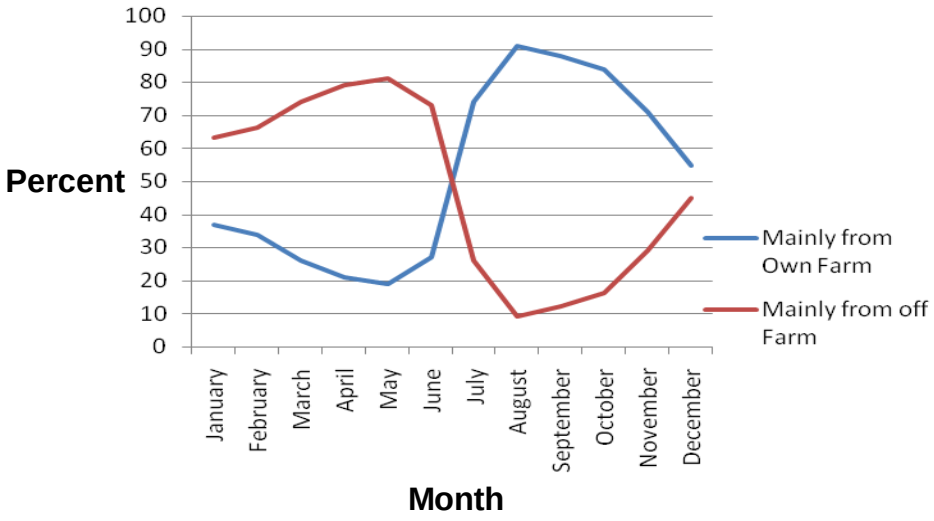

Figure 2. Percentage of households getting food from own farms and off-farm sources.
Source: Sayula et al. (2011).

For example, over half of the households depend on other peoples' farms as a source of income. Remittances are also an important source of cash income for one-half of the surveyed households. Thirty-four percent are receiving some income from small businesses (*ibid.*).

The study further show that food deficits are high from January to June, May being the highest, when 81% of households report that food comes mainly from off-farm sources (Figure 2). The food deficit months are those before harvesting. These are the months where cash is especially needed to buy foodstuffs from shops and markets. Thus, over one-half of households experience food deficits for 6 months of the year. Only 4% are 'food secure' all year long. About 7% of the interviewed households reported to have access to enough food for their families for at least 10-11 months of the year. About 26% of these households struggle to get enough food to feed their family for 3-4 months/year. Also, about 27% face 5-6 months of food deficit, and over one-third experience food deficit for more than 6 months per year (Sayula et al. 2011).

The shortage of food is bound to get worse in the future in view of the anticipated climate change impact which would lead to temperature increase and alteration of rainfall pattern thus leading to incidences of crop failure and thus decline in crop yield. This may have serious consequence on nature forest as the majority would depend on off-farm activities for their livelihoods.

According to Jambiya (1998), land scarcer and stagnated returns from agriculture have contributed to out migration of the youthful male population to other districts in the lowlands and urban areas, and declining circular migration to such large towns as Dar es Salaam, Tanga, Moshi and Arusha. Likewise, Wangui et al. (2012) established evidence of a high degree of community interdependence along environmental gradients from high to low altitude. Similar findings are also reported by Yanda and Shishira (2009). This provides avenue for livelihoods of communities surrounding forests in the Pare and Usambara Mountains.

Forests are also reported to be important source of livelihoods. Non-wood forest products contribute through direct consumption of harvested wild foods and indirectly through income generation (Kajembe et al., 2000). A study conducted by Msuya et al. (2010) identified 114 indigenous forest food plant species representing 57 families used by communities living adjacent to the Uluguru North (UNM) and West Usambara Mountains (WUM). This is one of the important off-farm sources of food for their livelihoods. The finding by Fleuret (1979) showed that in Lushoto District, vegetable relishes prepared from the foliage of wild plants are an integral and essential element in the diet of the people at all seasons of the year. Introduced cultivated vegetables are not replacing wild relishes. In this regard, therefore, degradation of forests poses a major food security challenge to the surrounding communities. On the other hand, community dependence on forest products for their livelihoods should form a catalyst for them to effectively engage in forest management.

IMPLICATIONS ON FOREST ECOSYSTEM MANAGEMENT

It is evident from the literature that land is a limiting factor due to increasing population and poor land productivity. This has resulted into individuals owning small land holdings scattered within or outside the village. To maintain its productivity, one requires making some investment. However, most of the conservation activities

are expensive. For instance, terracing which is a key to soil conservation and water infiltration is labor intensive and many farmers cannot afford it. Tree planting requires buying of seedlings yet the majority of farmers are poor bound, thus cannot afford to buy seedlings (Sayula et al., 2011).

As most peasants have limited alternative means of production, the expansion of farmlands is achieved largely through clearing of natural forests, thus, contributing to deforestation and degradation of forest ecosystems (Kaoneka and Solberg, 1994). This would ultimately lead to loss of biodiversity and degradation of other ecosystems goods and services derived by the forest ecosystems. However, a study conducted by Munishi et al. (2008) in West Usambaras identified 47 tree species belonging to 23 families and used by local people for various purposes in the agricultural fields. These species are indigenous and were retained from existing ones during farm clearing.

Munishi et al. (2008) further established that the species diversity is comparable with that of adjacent natural forests. There are apparently high on-farm tree species richness and diversity, the conservation of which can contribute to *ex-situ* biodiversity conservation. Authors conclude that on-farm tree management should be encouraged, especially where there is population pressure on the existing natural forests. A related study conducted by Musuya and Kidegesho (2009) identified nine traditional practices for conservation of wild plants as domestication, beliefs in sacredness of trees, beliefs in sacred forests, respect of cultural forests, protection of plants at the burial sites, selective harvesting, secrecy, collection of deadwood for firewood, and use of energy-saving traditional stoves. Through botanical surveys of sacred forests, cultural forests, farms/homesteads, and burial sites, some 1,518 wild plants belonging to 100 species were identified. This study also concludes that the traditional management practices have a significant role in the conservation of biodiversity. Ylhäisi (2004) also reports traditionally protected forests (TPFs) and riverine forests to constitute about 1/3 of the size of closed forests inside the Forest Reserves in the North Pare Mountains. Lulandala (1998) further recommends that effective future biodiversity conservation strategies will not lie in the routine *in situ*, but through radical *ex-situ* conservation.

These studies fall short of the fact that *ex-situ* (on-farm) conservation cannot have the same value as the natural ecosystems (Fleuret, 1980). These studies only present some elements of biodiversity resources that the natural ecosystems harbor. Furthermore, fragmentation nature of the *ex-situ* conservation may not offer good habitat for species with long home range. Likewise, such parcels will not offer ecosystems goods and services as compared to the natural ecosystems. Such goods and services include: water provision, carbon storage and capture and habitat (for flora, fauna and avi-fauna). Continued degradation of natural forests could lead to alteration of hydrological regime and thus affect water availability downstream (lowlands such as Pangani Basin). Moreover, cleared land will be exposed to soil erosion in the farms and hence contribute to siltation of water bodies downstream.

Community engagement through Participatory Forest management has recently been seen as an avenue to effectively engage communities in forest management. Thus management regime has been sought to be a way to ensure sustainable forest management. However, a study conducted in Ambangulu Mountain Forest revealed that transaction costs relative to benefits for CBFM were found to be higher for poorer households compared with medium income and richer households (Meshack et al., 2006). Higher income groups obtained the most net benefits followed by medium and poorer households. Community involvement in forest management may lower the transaction costs incurred by government, but a large proportion of these costs are borne by poorer members of the community. Transaction costs are critical factors in the success or failure of CBFM and need to be incorporated into policies and legislation related to community-based natural resource management (Meshack et al., 2006). Carbon payment through REDD+ and other community engagement in environmentally friendly activities like beekeeping could provide additional incentive for community engagement in forest management. However, careful consideration has to be made in operationalizing these opportunities. Communities should be on the decision making position to make these initiative successful.

CONCLUSION

The literature shows that community livelihoods are the major drivers of forest degradation in the Pare and Usambara Mountains. Continued degradation of forest ecosystems will deprive forests the capacity to offer ecosystems goods and services which are vital to the welfare of communities downstream. Moreover, degradation of such goods and services will also compromise dependence of such services by the communities in the highlands as well. This cause and effect relationship calls for integrated and landscape approach in addressing deforestation and forest degradation as this will affect all regardless of the location. Climate change will add additional stress on the forest ecosystems, thus degrading provision of goods and services. The currently available wild food is to be limited due to climate change, thus enhance community food insecurity. There are however, a number of research questions that require further investigation:

(1) Characterization of social groups who is involved in deforestation and forest degradation (is it the poor or the rich)?
(2) What are the motivations for such deforestation and

forest degradation?
(3) How has climate variability been affecting availability of wild food in the forest (abundance during the extreme wet period as compared to the extreme dry period)?
(4) How much does wild food contribute to the household food budget in a year for different social groups?

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