

## **Community Lessons on Participatory Forest Management (PFM) Performance within the Mau Forest Complex, Kenya**

*Dr. Stanley M. Makindi, Ph.D.*

*School of Environment and Natural resources management,  
Machakos University*

*P.O. Box 136-90100, Machakos, Kenya*

*Email: [mankindsm@gmail.com](mailto:mankindsm@gmail.com)*

*Tel: +254 722 228001*

### **Abstract**

Forest resources are faced with challenges that range from mismanagement, overutilization, conflicts and competing claims. Consequently, this has given rise to legislation and policy to protect forests. However, many governments in the developing countries have difficulties in implementing sustainable forest management (SFM). One of the strategies advocated to foster SFM is participatory forest management (PFM). The PFM approach has been practised formally in Kenya since 2005 when the Forests Act of 2005 came into force. The aim of this study was to assess PFM performance since the inception of three project areas (Nairotia, Nyangores and Olenguruone) in the Transmara Forest Block within the Mau forest complex, Kenya. The data and information ranged from reviews from field meetings and in-depth focus group discussion with Community Forest Associations (CFAs), Kenya Forest Service (KFS) officials and various key stakeholders. The results indicated that there are variations in results and progress towards PFM implementation in Kenya. While a number of activities had been carried out at each of the CFAs reviewed in the study, there was variation in terms of how the forest management agreements and plans were being implemented. In particular, the level of community and stakeholder participation, number of consultative meetings held and level of donor funding to facilitate participatory forest management plans (PFMP) development and project activities. A number of issues were also noted by CFAs as having been omitted in the management plans, specifically, benefit sharing. Absence of benefit sharing framework was cited often as a major drawback in PFM as it has constrained some of the anticipated benefits from forest activities. However, the community members indicated that there was improved awareness amongst them on the need to conserve the forest resources and controlled access to sustainable utilization of the forest resources.

*Key Words: Community, Sustainable, Participatory, Management plan, Forest Association*

## **Introduction**

Kenya's forests have been managed under command and control beginning with the East Africa Forest regulations of 1902 which was later expanded into Forest Ordinance of 1911. The evolution saw the forest legislation undergo several amendments in 1941 to 1954 to capture the Constitutional changes in the then Kenya Colony. In 1964 further reviews resulted into the Forest Act Cap 385 which provided for establishment, control and acquisition of forests in independent Kenya.

Communities participated in forestry matters as forest workers on a paid basis or as cultivators who were instrumental in the establishment of industrial plantations under the *Shamba System* (now PELIS – Plantation Establishment through Improved Livelihood System). The increased forest destruction in 1970s, 80s and 90s was mostly blamed on inappropriate and non-inclusive forest governance policy and legislation (Nurse and Edwards, 1993). There was a general trend of decline of forest land from 1990 to 2000 due to degazettement of forestland to open up areas for agriculture especially in the Mau ecosystem (FAO, 2015). Consequently, in 2005 the Government of Kenya ratified a new Forests Act replacing Cap 385 (GOK, 2005). The act, generally referred to as the Forest Act 2005 introduced a new paradigm shift in forest management in Kenya. Under the Act, community participation is provided for through participatory forest management (PFM) as a major tool.

*According to section 46 (1) of the Forest Act, a member of a forest community may together with other members or persons resident in the same area register a community forest association (CFA) under the Society's Act. According to section 46(2), an association registered under section (1) may apply to the Director of Forest Service for permission to participate in the conservation and management of a state forest or a local authority forest in accordance with the provisions of the Act (GoK, 2005).*

Forest management has been decentralized to include forest adjacent communities and other stakeholders in management through the introduction of PFM (Ameha *et al.* 2014). Participatory forest management is a process and an approach in which a group of local individuals exercise some control in the use of the local forests especially those that are found within their local communities. It includes activities of forestry enterprises and public forest services, which encourage and assist forestry activities at the community level. Other features of PFM entail the sharing of authority, responsibility, revenues and duties with the organization responsible for forest management (Ribot *et al.*, 2006; Saarikoski *et al.*, 2010).

The PFM approach is often held out as the instrument of choice for effecting an inclusive and equitable forest management in gazetted forests. Significant investment has been made to operationalise PFM. Reliable information on performance of PFM in the field however is lacking. The anticipation is that the development and implementation of PFM in a forest area would, among others, result in the following (Agrawal *et al.*, 2008; Hjortso, 2004; Somanathan *et al.*, 2009);

- empowerment of marginalised groups through recognition of rights and responsibilities
- stronger partnerships and alliances against external conservation threats
- Enhanced incorporation of scientific approaches to forest management.
- Enhanced involvement of the forest adjacent communities and other stakeholders in forest conservation,
- Minimization of conflicts with forest adjacent communities and other stakeholders through enhanced mechanisms for working together,
- Creation of opportunities for local people and other stakeholders to contribute towards protection and rehabilitation of forest resources and hence share the costs of management,
- Support of sustainable forest-based livelihoods in poor rural communities.

Participatory Forest Management involves many stakeholders that have different roles and responsibilities (Somanathan *et al.*, 2009). The main Stakeholders in Forest Management in Kenya are; Kenya Forest Service (KFS), Forest Adjacent Communities, Community Forest Associations (CFAs), Other Government Agencies (Local Authorities, Water, Agriculture, KWS, Regional Authorities, Wood Industry (pulp, paper, sawmills), Private Sector (lending institutions, tea estates) and Civil Society Organisations (CSO's) and other Non-governmental Organizations (NGOs).

Government institutions led by KFS play regulatory and supervisory roles. The functions of CFAs is to formulate and implement forest programmes consistent with the traditional forest user rights of the community concerned in accordance with sustainable use criteria. It also assists the Service in enforcing the provisions of the Forest Act and any rules and regulations made pursuant thereto, in particular in relation to illegal harvesting of forest produce. The role of CSOs and other NGOs entail resource mobilization, lobbying and advocacy as well as

capacity building and community mobilization. The Private Sector on the other hand is involved in providing marketing outlets, technology development and transfer, financial and other resource mobilization and forest development (woodlots, forest estates). To ensure the continuity in effective forest management there is need to ensure the smooth operation of CFAs (Agevi *et al.*, 2014; Ongugo *et al.* 2007).

This paper documents findings of a study project on the transferable knowledge and insights arising from the implementation of activities in supporting participatory forest management (PFM) in Transmara forest block, Mau complex, Kenya for the last five years. The undertaking aimed at assessing the institutionalization and enhancement of PFM planning, development and implementation through the strengthening of three Community Forest Associations (CFAs) operating in the Transmara forest block. The three CFAs namely; Nairotia, Nyangores and Olenguruone signed Forest Management Agreements (FMA) with the KFS in 2014 to formalize working relations on forest co-management. This was to grant legal access and forest use rights to communities and assist in the long-term conservation of the forest, in tandem to the Forest Act 2005. Before this, their Participatory Forest Management Plans (PFMPs) were developed and officially launched in 2012. Towards this end the study assessed and documented the status of PFM planning and implementation using the experience of the three CFAs in order to synthesize the knowledge generated through project interventions by revealing the achievements, challenges and lessons learned.

Attainment of the above would not only spur development of the forest sector but contribute towards attainment of Vision 2030. This justifies investment of significant resources by the government, KFS and other partners to adopt and operationalise PFM in Kenya. In order to enhance the effective investment of these funds, this review was undertaken to establish performance and generate recommendations for enhancing PFM effectiveness in the future.

## **Methodology**

### **Study area**

The Mau Forest Complex is a montane forest in the Rift Valley region of Kenya covering an area of approximately 400,000 hectares (GOK, 2009). The forest is a vital resource to Kenya and the entire East African region and forms one of the five main water catchment areas in Kenya with the largest closed-canopy forest ecosystem in the country. The forest acts as a

source of 12 major rivers running across Kenya (Were *et al.*, 2014) that support settlements and livelihoods as well as key economic sectors across the country, including energy, tourism, agriculture and water supply.

Despite the ecological and economic services provided by the Mau forest, massive degradation have occurred in recent years. In the last two decades, 25% of the forest has been converted to other non-forest land uses mainly through ill planned settlements, expansion of agricultural lands and illegal extraction of forest resources (GOK, 2009). Apart from the ecological impact, the destruction and deforestation of the Mau forest complex has had considerable economic implications for the Kenyan economy. In addition, the forest adjacent communities are experiencing unprecedented challenge of environmental degradation impacts and the corresponding socio-economic losses. For instance, a joint report by United Nations Environment Program (UNEP) and KFS showed that deforestation deprived Kenya's economy KES 5.8 billion (\$58 million) in 2010 (UNEP, 2012).

### **Data collection**

Multi-faced structured approach was adopted in data collection and collating of information from both primary and secondary sources. This involved literature review, both structured and plenary discussions as well as consultative meetings. The undertaking was guided by the following variables in assessing PFM performance;

- Review of work plans and operational plan guided activities
- Definition of rights, roles/responsibilities of stakeholders
- Sustainability of resource use
- Level of awareness and involvement in the process of formulating of PFM and FMAs.
- Training and organizational capacity of the CFAs
- Sustainable forest management activities
- Change in socio-economic indicators

Secondary data was collected through literature review following a checklist on selected variables to find out the baseline condition of the forest, prevailing status on sustainable participatory forest management in Kenya, its implementation as well as management gaps and emerging issues. Among the documents reviewed include; Constitution of Kenya 2010, Forest Act 2005, Water Act 2002, 2016, Land Act 2012, 2016, Draft Forest Policy 2014, Forest Conservation and Management Act 2016, FAO Forest Resource Assessment

Framework 2015, KFS Strategic Plan 2009/10-2013/14, PFM guidelines, PFMP manuals and Review of successful global case studies, amongst others.

Primary data was collected via meetings and interviews conducted targeting representatives of CFAs, KFS and Key stakeholders including County governments and project partners. Structured discussions as well as questionnaires were used to gather information. The target was CFA members, CSO representatives and KFS foresters at station level. A consultative meeting session was held at each forest station, where emerging issues were captured and discussed. A total of nine field meetings were held three per each station.

## **Results and Discussion**

### ***Demographic information of the CFAs***

The table below (Table 1) provides brief information on the membership of the three CFAs that were included in the study.

**Table 1: The history and membership of the respective CFAs**

<b>CFA</b>	<b>Year of Formation</b>	<b>Year of registration</b>	<b>CFA members</b>
Nyangores	2008	2011	1000
Nairotia	2008	2011	2300
Olunguruone	2009	2012	900

### ***Participatory Forest Management***

The process of developing both the PFMPs and FMAs was found to be inclusive and quite participatory as a significant number of stakeholders were involved, including; Ministry of Agriculture, KFS, National Environmental Management Authority (NEMA), CFAs, World Wide Fund for Nature (WWF), Forest Action Network (FAN), Kenya Tea Development Authority (KTDA), Religious groups, amongst others.

The community members reported that they were contented and satisfied with the agreements. They also noted that the regulations instituted enabled effective and supportive environment in moving towards SFM and enhancing livelihoods. However, implementation of some proposals in the agreement, such as Income Generating Agreements (IGAs) was indicated as not to have been implemented to the latter.

The PFMPs and FMAs outline the responsibilities of the communities. If people are unclear about their rights and responsibilities regarding forest land and resources, the results are conflicting claims to resources. Insecure tenure makes the people who inhabit or exploit forest areas unsure about their future, leaving them with little incentive to manage resources sustainably. Denial of access to vital forest resources can force local populations into destructive practices such as illegal logging, uncontrolled and damaging use of forest resources and unsustainable trade in forest products.

Key obstacles established by the assessment were as follows:

- Inadequate financial resources to facilitate implementation of PFMPs.
- All management plans for the three forest stations assessed were largely financed by development partners.
- Support from development partners has focused on development of PFMPs and strengthening CFAs and not implementation.
- KFS expenditure at station level is guided by targets set from the national government, where implementation of PFMPs is not prioritized but development of PFMP is factored in.
- Lack of business plans and markets hamper successful development of nature based enterprises and investments as alluded to in PFMPs.
- Absence of benefit sharing guidelines on specific activities in the forest such as grazing and fuel wood collection.
- Little focus on IGAs like eco-tourism.
- Lack of adequate information on Carbon trading its operation.

Various types of benefits were found to accrue from CFAs in relation to PFM implementation that mandate for the following user rights at household level, including;

- Grass harvesting and grazing,
- Collection of thatch grass,
- Collection of medicinal herbs,
- Fuel wood collection,
- Ecotourism and recreational activities,
- Honey harvesting,

- Collection of forest products for community based industries,
- Recruitment as scouts, and
- Employment as casuals and contracts in carrying out some silvicultural operations.

The CFAs had developed, negotiated and signed FMAs with KFS. Largely, FMAs focused on user rights already granted by the Forest Act 2005 consisting of traditional uses such as grazing, fuelwood collection and herbal plants collection that are not deemed by communities as IGAs. In the absence of benefit sharing to spur participation, the effectiveness of PFMPs is greatly reduced. However, the CFAs has within the spirit of PFM started local arrangements to collect some fees from the collection of goods from the forest above the KFS charges.

Although majority of these IGAs fall within the traditional line, the effectiveness of the PFMP is felt through their implementation due to their contribution to livelihood support. The IGAs also contribute towards improved forest conservation by their nature of utilisation of natural environment such as bee keeping and ecotourism. Again, the IGAs create a culture of positive relationship with the forest although presence of benefit sharing framework would lead to more benefits. The IGAs act as incentive to community and an important aspect in PFM. This is especially important in forest related activities as they are by nature long term hence need for having buy-in for the community as they wait for forest related benefits.

### ***CFA Challenges***

All CFAs studied indicated they are faced with lack of adequate funding for PFM implementation. All the CFAs are highly dependent on donor funds but have inadequate capacity to undertake proposal writing even in the absence of direct funding from government. Where CFAs have funding it is tied to donor conditions and which is seasonal meaning that long term planning cannot be effected. In addition, CFAs had not put in place mechanisms for raising own funds through membership subscription, annual fees and income from supported IGA activities. This presents a big challenge to the CFAs during activity implementation and project termination and they should put in place mechanism for sustainable funding with view of being self reliant and sustenance.

Currently the main activities implemented under PFMPs is afforestation, grazing and tree planting. Others include livelihood aspects such as bee keeping, fruit farming and firewood



collection for sale. Low income and poverty present among the community members was a challenge to the regulated access and harvesting of forest resources. Some community members lack money to pay the access fees hence they have to enter illegally and harvest forest resources.

### ***Effectiveness of PFM/ CFA in achieving project objectives***

The effectiveness of PFM and CFAs can be considered from the viewpoint of both biophysical and socio-economic outcomes that collectively contribute to sustainable forest management and enhanced livelihoods. Changes in forest condition since the commencement of a PFM regime can be judged from indicators such as: changes in area of forest, wood volume or biomass and regeneration. Changes in biodiversity can be judged from changes in species diversity over time.

Another indication of the effectiveness of a PFM regime is a reduction in the level of threats that can be associated with improved overall management. Key threats affecting forest conservation in Kenya identified by Forest Action Network (FAN, 2015) include; illegal extraction of forest products (such as fuel wood, charcoal, timber and poles), uncontrolled grazing and wildlife damage.

Improvement in social outcomes is generally an explicit part of the rationale for adopting community based forestry. Continuing community support for PFM is contingent on community members receiving sufficient benefits from their involvement to outweigh the costs involved. Many, but not all, benefits have a financial value, although it is not always easy to assign a monetary value to them. Much of the rationale for promoting PFM is based on a stated intention of improving the livelihoods of rural people. This generally involves improving access to subsistence goods and services and increasing income from the sale of goods and services.

The following criteria and indicators for the CFAs assessment in achieving project objectives were operationalized and scored as below, (+) indicating an *Increase*, while (-) indicates a *Decrease*):

- Change in area, condition of forest and biodiversity (+).

- Change in level of threats, including unplanned or wild fires, illegal logging, wildlife poaching, encroachment for agricultural purposes, land grabbing, charcoal burning, overgrazing, extraction of firewood and over-exploitation of Non Tree Forest Products (NTFPs) (-).
- Change in quantity of forest products harvested including firewood, poles, fodder, leaf mulch, wildlife, food and Non Wood Forest Products (NWFPs) (-).
- Change in key social indicators and financial indicators including social capital, human capital, availability of forest goods and services (+).

Table 2 indicates the overall effectiveness of the three CFAs under study in achieving PFM objectives by combining the ratings for each of the key indicators into one score. The score indicates that the enabling environment is supportive and effective in achieving SFM and enhancing livelihoods.

**Table 2: Summary of level of effectiveness of PFM in enhancing the achievement of the project objectives**

Key indicators	Summary of indicator ratings from Appendices 1, 2, 3, 4 and 5, and overall effectiveness of achieving objectives				
	(1)	(2)	(3)	(4)	(5)
Area and condition of forest (+)				X	
Threats to forest (-)				X	
Quantity of products harvested (-)			X		
Social indicators and Financial indicators (+)				X	
Overall assessment of effectiveness in moving towards SFM and enhancing livelihoods  <i>1 being ineffective in moving towards SFM and enhancing livelihoods and 5 being highly effective in moving towards SFM and enhancing livelihoods</i>	<b>4</b>				

## **Lessons Learned**

A notable lesson learned was the need for more stakeholder and community involvement in the implementation of PFM projects. Thus, in order to have effective change, there is need to harmonise development of PFMPs in terms of process and content including programmes and sustainable activities that not only directly benefit the communities but also foster their attitudes to conserve the forest. Such lessons as cited can be summarised as follows;

- Formulation of PFMPs varies widely in terms of cost, process followed and level of stakeholder participation. The 3 CFAs outlined areas of improvements and expansion of forest user rights.
- Benefits from payments for ecosystem services such as carbon trading and ecotourism has not been realised in spite of improved forest conservation.
- Benefit sharing of revenue between KFS and CFAs is highly skewed towards KFS. Alternative IGAs are still inadequate and benefits to communities are still meager with KFS benefiting more from controlled forest harvesting activities and community policing (patrols by scouts).
- Discussions on PFM planning and implementation tend to focus on KFS and CFAs, yet other players such as county governments are also critical partners.
- CFAs are characterised by several challenges that are related to funding, governance and sustainability, which weakens their position in terms of engagement with KFS and other stakeholders within the forest sector.
- Inadequate incorporation of conflict management mechanisms within CFAs structure, PFMPs and operations to a large extent has contributed to escalation of conflicts among CFAs.
- Absence of budgetary allocation to CFAs activities from KFS and weak resource mobilisation negatively impact on CFAs activities.
- The decision by KFS management to engage CFAs in short term contracts to undertake silvicultural operations has significantly boosted CFAs participation in PFM activities.
- Communication and partnerships between KFS and CFAs is weak and ad hoc.
- CFAs have diversified their income streams by investing in alternative non-nature based enterprises in order to sustain CFA operations.

## **Conclusion and Recommendations**

### ***Conclusion***

The study has demonstrated that major steps have been made to strengthen forestry and integrate community concerns in the forest regulations. However, there still exist constraints and gaps in steps to be taken for full implementation. Most forest adjacent communities are willing to participate in forest conservation and management. There is substantial evidence to confirm the general assumption that PFM, when well facilitated, can enhance sustainable forest management as manifested in activities such as assisting in fire fighting, rehabilitation of degraded areas and involvement in forest protection through reporting of illegal activities. PFM is also contributing to livelihood improvement especially where communities are engaged in forest based enterprises and ecotourism activities.

There are variations in results and progress towards PFM implementation in Kenya across the different community based forest regimes. Main weaknesses are that PFMs require huge financial resources for their implementation and are heavily reliant on donor funding. The communities also have limited access to markets for their produce, are faced with competing land uses, lack adequate capacity to engage in forest conservation and are subjected to inappropriate benefit sharing mechanisms. The three CFAs reviewed have been formerly legislated and existed for less than five years. Assessing the performance of PFM in enhancing the extent and condition of forests and improving the livelihoods of the communities is a long term process. However, despite the challenges, overall, the PFM in these areas was highly successful in achieving its objectives in creating an enabling environment highly supportive in moving towards sustainable forest management and enhancing livelihoods. This can be summarised as follows:

- A substantial improvement in forest condition and biodiversity.
- An overall reduction in threat level and decrease in quantity of forest products harvested.
- Improvement in social outcomes.
- Improvement of livelihoods of CFA members and adjacent communities through income from sale of forest products, community based enterprises, micro-credits and casual employment.

### ***Recommendations***

To further address the challenges and obstacles experienced in enhancing the opportunities for PFM, and in order to effectively internalise forest management activities within the PFMPs, the study recommends following;

- There is need to focus more on IGAs through setting mechanisms to provide start up capital for IGAs and development of business plans. Such activities include;
  - ✓ Increasing the area and number of tree nurseries to increase seedling production and providing market for seedlings in the local market and region,
  - ✓ Training of farmers on zero grazing to reduce pressure on the use of the forest as grazing land,
  - ✓ Develop a complete value chain of agroforestry and commercialize fruit trees,
  - ✓ Strengthen opportunities in honey production and farming of bamboo,
  - ✓ Enhancing alternative energy saving and sources like energy saving “jikos” and biogas production.
- The issue of benefit sharing should be addressed as it has remained largely unclear especially in the absence of a benefit sharing framework breeding conflicts among the stakeholders.
- There is need to wean CFAs from donor dependency to self-sustenance through provision of an enabling environment for gainful engagement in enterprise development and development of funding opportunities and raising of their own funds to enhance financial sustainability.
- To guarantee adequate stakeholder participation in preparation of PFMPs, effective communication among all stakeholders is critical. Targeted support should be provided to enhance adequate consultation between KFS, CFAs and other partners.
- Capacity building of KFS officers at station level (foresters and forest rangers) and CFA members should be prioritized to enable them effectively participate in, and take charge of PFM implementation and monitoring. This should entail providing the necessary capacity that should include skills as well as infrastructure. Among priorities include;
  - ✓ Support to CFAs to have functional offices.
  - ✓ Training of CFAs on governance, record keeping, financial management, and group dynamics.
  - ✓ Organize joint trainings on PFM for CFA scouts and forest rangers.

- ✓ Increase budget allocation at the forest station level for enhanced PFM implementation.
- Strengthen partnership with other stakeholders including the county government and local authorities.

### **Acknowledgement**

This study was financed by the Forest Action Network (FAN) Kenya through WWF-Germany.

### **References**

- Agevi, H., Wabusya, M., & Tsingalia, H. M. (2014). Community Forest Associations and Community Based Organizations: Redesigning their Roles in Forest Management and Conservation in Kenya. *International Journal of Science and Research*, 3, 1916-1922.
- Agrawal, A., Chhatre, A., & Hardin, R. (2008). Changing governance of the world's forests. *Science*, 320: 1460–1462.
- Ameha, A., Nielsen, O. J. & Larsen, H. O. (2014). Impacts of access and benefit sharing on livelihoods and forest: Case of participatory forest management in Ethiopia. *Ecological Economics*, 97:162–171.
- Forest Action Network. (2015). *Community Forest Situation in Kenya*. A scoping study. Forest Action Network. Nairobi, Kenya.
- Food and Agriculture Organisation. (2015). *Global Forest Resource Assessment 2015*. Country Report Kenya, Rome.
- Government of Kenya. (2005). *Kenya Forest Act (2005)*. Retrieved from <http://www.law.pace.edu/sites/default/files/IJIEA/ForestsAct2005.pdf>
- Government of Kenya (2007). *Sessional Paper No. 1 of 2007 on Forest Development Policy*. Nairobi: Government Printer.
- Government of Kenya. (2009). *Rehabilitation of the Mau forest ecosystem*. A project concept prepared by the interim co-ordinating secretariat, office of the prime minister, on behalf of the Government of Kenya. Nairobi
- Hjortso, C. N. (2004). Enhancing public participation in natural resource management using Soft OR- an application of strategic option development and analysis in tactical forest planning. *European Journal of Operational Research*, 152, 667–683.

- Ribot, J. C., Agrawal, A. & Larson, A. M. (2006). Recentralizing while decentralizing: how national governments reappropriate forest resources. *World Dev.*, *34*, 1864–1886.
- Nurse, M. C. & Edwards, S. R. (1993). *Strategies for Sustainable Conservation of Forests Under Threat from their Adjacent Communities*. KIFCON Kenya and Birdlife International.
- Ongugo, P. O., Mbuvi, M. T. E., Obonyo, E., Mogoi, J. N, Maua, J. O., Koech, C. O. & Othim, R. A. (2007). Emerging roles of Community Forest Associations in Kenya: the cases of Arabuko-Sokoke Forest adjacent Dwellers Associations (ASFADA) and Meru Forest Environmental and Protection Community Association (MEFECAP). Proceedings of International conference on Poverty reduction and Forests. Bangkok September, 2007.
- Saarikoski, H., Tikkanen, J., Leskinen, L. A. (2010). Public participation in practice assessing public participation in the preparation of regional forest programs in Northern Finland. *Forest Policy and Economics*, *12*, 349–356.
- Somanathan, E., Prabhakar, R. & Mehta, B. S. (2009). Decentralization for cost-effective conservation. *Proc. Natl. Acad. Sci.*, *106*, 4143–4147.
- United Nations Environment Programme. (2012). Deforestation Costing Kenyan Economy Millions of Dollars Each Year and Increasing Water Shortage Risk. Retrieved from <http://www.unep.org/newscentre/Default.aspx?DocumentID=2698&ArticleID=9316&l=en>.
- Were, K., Dick, O. B. & Singh, B. R. (2014). Exploring the geophysical and social-economic determinants of land cover changes in Eastern Mau forest reserve and Lake Nakuru drainage basin, Kenya. *Geo Journal*, *79*, 775-790.