THE ROLE OF COMMUNITY FOREST ASSOCIATIONS IN PARTICIPATORY MANAGEMENT OF ONTULILI AND NGARE NDARE FORESTS IN NORTH CENTRAL KENYA

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DECLARATION

Candidate's Declaration

This thesis is my original work and has not been presented for a degree or any other award in any other university.

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DEDICATION

This thesis is dedicated to my husband, John Musyoki Maluki and our beloved children Faith Mutheu and Melody Mawia for their prayers, encouragement and moral support during my studies. You are a wonderful gift to me. God bless you.

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ACRONYMS AND ABBREVIATIONS

ARPIP	Action Research in to Poverty Impact of Participatory Forest Management
CBO	Community Based Organizations
CETRAD	Centre for Training and Research and Development
CFAs	Community Forest Associations
CIFOR	Centre for International Forestry Research
FAC	Forest Adjacent Communities
FAN	Forest Action Network
FAO	Food and Agriculture Organization of the United Nations
FGD	Focussed Group Discussion
IGAs	Income Generating Activities
KEFRI	Kenya Forestry Research Institute
KFS	Kenya Forest Service
KNBS	Kenya National Bureau of Statistics
NGO	Non-governmental Organizations
PELIS	Plantation Establishment and Livelihood Improvement System
PFM	Participatory Forest Management
URT	United Republic of Tanzania
DRSRs	Department of Resource Surveys and Remote Sensing
KFWG	Kenya Forests Working Group
MENR	Ministry of Environment and Natural Resources
EMPAFORM	Strengthening and Empowering Civil Society for Implementation of Participatory Forest Management in East Africa
PRA	Participatory Rural Appraisal
IFAD	International Forestry and Agriculture Development
SPSS	Statistical Package for Social Scientists

ABSTRACT

Forests enhance conservation of the environment, biodiversity, water, and soil resources while significantly contributing to the livelihoods of forest adjacent communities. Under the Kenya's new Forest Act (2005), community participation is provided for through formation of Community Forest Associations (CFAs). Past studies have shown how major CFAs in Kenya operate and the challenges they face. However, factors determining household decision to join CFA and the CFAs' capacities to meet PFM objectives have not been studied adequately in Kenya. Hence, this study focused on Ontukigo and Ngare Ndare CFAs involved in participatory management of Ontulili and Ngare Ndare forests in North Central Kenya. The objectives were to: (i) identify household factors associated with decision to participate in CFAs;(ii) identify the differences between CFA and Non CFA members in their participation in forest conservation activities; (iii) assess the relationship between the level of participation of CFA members in PFM and their perceived benefits; (iv) assess community perceptions on contribution of PFM to improvement of livelihoods of CFA members and (v) assess community perceptions on contribution of PFM to improvement of CFA members' livelihoods. The households were stratified on the basis of CFA membership. Semi structured questionnaires were then administered to randomly selected 80 CFA and 80 Non CFA members. Participatory Rural Appraisal tools, namely historical timelines, focused group discussions and community wealth characterization were used to collect qualitative data for precise description of the quantitative data. Chi-square tests and correlations were computed using SPSS to test the existence of significant relationships between dependent and independent variables, their direction and strength. A t-test was used to test significance of the difference between the means of various variables of CFA and Non CFA. Household factors influencing CFA membership included household size ($t=2.065$, $P=0.05$); age of community members ($t=2.408$, $P=0.01$); and livestock owned ($t=2.804$, $P=0.01$). Participation in forest conservation activities such as forest patrol, fire control, tree nurseries and tree planting was positively influenced by CFA membership ($\chi^2 = 7.83$, $P=0.05$). The level of participation of CFA members in PFM activities was positively and significantly influenced by the level of perceived PFM benefits ($\chi^2 = 38.73$, $P=0.05$); range of farm size ($\chi^2=12.72$, $P=0.05$); and nature of household headship ($\chi^2 =29.99$, $P=0.001$). Access to training in forest management and planting of trees on farms was influenced by CFA membership positively. Increase in forest cover was associated with CFA participation in PFM. All community members perceived that the livelihood of CFA members had improved after PFM due to; knowledge and awareness gained from PFM training, benefits from forest products, financial gains from PELIS, tree planting and sale of tree seedlings. Improvement in economic wellbeing of CFA members was significantly influenced by their participation in PFM ($\chi^2=80.00$, $P=0.001$) enhancing access to firewood, water, fodder and participation in various PFM income generating activities. Access to forest products was significantly influenced by CFA membership ($\chi^2=15.88$, $P=0.001$). Changes proposed for improvement of PFM included; imposition of stiffer penalties to forest offenders, increased benefits to CFA members, assistance to the communities living adjacent to the forests and empowerment of CFAs in forest management. Modalities of benefit sharing between Kenya Forest Service and the CFA members need to be streamlined to enhance CFA participation in PFM. There is need for intensive analysis of the environmental and economic impacts of PELIS and firewood collection from the government forest.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Forests are globally important in conservation of the environment, biodiversity, water, and soil resources. Conservation of these resources is very vital because of their contribution to the livelihoods of communities living adjacent to the forest by providing them with various ecosystem goods and services (Geller *et al.*, 2007). Some of the products obtained from the forests by adjacent communities include fuel wood for domestic use, food in form of wild fruits and vegetables, medicinal herbs, wood for carving and other small cottage industries. Other forest products accessed from the forests include dyes for adding value to handicrafts, fibres for weaving, honey, timber, poles, and posts, among others. Cultural services provided by forests include use of forests as venues for traditional ceremonies such as circumcision and religious purposes (Geller *et al.*, 2007).

In Kenya, gazetted forests cover a total area of 1.4 million hectares, representing about 1.7% of total land area. This does not meet the internationally recommended minimum of 10% of country forest cover. The forests outside gazetted forests are estimated to be 0.18 million hectares and are mainly situated in high and medium potential land area where the human population and agricultural production are concentrated (Ruotsalainen, 2004).

There has been an increasing rate of forest destruction and consequential decline in forest resources in Kenya due to the high rate of increase in human population thus exerting a great strain on natural resources. The decline has been attributed to factors such as deforestation, commercial agriculture, urbanization, pastoralism, charcoal burning, forest cultivation and replacement of indigenous forests with exotic

plantations (Geller *et al.*, 2007). Decline in forest resources has been further exacerbated by increasing poverty levels and the community perception of forest as a public good in addition to changing global forestry trends.

More so, weak capacity in forest institutions in conjunction with political obstruction, insufficient business environment, rigid budgetary allotments and corrupt practices have also contributed to poor plantation management, abuse in the disposal of forest land and produce as well as preferential licensing which have contributed to decline in supply of timber and other products (Geller *et al.*, 2007). Therefore, improving forest cover and reducing forest destruction and degradation has now surfaced as a significant element of Kenya' development strategy (DRSRS and KFWG, 2006). Central to this is the government' recognition of the critical role to be played by forest-adjacent communities in ensuring that tree cover in the country is maintained above current alarming levels (MENR, 2007). Conservation and management of natural resources have to actively involve all relevant stakeholders and particularly the local communities (Purnomo *et al.*, 2005) for success.

The inclusion of communities in the management of state-owned forest resources has become increasingly common in the last 25 years. Schreckenberg (2006) indicated that majority of the countries in Africa and Asia are promoting the participation of rural communities in the management and utilization of natural forests and woodlands through some form of Participatory Forest Management (PFM). Participatory Forest Management is the local involvement of stakeholders in management of a forest, which may be dry woodlands, tropical forests, mangrove or plantations, for the mutual benefit of both the species of flora and fauna and the community. In Kenya, it is a legal requirement according to the Forest Act 2005 that communities form

Community Forest Associations (CFAs), before entering into a forest management agreement with Kenya Forest Service (KFS) under the PFM process (Ludeki *et al.*, 2006).

In Kenya the formation of CFAs started in 1997, and currently there are over 40 forests where communities are participating in forest management (Thenya et. al., 2007). Studies have been undertaken to help understand how major CFAs in Kenya such as Arabuko-Sokoke Forest Adjacent Dwellers Association (ASFADA) and Meru Forest Environmental and Protection Association (MEFECAP) operate and the challenges faced (Ongugo *et al.*, 2007). However, community perceptions on the capacity of the CFAs to meet PFM objectives and their perception on how to enhance the PFM process have not been assessed in forests in Timau District hence the need for this study.

1.2 Problem statement and justification

The result and impacts of interventions in natural resource management in Kenya call for a clear understanding of how conservation goals can be reconciled with economic interests of local communities. This is because most of the rural households gain their livelihoods from natural resources. Natural resources in Kenya have continually been degraded due to the high discount rates of the local communities and a lack of clear policies that allow participatory management approaches. Participatory Forest Management approach therefore aims at improving forest cover and the livelihoods of forest adjacent communities as provided for in the Forest Act 2005.

Studies on the emerging roles of CFAs in Kenya have presented the different challenges faced in implementing the PFM process (Ongugo *et al.*, 2007). Further examination of

CFA roles in the decentralization process of Kenyan forests have highlighted the emerging issues which have slowed down the development of PFM process such as the right for communities to licence extraction and movement of forest products, arrest and prosecution of offenders in forests under PFM and cost and benefit sharing among others (Ongugo *et al.*, 2008). However, community perceptions on CFA capacity to meet PFM objectives and their views on these emerging issues have not been captured adequately. In addition, adequate understanding of the changing perceptions and attitudes of local communities towards PFM process is lacking. For example, we do not clearly understand the decision making process of households in regard to joining CFA. Limited studies have been undertaken to identify factors influencing CFA members' level of participation in PFM and determinants of access to forest products in the two forest sites. Such information is crucial for sustained participation of CFA members and other community members in PFM. The missing information is needed in order to design forest management measures that will meet local needs and therefore attain long-term support for natural resource management initiatives (Thenya *et al.*, 2007).

Poorer people have been indicated by many researchers to be more dependent on natural resources. Therefore household socio-economy may play a role in resource use decision-making. Understanding factors influencing community participation in forest management programs such as PFM may be critical to forest managers and decision-makers. Factors motivating their motivation to participate in decisions and activities for preservation of state forests or protected areas may be likewise important. A better understanding of community members' motivation for participation in PFM is fundamental to the development and implementation of management strategies that are both sustainable in the long-term and sensitive to the local need (Dolisca et al, 2006).

Participation of rural community members in management of protected forests may vary according to socioeconomic and demographic backgrounds of the individual farmers. Individual community member's characteristics may influence decision-making on whether or not to participate in PFM. This study will therefore assess the roles of CFAs in management of Ontulili and Ngare Ndare forests in North Central.

1.3 Research questions

The study sought to answer the following questions:

1. What household factors are associated with the decision of community members to join CFA as required for their participation in PFM?
2. What are the differences between CFA and Non CFA members in their level of participation in forest conservation activities?
3. What is the relationship between the level of participation of CFA members in PFM and their perceived benefits?
4. What kind of change in forest cover do the members of forest adjacent communities associate with CFA members' participation in PFM activities?
5. What are the communities' perceptions on the contribution of PFM to improvement of the livelihoods of CFA members?

1.4 Research objectives

The broad objective of this study was to assess the role of CFAs in participatory management of selected forests in North Central Kenya. The specific objectives were:

1. To identify household factors associated with decision to participate in community forest association.

2. To assess the differences between CFA and Non CFA members in their participation in forest management.
3. To assess the relationship between the level of participation of CFA members in PFM and their perceived benefits.
4. To assess community perceptions on the contribution of CFA to improved forest cover.
5. To assess community perceptions on contribution of PFM to improvement of CFA members' livelihoods.

1.5 Research hypotheses

The study was guided by the following hypotheses:

1. There are no factors associated with household decision to join CFA.
2. There is no difference between CFA and Non CFA members' participation in forest conservation activities.
3. There is no relationship between CFA members' level of participation in PFM and their level of perceived PFM benefits.

1.6 Significance and anticipated outputs

Participation of the CFAs in forest management is aimed at contributing to poverty reduction, employment creation and improvement of livelihoods through sustainable use, conservation and management of forests and trees. It is also aimed at contributing to sustainable land use through soil, water and biodiversity conservation. It also focuses on promoting participation of communities adjacent to the forests, private sectors and other stakeholders in forest management to conserve water catchment areas and ensure sustainability of forest management (Ongugo *et al.*,

2008). For these objectives to be attained, active participation of community members by incorporating their views concerning improvement of the process is a prerequisite. This study is significant because it will provide recommendations for improvement of the PFM process in Ontulili and Ngare Ndare forests. Information documented under this study will be of advisory use to KFS and other organizations involved in management of these forests. It will give recommendations to the forest policy makers, community members living adjacent to forests and other PFM stakeholders on how to enhance the PFM process for improved forest cover and improved livelihoods. The results of this study will add to the known case studies, and broaden the scope of current research knowledge on participatory forest management globally. Therefore, the results of this study will directly and indirectly contribute to improvement of forest cover as well as the livelihood of communities neighbouring the forests.

1.7 Conceptual frame work

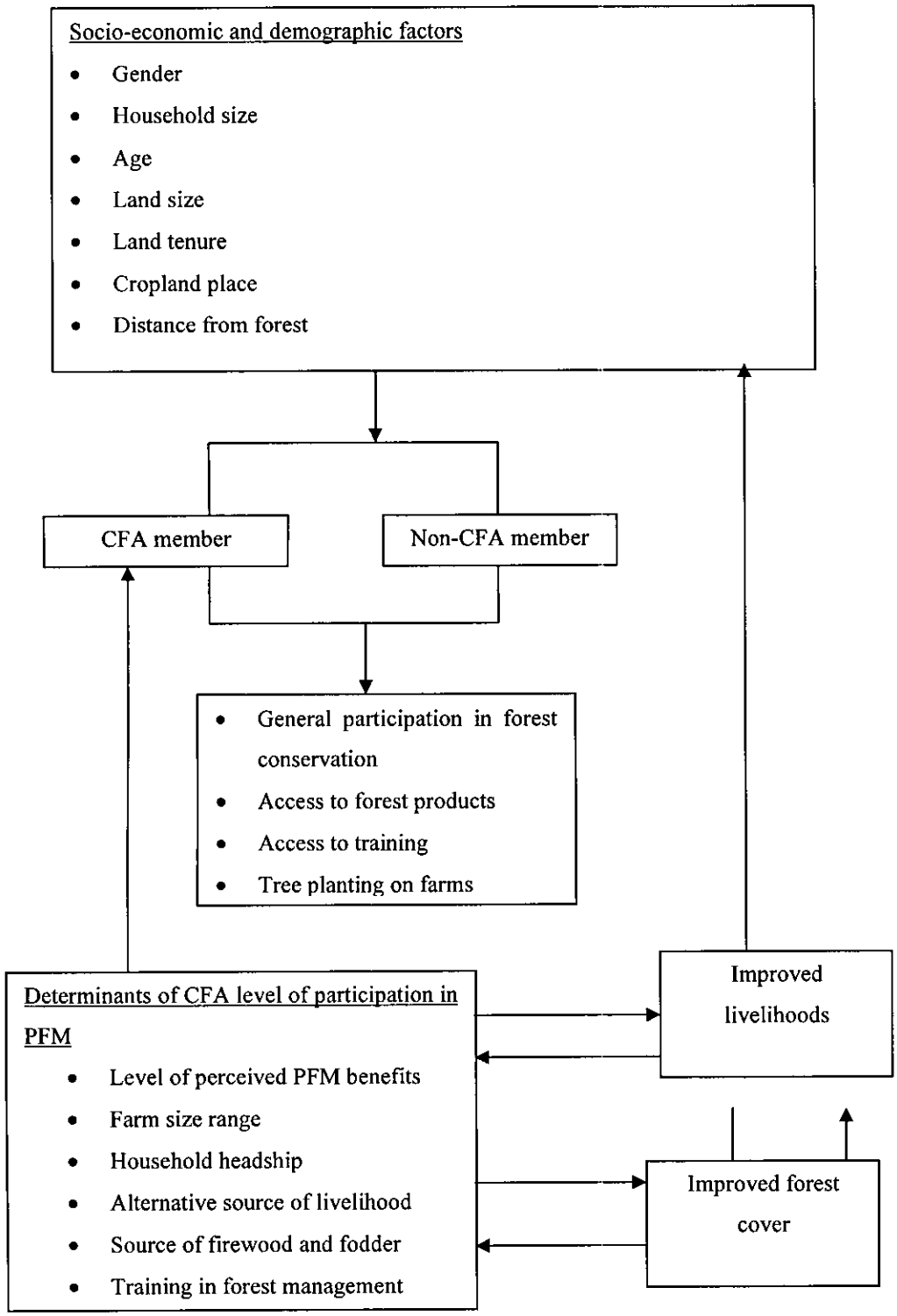
The concept of participatory forest management as implemented by CFAs is premised on the principle of active participation that seeks to empower the local community members living close to forests (Mulwa and Nguluu, 2003). Participation is defined as an active process whereby beneficiary or client groups influence the direction and execution of development or management of a natural resource to enhance their wellbeing in terms of income, personal growth, self-reliance or other values (Little, 1994). In general, local community participation in forest management is a function of the informal institutional background, socio-economic and demographic factors. Other internal and external factors influence community members' ability and desire to participate in forest management in different ways (Ostrom, 1990; Araral, 2009).

Community participation ensures that local contribution is maximized and the main incentive includes people's small successes that increase their morale. External

facilitation and moral support such as training by KFS and KEFRI staff among other stakeholders seems to encourage high level participation in forest conservation among CFA members. Empowerment due to active participation has the potential to ensure sustainable process of development. This also encourages people to take responsibility for maintenance and continued use of facilities (Mulwa and Nguluu, 2003) and/or natural resources. Management of local natural resources by local communities through CBOs and CFAs is widely accepted as very important but there is a high inclination towards regulated participation.

Figure 1.1 is used to conceptualise on factors influencing community members' decision to participate in PFM through joining CFA and understanding the contribution of PFM to improved forest cover and improved livelihoods in the study sites in Kenya. Various socio-economic and demographic factors influence household decision to join CFA through which they participate in PFM. CFA membership affects general community members' participation in forest conservation, access to forest products and training.

A perception of high-level benefits from forest may encourage a high level of participation in PFM activities for the CFA members. CFA high-level participation in PFM contributes to improved forest cover and improved livelihoods. A perception of improved livelihood and improved forest cover among CFA members and other stakeholders will directly enhance their participation in forest management.



Adapted from Coulibaly-Lingani *et al.* (2011)

Figure 1.1: A conceptual framework on active participation of CFAs in PFM

1.8 Definition of Key terms

Participation: "the voluntary involvement of people in self-determined change" or "the involvement of people in their own personal development; the development of their lives, and their environment/forest resources.

Community: It is defined as "a group of people who live in the same area, and often share common goals, common social rules and/or family ties.

Participatory forest management: a forest management approach that deliberately involves the forest adjacent communities and other stakeholders in management of forest within a framework that contributes to community livelihoods.

Sustainable livelihood: A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.

Sustainable forest development: This is the use of a forest and any of its natural resources in a way that does not compromise its capacity to meet the needs of the future generation and in a manner that does not degrade the carrying capacity of supporting ecosystems.

The Community-Based Natural Resources Management approach (CBNRM): It is a people-centred, community-oriented and resource-based management approach based on the premise that people have the natural capacity to understand and act on their own problems.

Forest Adjacent Communities: Community members living adjacent to the forest and mainly having homestead within a distance of 5 kilometres from the forest.

CHAPTER TWO: LITERATURE REVIEW

2.1 Overview

This chapter presents information on what the PFM approach is and how it started in Kenya. It also provides information on experiences in participatory forest management globally and in Tanzania, Uganda and Kenya.

Participatory Forest Management has been necessitated by an alarming rate of deforestation and loss of forest cover. The global net rate of change in forest cover for humid tropics is estimated to be 23% (Archard *et al.*, 2002) signifying a high reduction rate of forest cover. This has led to the realization of the need to involve the community members living close to the forests in management of the forest resources to reduce this rate of forest loss.

Participatory Forest Management is a new approach to forest management in which new partnerships are created with forest adjacent local communities. This perspective is influenced by the realization that resource conservation and sustainable development could only be achieved if people enjoy a secure livelihood. Involving local communities in forest management is therefore viewed as a better approach to sustainable forest management and conservation. The principle of local participation is aimed at inclusion of the interests of stakeholders for improvement in meeting basic needs while enhancing forest conservation as well (FAN, 2007).

Eva Wollenberg (FAO, 1998) defined collaborative forest management as "management schemes based on the sharing of rights, responsibilities, benefits and obligations from the forest between local people and usually the state". According to her, three themes characterise the collaborative management of forests. The first

theme is that local people contribute to maintaining the productivity or sustainability of the forest. The second theme is that people living near the forest acquire a share of the forest benefits and maintain control over decisions and property related to forest resources. The last theme is that competing demands on the forest are resolved in ways that reduce conflict and enable complimentary or synergic relationships among different forest uses and users. PFM mainly prevail where local populace will have substantial control and /or involvement and the majority if not all benefits remain with the community/stakeholders without having to compromise the forest and its resources.

Balancing the effective, sustainable management of forest resources with economic, social and environmental factors has emerged as one of the key challenges in natural resource management. The environment and fora in which decisions concerning natural resource management are made are evolving as a result of global trends such as the globalization of the economy; growing awareness of and response to environmental concerns; decentralization and devolution of government control; the need for secured property rights; and increasing pressure for democratization (FAO, 2009).

Among the responses to these trends is a greater willingness to consider local forest management as a viable alternative to centralized state control. Globally, a large number of forestry activities (national, multilateral, bilateral and non-governmental) with participatory, local or community forestry components are being implemented. Although much remains to be done, participatory approaches are increasingly recognized as essential to sustainable forest management (FAO, 2009).

Participatory Forest Management has been institutionalised as a conservation approach through the enactment of the Forest Act of 2005. The Act provides for the participation of communities through formation of CFAs. The new Forest Policy in Kenya recognizes that there are benefits arising from involvement of local communities and other stakeholders in forest management. It aims at mainstreaming the forestry sector in economic recovery and thus contributes to poverty reduction strategies. The Forest Act 2005 came in to operation on 1st February 2007 and it is very relevant to the new paradigm shift in forest management since it upholds the principle of public participation in natural resource management (MENR, 2007).

2.2 Global status of Participatory Forest Management

At the international level, it was noted that there was limited focus on local issues of decreasing access to forest resources, and the implications for local people whose livelihood is dependent on the forests. In recognition of this, local forestry programmes have made efforts to enhance the wellbeing of rural communities depending on the forest. To achieve this major international funding agencies have been trying to promote institutional change within forestry bureaucracies in order to encourage them to be quick to respond to the needs of the rural communities living adjacent to forests (Hobley, 1996).

Efforts have also been made to decentralize some forest management control to the local people level through various new institutional arrangements, changes in policy framework and the bureaucratic structure. Therefore participatory forestry emerged as a new global practice for forestry development to meet local community needs, and it was promoted by international organizations and disseminated through programme and project packages (Hobley, 1996).

Participatory forestry has become an important initiative within the forestry sector, as a result of international community's desire to achieve sustainability and efficiency through decentralization and public sector reform. Decentralization has been seen as a means by which the state can be made more responsive and more adaptable to regional and local needs than is the case with concentration of administrative power and responsibility in the central state. However, decentralization does not always involve devolution of power (WCED, 1987).

The search for sustainable development requires a political system that secures effective participation in decision-making. Decentralizing the management of resources upon which local communities depend and allowing the local communities to have an effective say over the use of those resources will best achieve sustainable development. This also calls for promoting citizens' initiatives, empowering people's organizations and strengthening local democracy (WCED, 1987).

South East Asia has witnessed a chain of experiments in the participatory management of forest resources. Social and community forestry programmes started in India and Nepal in the 1970s with the aim of transforming the relationship between the powerful state bureaucracy and local people directly dependent on forest resources. A new forest Act enacted in Nepal in 1993 acknowledges the rights of user groups to manage and protect the forest but it states that ownership remains with the government. In Nepal all the forest resources are legally transferred as a right to the local people while in India the rights to share the forest products are only granted administratively and are not a legal right (Campbell and Denholm, 1993). Just as it is in Kenya, participatory forestry in India and Nepal have been faced with the questions

of equity, empowerment, income generation and long-term role of forest departments as facilitators of social change (Hobley, 1996). Joint Forest Planning and Management (JFPM) started in Karnataka, in India in 1993 and has been faced by several challenges. Such include lack of clear and adequate rights over forest produce and lack of sufficient autonomy in day-to-day management. More so, there are no transparent guidelines for ecological sustainability and attention to existing rights and privileges is lacking hence leading to confusion and often worsening intra-village inequities in forest access. The PFM approach also lacks security of tenure and sustainability of institutions due to the programmatic and project-dependent and funding-oriented nature of implementation. PFM is also faced with biased focus on only degraded forest department lands leading to only partial coverage of the public lands used by villagers (Lele, 2008).

Participatory forest management is adequately prevalent and successful in Africa. It is currently acknowledged as a significant course towards securing and sustaining forests. PFM is implemented in different ways in most states but there are remarkable broad common processes and paradigms. The core causes of failures in 20th century forest management are fairly common, as are the forces now driving action. The major causes include widening socio-political transformation on the continent towards more wide-ranging norms in the governance of society and its resources. Participatory forest management is one of the new strategies in the forestry sector that represent democratisation (Wily, 2002).

Forestry administrations have started noting that local participation is becoming more important and effective where local populations are involved not as cooperating forest

users but as forest managers and even owner-managers in their own right. This change is so far seeing most delivery in respect of unreserved forests, those that have not been formally drawn under government jurisdiction and/or tenure. Empowerment of local communities as owner managers of developing 'community forests' is gaining particular momentum from consequence land reform strategies that provide customary land interests with much improved eminence in state law (Wily, 2002). PFM was introduced in Ethiopia in the early 1990s and it is shown to have positive impacts both on the state of the forest and living conditions of participant households. However, the sustainability of PFM is threatened by the weak government support for the scheme. PFM is therefore far from being mainstreamed in the forest management system of the country. It is thus appropriate to assess how the PFM programs would perform few years after the support of the NGOs lapses (Gobeze *et al.*, 2009).

2.3 Participatory Forest Management experiences in Tanzania

Tanzania is renowned as a leader of PFM in Africa as far as policy and practice is concerned. Like other African countries, forest management in Tanzania has been characterized by increasing central government control and alienation of forest adjacent communities from any form of benefit sharing or management role. However, since the mid-1990s, there has been an increasing realization that central governments have a limited capacity to exert a real management influence on unreserved forests and to some extent the reserved forests hence the need to adopt PFM approach (Wily and Dewees, 2001).

Participatory Forest Management in Tanzania is a strategy to achieve sustainable forest management by encouraging the management or co management of forests and

woodlands by the communities living adjacent to them. Other stakeholders drawn from local government, civil society and the private sector support this form of management. The three principal policy objectives include maintain or enhance forest quality and condition, enhance local livelihoods through increased forest revenues and supply of subsistence forest products and establishing or strengthening effective and representative village Natural Resource Management institutions (Blomley and Ramadhani, 2005).

Currently, PFM has been accorded high priority in Natural Forest Policy and National Forest Programme in Tanzania. Legal and institutional frameworks to support PFM implementation have been put in place. PFM is also a part of an overall rural development strategy intended to improve rural livelihoods by reducing poverty while protecting the environment and promoting equitable distribution of benefits (Meghji, 2003). Participatory forest management has so far been established in over 1800 villages covering over 3.6 million hectares of forests. This is equivalent to approximately 11% of the total forest cover and 18% of all villages on mainland Tanzania (URT, 2006). In order to secure the sustainability of PFM, the major focus is on conservation and economic incentives for communities. One of the unique developments in PFM in Tanzania has been the effort to re-introduce and strengthen indigenous knowledge and practices in managing and protecting forests (Blomley and Ramadhani, 2005).

2.4 Community Participation in Forest Management in Uganda

Participation of local communities in forest management in Uganda is practiced in form of Collaborative Forest Management (CFM). Collaborative Forest Management

is defined as a legal partnership between forest interest groups and government authority and this was initiated in 1995 (through the National Forestry Authority to manage forest reserves (Republic of Uganda, 2002). The major aims of this strategy have been reducing conflicts, increasing community benefits from forests and involving local community in forest management to reduce forest destruction.

Analysis of CFM performance such as for the Budongo Forest Community Conservation Association has indicated that participation of local communities has the potential to reduce conflicts and forest destruction. It has also resulted in enhancing forest restoration and community livelihoods as well as reducing forest management costs on the government. Collaborative Forest Management creates a sense of ownership among the local community members living adjacent to the forest. However, there have been challenges such as the process being quite long, scarcity of resources, low literacy level among the members of the community association and limited funding.

Collaborative Forest Management policy in Uganda has contributed to increased people's rights of participation but there is still inequitable benefit sharing and power imbalance. The policy can be improved through capacity building, legal counselling, and government commitment. More so, the policy is more applicable under strong democratic and decentralised governance, clear tenure rights, multi sectoral and community-based management approaches (Babirye, 2009).

2.5 Participatory Forest Management Experiences in Kenya

The Forest Act (2005) stipulates collaborative management (co-management) or PFM of forest that involves active participation of the local people and key stakeholders in the sustainable management of the forests. CFAs are recognized as partners in management.

CFAs in Kenya are facing various challenges in their efforts of implementing PFM. Though PFM in Kereita and Upper Imenti was started in 2000, legislation and lack of funds are major factors that have slowed down the process. Almost all these PFM sites are donor driven partly because of the initial high costs. Community expectations are also high despite lack of clear benefit/cost sharing mechanisms and difficulties in registering Community Forest Association (CFAs). The Forest/Land tenure status/system determines the pace of registering CFAs, while the Societies Act (CAP 108) and Forest Act, 2005 also limits CFAs activities (Thenya *et al.*, 2007).

2.5.1 Traditional Community Association in Loita

Loita forest provides a completely different form of PFM, namely traditional Community Based Forest Management (CBFM) that illustrates that communities are able to manage forest resources without destroying those (Maundu *et al.*, 2001). However, it is evident that the system is facing challenges emanating from changing socio-economic situations. In Loita, CBFM has been in practice for many generations with formal recognition since 1992. The forest is on trust land and the local authority is supposed to manage the forest for the local community. The community went to court and succeeded in preventing the local authority from changing the management objective to a national reserve with key focus on tourism development. Therefore, the

forest is at the extreme end of the PFM continuum where the communities are the owners and managers of the forest and the state is not involved in any way.

The major stakeholders in management of Loita forest have varied objectives. The community objectives in Loita are to own and manage the forest and to maximize on benefits especially from tourism. The objectives of the NGO involved are to ensure that resources benefit the Loita Maasai; to conserve the forest and to develop the forest's eco-tourism potential. The term 'PFM' is not known but the community are aware that they are the owners and managers of the forest (Mbuvi *et al.*, 2008).

2.5.2 The Community-Based Forest Organizations in Kakamega forest

Kakamega forest is the only remaining equatorial rain forest in Kenya. One part of the forest is a nature reserve that has been under the management of KWS since 1988 and the rest is managed by KFS which has two forest stations namely Isecheno in Kakamega district and Kibiri in Vihiga district. The community involvement in forest management has been re-started with adjacent communities having formed 10 Village Environment Committees (VEC) with eight of them located in Kakamega District and the rest in Vihiga District. The VECs are composed of more than two villages.

The main community based organizations involved in forest management in Kakamega include Kakamega Environmental Education Group (KEEP), Isukha heritage Organization, Kakamega Regional Christian science Group, Mukango Forest, Virhembe Development Youth Group, Tree nursery Group, Wanzala Mines service Group, and Jitegemee self-help group. PFM in Kakamega has been on and off since 1990. The main challenges facing the CBOs and community structures involved in

PFM in Kakamega include lack of partnership and local networking arrangement. There is need for harmonization of the Village Environment Committees (VEC) being formed through KFS facilitation with other initiatives by KEEP, Forest Action Network and Isukha Heritage. Popularization and awareness creation about PFM is required especially for the VEC. The organizations are also facing a challenge of convincing other partners that the current PFM initiatives will succeed considering that earlier similar initiatives in 1990s through the KIFCON project stalled. The community members involved are currently benefiting from the forest but implementing the PFM process is still facing various challenges. There are limited options when negotiating for benefits because of the biodiversity value attached to the forest. High population density has made the community to view the forest as a potential farming area. Increased donor support may also undermine the sustainability of the local CBOs.

Despite the challenges, Kakamega forest remains a major source of livelihoods for the community and the community has an interest in its conservation. The number of local CBOs is increasing with KEEP and Isukha Heritage being well represented and fairly known in almost all villages around the forest. These two CBOs have the potential of converting into local NGOs, which could partner with National and International NGOs and other development partners to manage Kakamega forest and improve the livelihoods of the forest adjacent community. The high biodiversity value of the forest has started benefiting the local people mainly through projects that have been started with direct benefit to the community. Volunteerism is very high and this is a virtue that needs to be enhanced (ARPIP, 2006).

CHAPTER THREE: MATERIALS AND METHODS

This chapter presents information on the study area, choice of site, target population and sample size, data collection methods and instruments and data analysis.

3.1 Study Area

This study was carried out in Ontukigo and Ngare Ndare CFAs operating in Ontulili and Ngare Ndare forests, respectively. These forests are located in Mbuuri District curved from former larger Meru Central District and it has two divisions namely Timau and Mbuuri.

Ngare Ndare forest covers an area of 5554.3 hectares (54km^2) and lies between $0^0$07'N to 0^0 10N and 37^{0}18'E to 37^{0}27'E. The forest is 2336 metres above sea level and 260 km from Nairobi through Nanyuki town. It is predominantly a dry cedar forest with an annual rainfall of about 450 mm occurring between March – May and November – December and average temperature is between 20^{0}C and 28^{0}C (Ngare Ndare Trust, 2008). Villages covered in the household survey included: Mbuju, Ngare Ndare, Suboiga and Ethi.

Ontulili forest is located within latitude 0.0666667° and Longitude 07.2833333°, about 15 km from Nanyuki town on the way to Meru and is wetter than Ngare Ndare forest. Villages around Ontulili where household survey was done include: Katheri, Lower Ngusishi, Upper Ngusishi and Sirimon. These forests are part of the seven forests formerly referred to as Mt Kenya forests and they are located near Mt. Kenya National Park (Figure 3.1).

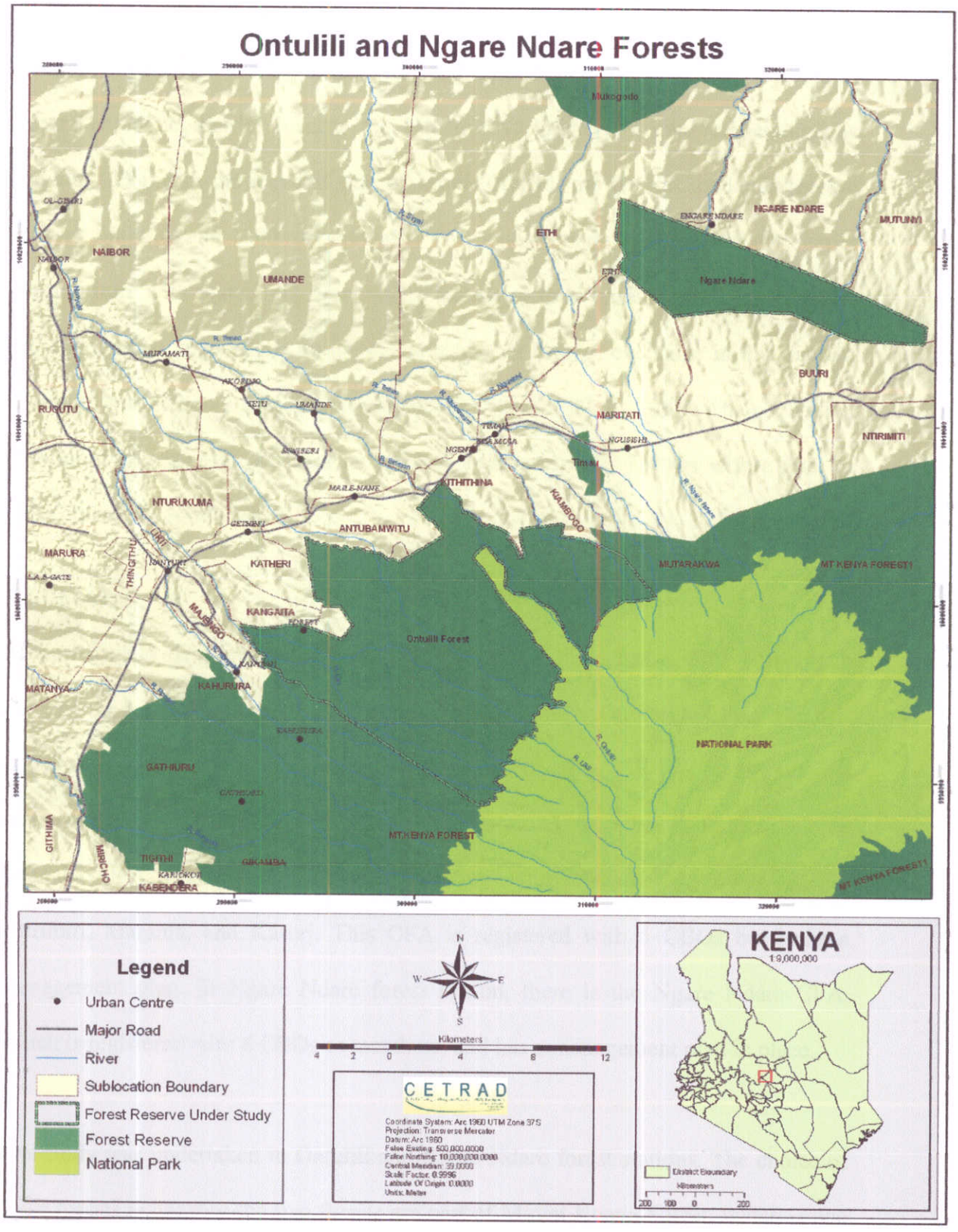


Figure 3.1: Location of Ontulili and Ngare Ndare Forests in Kenya
Map Source: CETRAD (2011)

Mbuuri district is partly lowland and semi-arid, it receives bi-modal rainfall pattern with the long rains occurring from March to May and the short rains from October to December. The district is near the Equator; variation in mean temperatures is minimal. Being in the leeward side of Mount Kenya, the district lowlands receive between 380 mm and 1000 mm annually. The major economic activity in the district is agriculture with maize and beans being the major food crops. Growing of flowers and commercial vegetable is an important source of foreign exchange in this district. Livestock production is practised throughout the district (GoK, 2001). The population of Mbuuri District was recorded as 109,803 people in 2009 Census with a total of 32393 households (KNBS, 2009).

3.2 Choice of site

Mbuuri district has three forest stations and each of them has a CFA working in partnership with KFS. In Ontulili Forest Station, there is Ontukigo CFA, which is composed of eleven community-based organizations. The CFA is registered and management plan preparation process is underway. Marania Forest Station has the Ntimaka CFA whose name originates from the three villages it covers namely Ntirimiti, Marania, and Karuri. This CFA is registered with 5 CBOs but lacks a management plan. In Ngare Ndare forest station, there is the Ngare Ndare CFA, which is registered with 6 CBOs as members, and has a management plan in place.

The study was undertaken in Ontulili and Ngare Ndare forest stations. The choice of these forests is because the two forests are part of Mount Kenya Forest, which is one of the 5 key water towers in Kenya and many people depend on it for their livelihoods. Another factor considered is that the two forests have different climatic and management conditions with the former being a wet forest under plantation

management and the latter being relatively drier and under indigenous vegetation. More so, Ontukigo CFA and Ngare Ndare CFA have both embraced PFM undertaking different activities. Hence it was considered necessary to assess the roles of the CFAs in management of the two forests and be able to present the differences in their capacities to meet PFM objectives of improving forest cover and community livelihoods.

3.3 Target Population and sample size

Purposive sampling technique was used to select CFAs working in the two forest sites because it is the CFAs who had the required information with respect to the objectives of this study. Focussed group discussions were held in each of the forest site with at least 10 members drawn from the CFAs and non-CFA members adjacent to these forests to provide the needed information. Interview schedules were administered to KFS staff, KWS, CFA staff and other stakeholders' officials selected by use of snowball sampling method (Mugenda & Mugenda, 1999).

For household interviews, the respondents were selected by use of stratified random sampling method whereby stratification was based on CFA membership. This was to ensure that CFA and non-CFA members are well represented during the survey. Gay (1981) proposes that for correlation research, 30 cases or more are required. Therefore based on this premise, the semi-structured questionnaire was administered to 80 CFA and 80 Non-CFA members selected by stratified random procedure from at least 4 randomly selected villages surrounding each of the two forests. Eighty households were interviewed around each forest site giving a total of 160 households in both Ontulili and Ngare Ndare forest stations.

3.4 Data Collection methods and instruments

Secondary data were obtained through review of relevant literature from libraries and Internet including resource materials such as journals, annual reports, books, workshop proceedings, periodicals, PFM reports, and district reports. Primary data was obtained by use of various qualitative and quantitative methods. The objectives of this study were mainly achieved by use of semi-structured household survey (see Appendix III). The household survey data was complemented through application of different PRA tools.

The first objective of this study was to identify household factors associated with decision to participate in community forest associations. Household interviews were done using structured questionnaires (Appendix 3) administered to selected households of both CFA and non-CFA members. The household interviews were useful in collecting socio-economic information from a cross section of these households to gain an understanding of variations between families. CFA and Non CFA members not represented among the leaders or focussed group discussion had an opportunity to air their views concerning the PFM process. It also provided the opportunity to compare community-wide issues discussed during community meetings with household level conditions. Factors such as gender, household size, farm size, homestead distance from the forest and numbers of livestock owned among other factors were analysed comparatively for both CFA and Non CFA members. This helped to identify the significant factors associated with the decision to join CFA and participate in PFM.

The second objective was to identify any differences between CFA and Non CFA members in their level of participation in forest conservation activities. This was attained using semi-structured questionnaire (Appendix 3) complemented by focussed group discussions and historical timeline (Appendix 2). A historical time line is a list

of key events in the life of the community that helps to identify its past trends, events, problems and achievements and how it has dealt with natural resource issues in the past. The significant events in the history of each forest adjacent community were documented including PFM introduction, its influence on forest management and how it has affected their level of participation in forest management. Participant observation was used to capture technical practices of CFAs in the forest sites. Photography was used for illustration of the field realities (Lelo *et al* 2000).

The third objective was to assess the relationship between the level of participation of CFA members in PFM and their perceived benefits. This objective was addressed using the semi-structured questionnaire (Appendix 3).

The fourth objective was assessing community perception on the contribution of CFA to improved forest cover was achieved using the semi-structured questionnaire complemented by interview schedule (Appendix 2) administered to KFS, KWS and CFA staff/officials and focussed group discussions with CFA and Non CFA members. An unstructured interview schedule is a set of questions that lack categories but act as an interview guide with a general plan that the interviewer follows. Probing was done to obtain greater in depth information (Mugenda and Mugenda, 1999). Photography was used to show some of the PFM activities undertaken by the CFAs in the forest in their efforts to improve forest cover.

The fifth objective involved assessing the perceptions of members of CFA on contribution of PFM to their economic wellbeing. Information on income generating activities undertaken under PFM and their influence on the CFA members' economic well-being was captured through the semi-structured questionnaire. CFA and Non CFA members' wellbeing categories were based on wealth characterization

undertaken by a few of the community members in each forest site. Photography was used to show some of the forest activities such as Plantation Establishment Livelihood System (PELIS) undertaken in the forest to enhance the economic wellbeing of the CFA members.

An unstructured interview schedule was administered to purposively selected government staffs especially KFS staffs and CFA workers in the two forest stations to understand community attitudes towards current government PFM conditions. This provided information on CFA and government legal conditions underlying the process of PFM as well as the performance of the CFA from their own perspective and that of the KFS staff. Problem analysis done through focus group discussion was used to document the problems faced by each CFA and other stakeholders in PFM, outlining the perceived causes, current coping strategies and opportunities or solutions for each problem. This involved analysis of the government PFM conditions to understand problems faced in PFM implementation hence determine aspects that require alteration and/ or initiation to enhance the capacity of CFAs to effectively manage the government forests while improving their livelihoods.

3.5 Data analysis

This study generated both qualitative data from PRA tools and quantitative data from semi-structured questionnaires administered through household surveys. The Qualitative data obtained through PRA tools were subjected to in-depth analysis and used to complement the discussion of analysed quantitative data. The quantitative data were cleaned, sorted, summarized, and stored using Ms Excel. The data was presented in forms of charts and tables where necessary.

Chi-square test statistics (χ^2) were computed for quantitative data using SPSS 11.5 to assess association between categorical variables. Computation of Chi-square values from the data was done as per the formula below:

$\chi^2 = \sum_i [(n_i - E_i)^2 / Ei]$, Where, ni = the observed number in category i and E_i is the expected number under Ho (Null Hypothesis). Rejection region: reject Ho if χ^2 exceeds the tabulated critical value for P ranging between 0.05 and 0.001 and Degrees of Freedom (df) = k-1, where k is the total number of categories (Ott, 1993).

Spearman rank order correlation statistic (r_s) measures the monotonic association between variables x and y. It is used to determine whether y increases (or decreases) with x, even when the relation between x and y is not necessarily linear. For the data in this report r_s was used determine the relationship between household size and fuel wood consumption, age and number of trees, farm size and number of trees. For comparison of average farm size, number of livestock, trees, mean age and number of tree planted by CFA and Non CFA members, t-test for independent samples was used to test whether the difference between the means were significant or not (Ott, 1993).

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Household characteristics of forest adjacent community members

4.1.1 Gender and household sizes for CFA and Non CFA members

Majority of CFA and Non CFA members interviewed in both study sites were of male gender (Table 4.1). The association between CFA membership and gender has a low significance ($\chi^2 = 3.79$, $p = 0.051$) hence gender was not a very important determinant in household decision to join CFA.

Table 4.1: Gender of respondents adjacent to Ontulili and Ngare Ndare forests

CFA membership status	Male (%)	Female (%)	N
CFA member	53.8	46.3	80
Non CFA member	68.8%	31.3	80
Total	61.3	38.8	160

Conversely, gender had a significant influence on participation of community members in forest conservation irrespective of CFA membership ($\chi^2 = 4.215$, $p=0.04$). More males (63.7%) were participating in forest conservation than the females (36.3%). This agrees with the observation made by Coulibaly-Lingani *et al* (2011) in Burkina Faso, that there is a highly significant relation between gender and participation in forest conservation. This implies that gender is important for some aspects of participation in Kenya just as reported for other developing countries such as Burkina Faso. Male and female community members experience different circumstances that affect their participation in forest conservation activities such as fire fighting and forest patrol among other activities. Women's personal and household attributes constrain their participation in community organizations in Southern Burkina Faso. Women are quite disadvantaged due to their social and household obligations such as childcare, fetching water, cooking food and farming. The role of women as care givers and nurturers hinders them sparing time from

domestic chores to participate in conservation activities or attend forest management meetings (Nuggehali and Prokopy, 2009).

In both Ontulili and Ngare Ndare forests, the adjacent communities outlined the nature of their household headship as: male headed; female headed; single parent headed and both parent headed (Table 4.2). Most of the respondents had their households headed by the males hence there is need to encourage participation of both men and women in PFM activities with respect to the existing family set up. This is because, although all the forms of headship are represented, men are the major decision makers in most African families hence directly and/ or indirectly influence all decisions made in the CFA. However, there was no significant association between CFA membership and nature of household headship (χ^2 = 1.02, p = 0.08) hence decision to join CFA was not necessarily determined by household headship.

Table 4.2: Nature of headship for CFA and Non CFA members

CFA membership status	Nature of household head (%)				N
	Male headed	Female headed	Single parent	Both parents	
CFA members	68.8	18.8	3.8	8.8	80
Non CFA members	73.8	13.8	2.5	10.0	80
Total	71.3	16.3	3.1	9.4	160

CFA and Non CFA Household sizes

The households surveyed in both sites had a total of 849 household members out of whom 54.1% were members of CFA households and 45.9% were members of Non CFA households. There was a significant difference (t-test where t=2.065; p=0.05) between the household size of CFA members (mean = 5.7 members per family) and Non CFA members (Mean = 4.8 members per family). This implies that household size is an important determinant of household decision to join CFA. Therefore, it is

most likely that CFA members have a greater demand for forest products such as firewood due to their larger household sizes hence the decision to join CFA in order to increase their chances of accessing forest products. This agrees with the observations of Chhetri (2005) that households with large family size are in better position to utilize the community forest resources hence are likely to participate more in PFM to meet their needs for forest products. Similarly, Dolisca *et al.* (2006) in a case study from Haiti identified household size to be having a positive effect on social level participation in forest management. This indicates that households with fewer members are less likely to participate in social forestry activities. Coulibaly-Lingani *et al.* (2011) also noted in a related study that respondents' household size had a positive effect on participation in decision making. This meant that heads of large families are more interested in participating in forest management decision making-process than other community members. This is also attributed to the possibility that individuals with larger families depend on forest resources to diversify household livelihoods as they may find it challenging to access alternative sources of livelihood (Coulibaly-Lingani *et al.* 2009).

4.1.2 Ages of CFA and Non CFA members

The mean ages of CFA (46 years) were significantly different from those of non-CFA members (41 years) in both forests ($t = 2.408$, $p = 0.01$). Therefore, age could be an important determinant factor in household decision to participate in PFM probably because the two communities respect the decision of the aged. This shows that more aged people were more interested in joining CFA than the younger ones. This could be due to the young people having various commitments that they value more than participating in PFM activities through joining CFA. The older may also be interested

because they have time to participate and the fact that they value their forests and are interested in conserving them. At the age of 46 years, most of the community members have families whom they have to fend for hence they depend on the forest to meet their domestic needs for forest products. They are also within the active age band at which they can participate in forest conservation activities as well as having a better chance to access various forest products. Highest participation in forest conservation for all community members in the two study sites was noted for respondents within the age band of 35-50 years. Other studies have reported conflicting results in regard to the influence of age on participation in forestry activities. For instance, Thacher *et al.* (1997) and Zhang and Flick (2001) found age to have no influence on forest management while Dolisca *et al.* (2006) found that age had a negative impact in explaining the level of participation in forestry activities. This implies that the young people were willing to participate in forest activities unlike in this study where the older people were the major participants through CFA.

4.1.3 Level of education of forest adjacent communities

Most (42.5%) of the CFA members in Ngare Ndare had a secondary school level of education while for Ontukigo CFA; most members had upper primary level of education. In both sites most of the Non CFA had upper primary level of education (Table 4.3). There was no significant association between the level of education and CFA membership in each of the forest sites ($\chi^2 = 8.791$, $p = 0.06$). There was also no relationship between level of education and the participation of both CFA and Non CFA members in forest conservation ($\chi^2 = 2.799$, $p = 0.06$) and their access to various forest products such as firewood, herbs and fodder and thatch grass among others ($\chi^2 = 3.838$, $p = 0.4$). These results agree with the results of Coulibaly-Lingani *et al*

(2009) that education did not influence respondent's access to the forest for fuel wood extraction and grazing livestock. However, previous studies show that education level has a tendency to reduce forest dependency. A higher level of education provides a wider range of job options hence making fuel wood collection unprofitable due to greater opportunity costs of collection (Adhikari *et al,* 2004).

Table 4.3: Level of education of Ngare Ndare and Ontulili forests

Forest	CFA membership status	Level of education (% respondents)					N
		Illiterate	Lower primary	Upper primary	Secondary school	Tertiary	
Ngare Ndare	CFA	7.5	17.5	27.5	42.5	5.0	40
	Non CFA	0.0	10.0	65.0	20.0	5.0	40
Ontulili	CFA	5.0	37.5	42.5	12.5	2.5	40
	Non CFA	2.5	27.5	47.5	22.5	0.0	40

Contrary to the findings of Obua *et al.* (1998) that education tends to increase one's awareness of the importance of the environment and of natural resources, in this study, there was no relationship between level of education of both CFA and Non CFA members and their awareness of the Forest Act 2005, growing of trees and participation in forest conservation.

4.1.4 Wellbeing categories of forest adjacent community members

Community wellbeing characterization

Using PRA tool of wealth ranking, the community members were able to give different characteristics for different wealth ranks (wellbeing categories) in their communities. Ontulili community members involved in wealth ranking characterized their wealth ranks as follows (Table 4.4).

Table 4.4: Wealth ranks as characteristics by Ontulili community members

Characteristic	Very rich (A)	Rich (B)	Poor (C)	Very Poor (D)
Farm size	More than 5 acres	2.0 - 4 acres	0.5 acres	Squatters (No farm)
House	Permanent Stone walls	Semi-permanent Cement floor Iron sheets	Temporary house	Rented or no house
Cows	More than 10 cows	5-9 cows	1-4 cows	No cows
Means of transport	Vehicle	Motorbike	Bicycle	No means of transport

Ngare Ndare community members involved in wealth ranking characterized their wealth ranks as follows (Table 4.5).

Table 4.5: Wealth ranks as characteristics by Ngare Ndare community members

Characteristic	Very rich (A)	Rich (B)	Poor (C)	Very Poor (D)
Farm size	20 acres or more	More than 17 acres	Small plot (50ft by 100ft)	Squatters (No farm)
House	Permanent Stone walls	Semi-permanent Cement floor Iron sheets	Temporary house	Rented or no house
Cows	About 100 cows, 300 sheep	2-3 cows, 20-30 goats/sheep	No cows	No cows
Transport Means	Tractors /combine harvesters	Motorbike	Bicycle	No means of transport

Wellbeing categories of CFA and Non CFA members

During the household survey, wealth ranking of the households in both forest sites was done on the basis of the community wellbeing characterization (Table 4.4 and 4.5). Analysis of wellbeing categories based on household surveys in the forest sites (Table 4.6) revealed that most of the CFA members were categorized as rich and poor in both forest sites. None of the CFA members were very rich and very poor in Ngare Ndare, while very few CFA members in Ontulili forest were categorized as very poor.

Only one Non CFA was categorized as very rich in Ngare Ndare forest (Table 4.6). Similar observations were made in Dida community managing Arabuko Sokoke Forest where majority of the PFM participants were rich (37.5%) and poor (37.5%) and very few were very rich (12.5%) and very poor (12.5%). However, there was no significant association between CFA membership and wellbeing categories in Ngare Ndare ($\chi^2 = 1.325$, $p = 0.5$) and Ontulili forest sites ($\chi^2 = 0.220$, $p = 0.9$).

Table 4.6: Well being categories of respondents in Ontulili and NgareNdare Forests

Forest	CFA membership status	% of Respondents				N
		Very Rich	Rich	Poor	Very Poor	
Ngare Ndare	CFA	.0	55.0	45.0	0	40
	Non CFA	2.5	47.5	50.0	0	40
Ontulili	CFA		65.0	30.0	5.0	40
	Non CFA		62.5	30.0	7.5	40

The same trend was also observed for Kereita, Upper Imenti and Esecheno communities. In Loita, none of PFM participants was categorized as very poor. It was observed that the very poor were under-represented in PFM participation. This was attributed to poverty, conditions set to join CFA such as membership fee and process requirement such as attendance of PFM meetings and doing activities such as forest patrol which get them out of their survival strategies like casual work. For some Non CFA members, they were finding it socially hard to sit with people who had been employing them as casuals to work in their farms (Mbuvi *et al.*2009). In Ontulili and Ngare Ndare, similar reasons were found applicable. However, the major reasons for non-PFM participation were highlighted as PFM being too much time demanding, very little benefit perceived, benefits taking too long to be attained and general lack of interest in PFM activities.

4.1.5 Homesteads' distance from the forests and CFA membership

Both the CFA and Non CFA members interviewed were living adjacent to the forests mainly within 0-1 km. There were only 2 CFA and 2 Non CFA members living at distances beyond 5 Km from Ngare Ndare forest. There were no community members living beyond 5 km distance from Ontulili forest (Table 4.7).

Table 4.7: Distances of homesteads from Ngare Ndare and Ontulili forests

CFA membership status	Respondent %				N	Average Distance (Km)
	0-1km	1.1-3km	3.1-5km	> 5km		
CFA	63.8	27.5	6.3	2.5	80	1.227
Non CFA	48.8	43.8	5.0	2.5	80	1.571

There was a significant difference between the average CFA and Non CFA homestead distances from the forests ($t = -1.253$, $p=0.05$). Therefore, homestead distance is a determinant factor in household decision to join CFA in both forest sites.

However, considering the relationship between general participation of all community members in forest conservation irrespective of CFA membership, it was noted that range of homestead distance from the forest had a very significant influence on the number of community members participating in forest conservation ($\chi^2 = 20.686$, $p<0.001$). As the distance of homestead from the forest increased, the number of community members participating in forest conservation activities decreased. Highest number of those participating (61%) was within 0-1km distances, reduced to 32.9% (1.1-3km), 4.8% (3.1-5km) and reduced further down to 1.4% (over 5.1km). This result concurs with Chhetri's (2005) observation that distance of the forest from the household had significant inverse relationship with participation in forest management.

4.1.6 Landholdings for CFA and Non CFA members

Most of the CFA members had their farm sizes within the ranges of 0.6-2.0 acres and 2.1-5.0 acres in both Ngare Ndare and Ontulili forest sites. Ngare Ndare CFA members had larger farms than Ontukigo CFA members. Non-CFA members in Ngare Ndare had larger farms than Non CFA members in Ontulili (Table 4.8).

The difference between the average farm sizes for CFA (3.484 acres) and non-CFA members (2.306 acres) was significant ($t = 1.495$, $p = 0.01$). CFA members had larger farms available for their use probably because they had more interest in growing crops and had more livestock hence forcing them to buy more land or rent as well as being able to access government forest land for grazing and for cultivation under PELIS in Ontulili forest. Access to more land in the government forests could also be a contribution of PFM to improved wellbeing of the CFA members.

Table 4.8: The farm sizes for Ngare Ndare and Ontulili respondents

Adjacent forest	CFA membership status	% of Respondents				N	Mean farm size acres
		0.0-0.5 acres	0.6-2.0 acres	2.1-5.0 acres	Above 5 acres		
Ngare Ndare	CFA	7.5	50.0	22.5	20.0	40	5.296
	Non CFA	7.5	57.5	20.0	15.0	40	3.116
Ontulili	CFA	12.5	67.5	20.0	.0	40	1.673
	Non CFA	35.0	50.0	12.5	2.5	40	1.496

Land tenure for CFA and Non CFA members

The main types of land tenure were; title deed, government forest allocated land, squatters and rented farms. All the Ngare Ndare CFA members interviewed had title deeds for their lands while 90% of the Ontukigo CFA members interviewed had title deeds. In Ontulili forest site, there were 15% of the CFA members who had government land allocated to them by KFS mainly for use under PELIS. This is a

system through which the CFA members are allowed to cultivate small parcels of land on condition that they prepare the land for tree planting, participate in tree nursery establishment and tree planting activities within the forest and weed around the planted tree seedlings to enhance their survival (Table 4.9).

Table 4.9: Type of land tenure for respondents in Ngare Ndare and Ontulili forests

CFA membership status	Type of land tenure	Number of respondents	% Respondents
CFA members	Title deed	76	95
	Squatters	1	1.25
	Government forest land allocated	12	15
Non CFA members	Title deed	71	88.7
	Squatters	1	1.25
	Rented farm	8	10

The CFAs had accessed their land through purchase (45%), inheritance (27.5%), being given free (27.5%) and through allocation by KFS (15%). The Non CFA had accessed their land through purchase (45%), inheritance (32.5%) and free allocation (22.5%). It was noted that renting of land as a form of land tenure influenced CFA membership negatively (χ^2 = 8.421, p=0.003, Gamma value = -1.000). None of the respondents renting farms was a member of CFA. This form of land tenure also had a negative influence on growing of trees on farm (χ^2 = 16.916, p<0.001, Gamma value = -0.921) and access to forest products and services (χ^2 = 14.902, p=0.002, Gamma value = -0.842). Government forestland allocation influenced CFA membership positively since all those allocated land in the forest were CFA members (χ^2 = 12.973, p<0.001, Gamma value = 1.000). Having title deed for land as a form of tenure influenced tree growing on farms positively (χ^2 = 19.537, p<0.001, Gamma value = 0.852) and access to forest products and services (χ^2 = 6.109, p=0.02, Gamma value = 0.616). This finding is consistent with the findings of Zhang and Pearse (1996), which

indicated that land tenure influences farmers' motivation to participate in forest management activities. Land tenure forms with longer terms and that are secure and able to provide more benefits to their holders were more likely to encourage participation in reforestation. It was similarly observed by Dolischa *et al.* (2006) that lack of secure land rights had contributed to farmer's non-participation in forestry programs in Haiti.

4.1.7 Major and alternative sources of livelihood for respondents

Analysis of major sources of livelihood indicated that most of the CFA and non-CFA members depended on cash crop growing. Other major sources of livelihood for CFA members include livestock production, forest product sales and other businesses (Figure 4.1). This is almost similar to what was observed for community members living adjacent to various forests in Tanzania, where the 6 main sources of household income were highlighted as agriculture, livestock, business, labor, forest utilization and sale of forest products (Meshack, 2009).

Although most CFA members associated the improvement of their economic wellbeing to PFM activities and forest products accessed as incentives for participation, only 5% and 4.1% indicated to be depending on forest products' sales as major and alternative sources of livelihood respectively (Figure 4.1). This could be attributed to a possibility that most of the forest adjacent community members in Kenya and other countries consider it a right to benefit from forest goods and services for free. In Tanzania, it was observed that forest utilization included fuel wood, thatch grass, building poles and fodder. Income from daily labour was the most important for the poor group. The poor groups were also noted to be selling forest products such

as fuel wood and grass for fodder to the people owning local restaurants and livestock (Meshack, 2009).

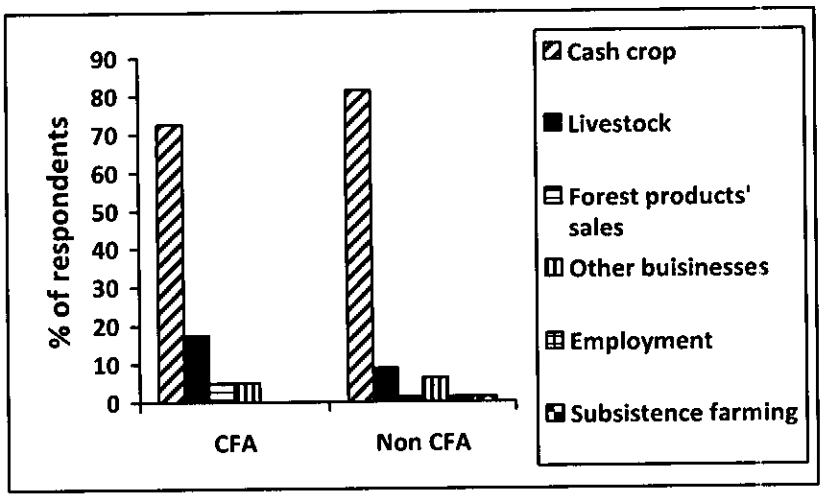


Figure 4.1: Major sources of livelihood for respondents in both forests

Most often community members living adjacent to forest do not consider the value of the forest products and services obtained in economic terms. Generally, a low perceived value of forests is also reflected in a series of economic policies and strategies that usually ignore forests. Emphasis on agricultural subsidies have had devastating impacts on forest cover and land use yet economic policy attention has rarely focused on promoting sustainable forest uses, enterprises and technologies or on providing low-cost alternatives to forest degrading activities. It should be noted that forests have intrinsic alternative values regardless of actual use. Such include their cultural, spiritual and heritage values among others (Emerton, 2001).

The main alternative sources of livelihood for CFA members were livestock keeping (60.8%), businesses (16.2%), cash crop (8.1%), casual work (6.8%), selling forest products and poultry keeping represented equally by 4.1%. For Non CFA members, the alternative sources of livelihood were indicated as livestock keeping (56.6%), cash

crop growing (23.7%), business (15.8%), casual work (2.6%) and selling forest products (1.3%).

4.1.8 Crop land for CFA and non CFA members

Majority of the community members living adjacent to Ngare Ndare forest and Ontulili forest depend on cash crop growing as source of livelihood. Majority of the community members plant both cash crops and food crops in their own farms (Figures 4.2 and 4.3). In Ngare Ndare forest, there is no association between CFA membership and place where crops are grown since none of the community members grow crops in the forest irrespective of their CFA membership status (Figure 4.2). This is because this forest is an indigenous forest in which no form of crop cultivation and exotic tree plantation establishment is practiced.

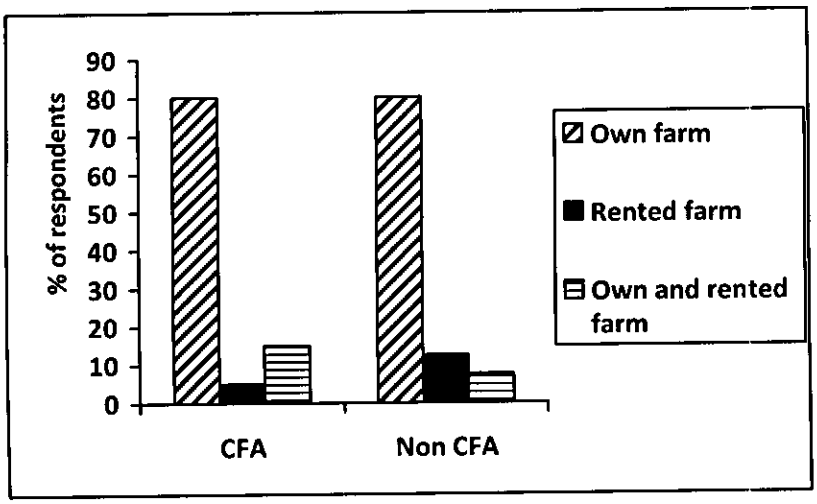


Figure 4.2: Crop land for Ngare Ndare CFA and Non CFA members

In Ontulili forest, there was a highly significant association between CFA membership and place where crops are grown (χ^2 = 22.762, p = 0.001). This is because the few community members growing crops in Ontulili forest under PELIS system are CFA members only (Figure 4.3).

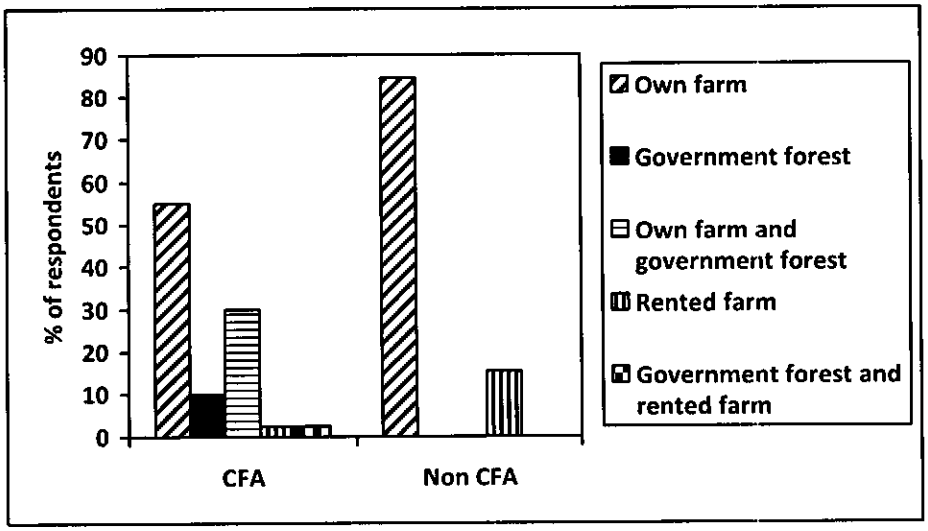


Figure 4.3: Crop land for Ontulili CFA and Non CFA members

Major food crops grown in Ngare Ndare and Ontulili include maize, potatoes, beans, and peas. The major cash crop for Ngare Ndare is wheat, while potatoes and French beans are important cash crops in both forest communities. The major crop grown by most of the Ontukigo CFA members under PELIS is potatoes while carrots are grown by a few members of the CFA.

4.2 Community Participation in forest conservation

4.2.1 Awareness of Forest Act 2005

Awareness of government provision for community participation in forest management is very important in encouraging community members to join CFA and participate in conservation of the Ontulili and Ngare Ndare forest. Majority of the CFA members were aware of the provision in the Forest Act 2005 for community involvement in forest management through the formation of CFA (Figure 4.4). There was a significant positive association between CFA membership and awareness about the provision for community participation in forest management by the Forest Act 2005 in both Ontulili and Ngare Ndare forest sites ($\chi^2 = 22.227$, $p = 0.001$). This

implies that awareness about the forest Act 2005 is an important determinant for household decision to join CFA.

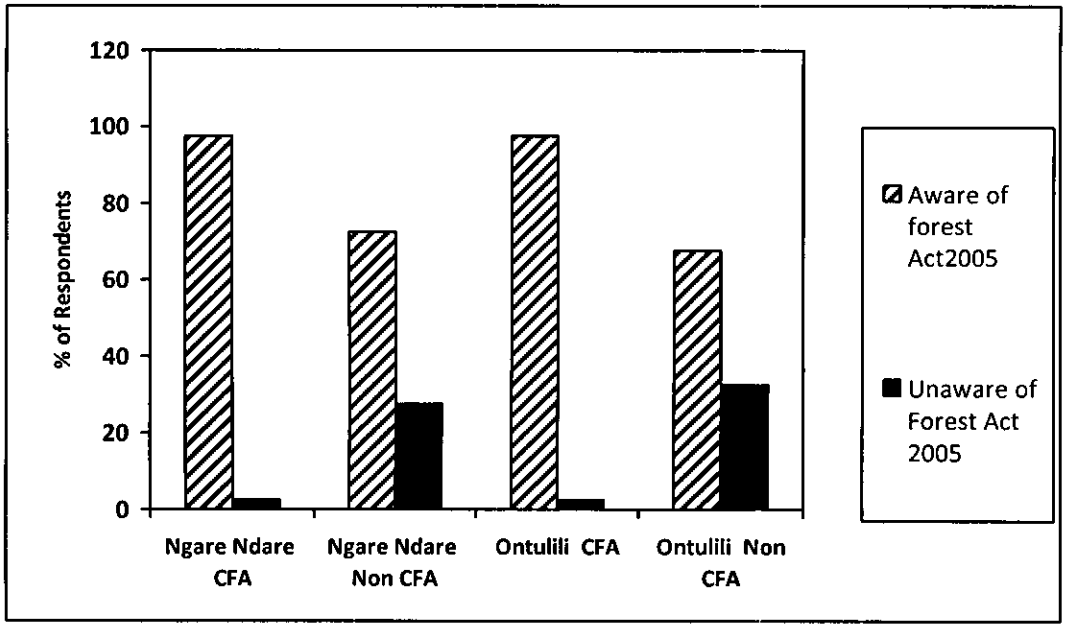


Figure 4.4: CFA and Non CFA awareness of Forest Act 2005

Sources of information about the Forest Act 2005

The main sources of information on the forest Act 2005 and the provision for community participation in forest management were outlined as CFA officials and KFS staff (Figure 4.5). There was a highly significant association between CFA membership and the major sources of information, that is, CFA officials ($\chi^2 = 19.867$, $p = 0.001$) and KFS staff ($\chi^2 = 19.297$, $p = 0.001$). Therefore as community members joined CFA, they increased their chances of interaction with CFA officials and KFS staff hence enhancing their access to information about the forest Act 2005 and the PFM process.

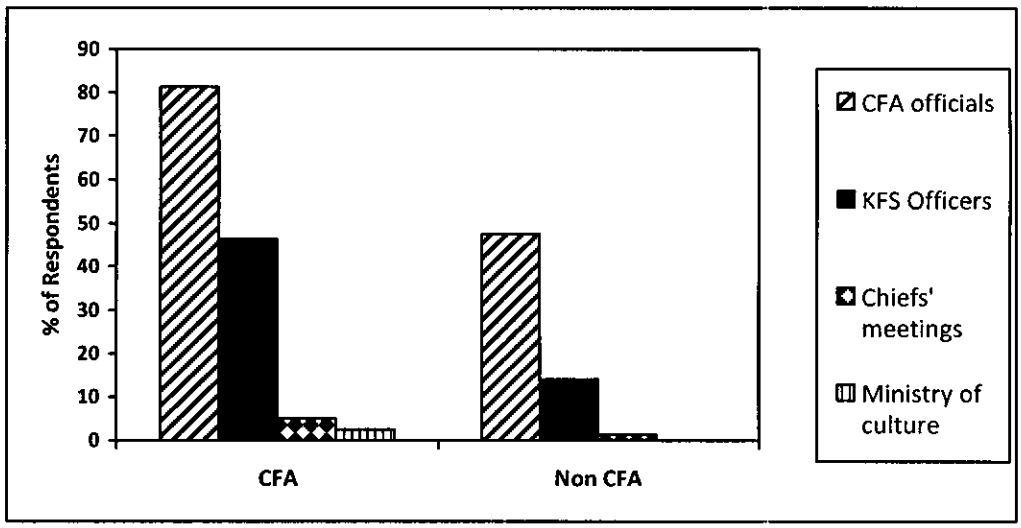


Figure 4.5: Sources of information on Forest Act 2005 for CFA and Non CFA

4.2.2 Participation of CFA and Non CFA members in forest conservation

The community members living adjacent to both Ontulili and Ngare Ndare forests indicated that they participated in various forest conservation activities irrespective of whether they were CFA members or not. It was observed that 97.5% of the CFA members were participating in forest conservation activities compared to 85% of the Non CFA (Figure 4.6).

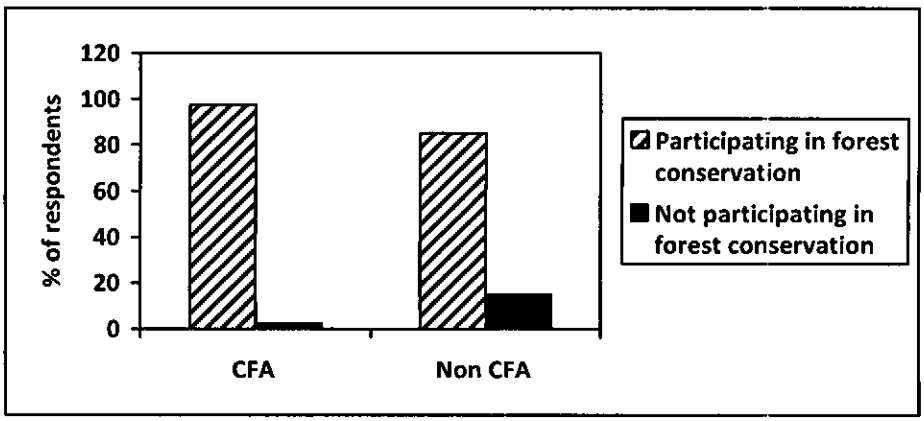


Figure 4.6: CFA membership and participation conservation of both forests

There was a positive significant association between CFA membership and participation in forest conservation ($\chi^2 = 7.83$, $p = 0.05$, Gamma value = 0.746). This has an implication that for more participation of community members in forest

conservation activities the government, through KFS should mobilize the community members to join CFA in each of these forests. The number of CFA and Non CFA members participating in forest conservation varied from one type of activity to another. Analysis of those community members participating in each forest conservation activity revealed that there were a greater percentage of CFA members participating in each forest conservation activity as compared to the Non CFA members (Table 4.10).

Table 4.10: Participation in forest conservation in relation to CFA membership

Forest conservation activity	Participation	Membership	
		CFA (%)	Non-CFA (%)
Forest patrol	Yes (%)	86.3	55
	No	13.7	45
Tree planting	Yes	86.3	27.5
	No	13.7	72.5
Fire fighting	Yes	95	27.5
	No	5	72.5
Tree nursery	Yes	86.3	1.3
	No	13.7	98.8

There was a strong positive association between CFA membership and participation in the major forest conservation activities in both Ontulili and Ngare Ndare forests. These activities include; forest patrol ($\chi^2 = 18.83$, $p = 0.001$, Gamma value = 0.674); tree planting ($\chi^2 = 56.29$, $p = 0.001$, Gamma value = 0.886); fire fighting ($\chi^2 = 76.79$, $p = 0.001$, Gamma value = 0.961) and tree nursery activities ($\chi^2 = 117.44$, $p = 0.001$, Gamma value = 0.996). Therefore CFA membership encourages more participation in forest conservation than non-CFA membership. This agrees with observations made by Pretty and Smith (2004) that social capital is an important resource for shaping individual's participation in biodiversity conservation. Therefore CFA membership seems to strengthen the social capital of the community members living adjacent to the two study forests with a goal of improving forest management while improving

their livelihood. Social capital includes characteristics of social organizations such as networks, norms, and trust that enable participants to act together more effectively in order to pursue shared objectives (Putman (1993) and such is apparent in the two CFAs studied. In Haiti, Dolisca *et al.* (2006) noted that respondents who indicated membership to local groups were positive towards social, environmental and economic participation inside Forêt des Pins Reserve. This is attributed to the possibility that non-local group members are not well informed about forestry programmes hence may overvalue or underestimate the benefits.

CFA participation in forest conservation in relation to awareness about CFA operations

The CFA members in both sites were also able to highlight the major operations/activities in which their CFA were involved and most of these activities were mainly aimed at forest conservation to increase the forest cover (Figure 4.7).

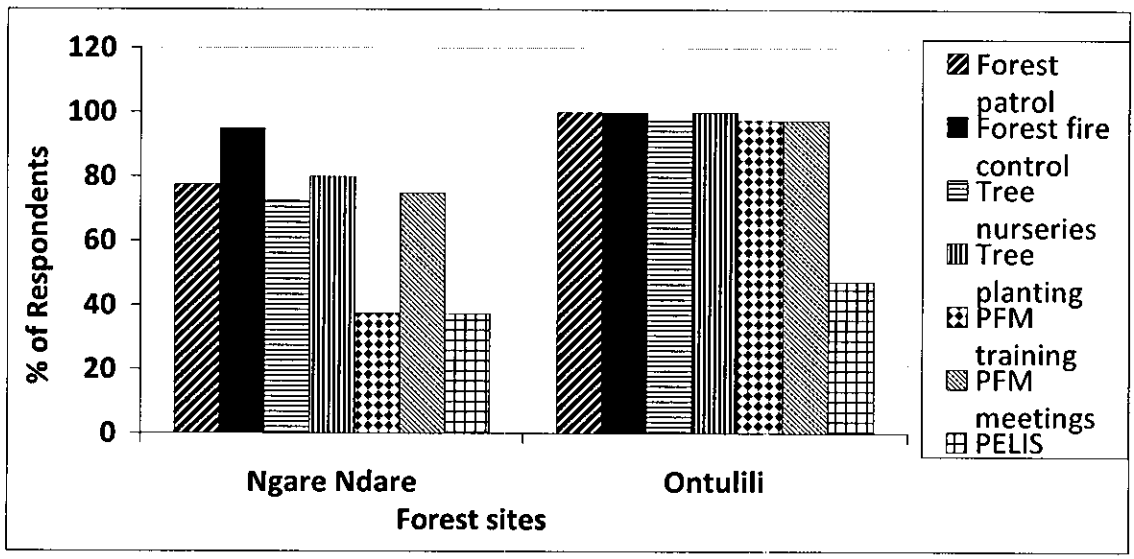


Figure 4.7: CFA operations as recognized by CFA members

The Ngare Ndare members and Ontukigo CFA members participating in the major forest conservation activities namely forest patrol, fire control, tree nurseries and tree

planting activities in their adjacent forests were a great percentage of those who had identified the respective activities as their CFA operations.

There was a strong positive association between awareness of CFA operations geared towards forest conservation and the actual participation of CFA members in those activities in all the forest sites. For instance, 94.2% of CFA members participating in tree nursery establishment in the forest sites were among those who acknowledged tree nursery activities as one of their CFA operations.

Majority of CFA members who participated in tree planting (98.6%) and forest patrol (95.7%) in both forests were also from among those who recognized these activities as their CFA operations (Table 4.11). Therefore, there was a significant relationship between actual participation of CFA members in tree nursery activities (Gamma = 0.955; $\chi^2 = 33.334$, p = 0.001), tree planting (Gamma = 0.983; $\chi^2 = 40.767$, p = 0.001 and forest patrol (Gamma = 0.927; $\chi^2 = 23.944$, p = 0.0001) and awareness of these respective activities as CFA operations.

Table 4.11: CFA participation in forest conservation as per CFA operation

CFA	Forest conservation activity	% of Respondents /Identified CFA operation				N (forest conservation Participants)
		Forest Patrol	Fire Control	Tree Nurseries	Tree planting	
Ngare Ndare	Forest Patrol	90.	-	-	-	30
	Fire Control	-	94.6	-	-	37
	Tree nurseries	-	-	89.7	-	29
	Tree planting	-	-	-	96.7	30
	N (CFA operations)	31	38	29	32	-
Ontukigo	Forest Patrol	100.	-	-	-	39
	Fire Control	-	100	-	-	39
	Tree nurseries	-	-	97.5	-	40
	Tree planting	-	-	-	100	39
	N (CFA operations)	40	40	39	40	-

The actual participation of Ontukigo and Ngare Ndare CFA members in the major forest conservation activities was assessed to identify any differences in CFAs' participation in the conservation of the two forests. It was observed that the number of Ontukigo CFA members participating in the major forest conservation activities in Ontulili forest was higher than the number of Ngare Ndare CFA members participating in similar activities in Ngare Ndare forest (Figure 4.8).

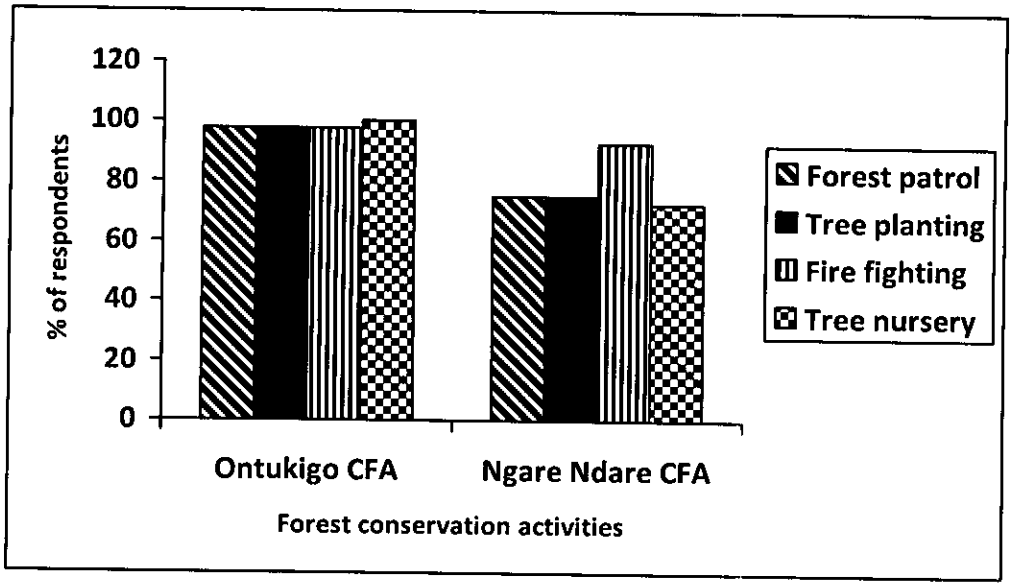


Figure 4.8: Participation of CFAs in forest conservation

A significant difference was observed between the number of Ontukigo and Ngare Ndare CFA members participating in forest patrol ($\chi^2 = 8.54$, $p = 0.003$); tree planting ($\chi^2 = 8.54$, $p = 0.003$); and tree nursery ($\chi^2 = 12.75$, $p = 0.001$). There was no significant difference between participation of Ontukigo CFA members (97.5%) and Ngare Ndare CFA members (92.5%) in forest fire fighting activities ($\chi^2 = 1.053$, $p= 0.305$). This could be implying that CFA members operating in plantation forests participate more than those operating in Indigenous forests.

4.2.3 Levels of participation of Ontukigo and Ngare Ndare CFA in PFM

The PFM activities undertaken by each CFA in Ontulili and Ngare Ndare forests were identified. A generally high level of participation was observed for all CFA members in most PFM activities except in the case of PFM training and PELIS, which had a higher percentage of Ngare Ndare CFA members not participating (Table 4.12).

Differences in the level of participation in different PFM activities among members of Ngare Ndare CFA and Ontukigo CFA living adjacent to Ngare Ndare and Ontulili

forests, respectively, were assessed based on the CFA members' perception and their physical involvement in the activities. High percentages for no participation in PFM training (65%) and PELIS (100%) in Ngare Ndare forest were observed (Table 4.13). This could be due to most PFM trainings had already been done for Ngare Ndare CFA officials and members during the process of developing PFM Plan. However, in Ontulili forest, the PFM plan development was still underway during the time of survey hence Ontukigo CFA members were actively participating at a high level in PFM trainings.

For PELIS, the system had just started with a few of the CFA members in some beats of Ontulili forest where establishment of plantations is done every year. However, in Ngare Ndare, PELIS is not practiced at all because this is a natural forest where crop cultivation is not allowed. Only indigenous trees are established in addition to enrichment planting being done annually using indigenous tree seedlings to enhance tree density. It was noted that the levels of participation in different PFM activities varied among the CFA members involved in PFM activities in the two forests. A high level of participation was noted for the Ontukigo CFA members in most of the PFM activities (Table 4.12).

Table 4.12: Levels of participation of CFA members in different PFM activities

PFM Activity	Level of Participation	Ngare Ndare CFA (%)	Ontukigo CFA (%)
Forest Patrol	No participation	25	2.5
	Low participation	15	20
	High Participation	60	77.5
Fire Control	No participation	7.5	2.5
	Low participation	2.5	8.8
	High Participation	90	82.5
Tree nursery	No participation	27.5	0
	Low participation	0	6.3
	High Participation	72.5	80

Tree planting	No participation	25	2.5
	Low participation	5	22.5
	High Participation	70	75
PFM training	No participation	65	17.5
	Low participation	7.5	10
	High Participation	27.5	72.5
PFM meetings	No participation	25	5
	Low participation	5	5
	High Participation	70	90
PELIS	No participation	100	57.5
	Low participation	0	0
	High Participation	0	42.5

The levels of participation of Ontukigo and Ngare Ndare CFA members in different PFM activities were significantly different (Table 4.13). High level of participation was associated with Ontukigo CFA operating in Ontulili forest. This could be attributed to the different status of the two CFAs in PFM development and the difference in nature of the two forests. Ngare Ndare forest is one of the indigenous forests hence tree nursery activities within the forest are mainly directed towards raising indigenous tree seedlings while tree planting activities mainly involve enrichment planting. Raising indigenous tree seedlings requires expert knowledge and the CFA has been able to employ a nursery manager hence less involvement of the CFA members. Tree nursery establishment, tree planting activities, thinning and pruning in the Ontulili plantation forest are more involving hence the need for high-level participation for Ontukigo CFA members.

The low significance of the difference between levels of participation of Ontukigo and Ngare Ndare CFAs in firefighting activity could be related to the emergency nature of fire outbreaks. This implies that fire outbreaks call for urgent participation of every community member living adjacent to the forest irrespective of whether the forest is a plantation or indigenous forest. PFM meetings usually target the CFA members

irrespective of the type of adjacent forest hence low significant differences between the levels of participation in comparison to other PFM activities in both forest sites (Table 4.13).

Table 4.13: The significant difference between Ontukigo and Ngare Ndare CFAs' levels of participation in PFM

Pearson Chi-square values (χ^2)	Patrol	Fire fighting	Tree nursery	Tree planting	PFM training	PFM meeting	PELIS
Computed value	8.54*	4.702	16.56*	11.89*	19.18*	6.33*	21.59*
Degrees of freedom (DF)	2	2	2	2	2	2	1
Critical value	5.991	5.991	5.991	5.991	5.991	5.991	3.841
P	0.01*	0.09	0.001*	0.003*	0.001*	0.04*	0.001*

Note * is used as a symbol of significant relationship (Computed χ^2 >Critical χ^2)

During focus group discussions, the Ontukigo CFA members pointed out that they participated in most of the PFM activities directly. This was done through provision of labour for tree nursery establishment and management, tree planting in the forest, forest patrol, fire fighting, tree pruning and thinning among other activities. They emphasized that their labour was not always paid for by KFS but they were motivated by the awareness of the importance of having well managed forest for sustainable provision of forest products and services for present and future generations. Through the PELIS (almost similar to Non-residential Cultivation) in the forest, the Ontukigo CFA members were able to establish new plantations in the forest and maintain them with minimal or no costs being incurred by KFS.

The Ngare Ndare CFA had already developed a management plan and had signed a Concession Agreement with KFS. The CFA had grown to such a level that it had the capacity to employ people such as the community scouts to do patrol and paid labour to undertake tree planting activities at times hence their direct individual participation

levels were lower than for Ontukigo CFA, which was still at the level of developing a management plan.

4.2.4 Factors influencing CFAs' general level of participation in PFM

The CFA members' level of perceived benefits in PFM

Effective resource management as desired in PFM entails balancing benefit entitlements and responsibilities of managing the forest resources. It is therefore important to determine whether there is any relationship between the levels of participation of the CFA members and their level of perceived benefits. A high level participation was noted for high benefit perception (68.8%) while a low level participation (17.5%) was observed for low benefit perception (Figure 4.9).

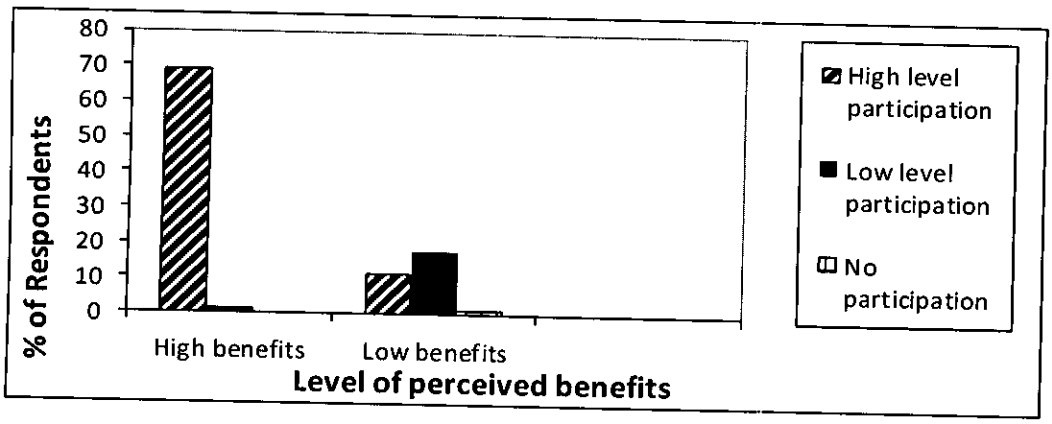


Figure 4.9: Levels of participation of all CFAs in PFM in relation to the level of perceived benefits

There was a perfect strong positive association between the level of CFA participation and their level of perceived benefits (Gamma value = 0.978) and the relationship was significant (χ^2 = 38.73, p = 0.05). This implies that an increased level of perceived benefits would generally lead to a higher level of participation. These findings are consistent with those of Coulibaly-Lingani *et al.* (2011) who noted that majority of those participating in forest management program in Burkina Faso were those receiving direct benefits from participating in such programs.

Dolisca *et al.* (2006) similarly observed that respondents who had benefited from Forêt des Pins Reserve in Ahiti were more positive towards social, environmental and economic participation. Environmental participation can hence be enhanced through providing opportunities for local people to increase incomes through participation. This implies that high forest dependency encourages participation in forest management. Lise (2000) also similarly concluded that the best chances of voluntary participation in forestry activities could be obtained from farmers who are highly dependent on the forest and who perceive the quality of the forest as good.

Degeti and Yemshaw (2003) noted that the level of benefits that people derived from the forest were directly related to their level of participation in forest management especially benefit from forest products and fodder for their livestock. Local consumption was noted to be the most important kind of benefit for the community members followed by monetary benefits obtained through sale of forest products such as firewood and through ecotourism services such as tour guiding among others. In the Oromia region, it was noted that majority of the community members involved in PFM engaged in selling fuel wood and other products to generate additional income.

Temesgen *et al.* (2007) noted that what motivates communities to manage forests is the income from the resource. Therefore, sustainable forest management should have a clear focus on managing forest product supply and demand. The more products available and thus the more potential livelihood opportunities at a forest site, the easier it is to set up community based forest management. Participatory Forest Management should therefore ensure that forest resources that are in high demand are grown in the forest.

The government should also work closely with the CFA members in developing income-generating activities within and off the forest and these activities should be those that do not compromise the state of the forest cover. For forest adjacent communities, forestland represents one key source of environmental capital, which they can use to build their set of livelihood activities. There is need for numerous sources of income in order to make forest management attractive and provide a sustainable foundation for successful PFM. A range of Non timber Forest Products (NFTPs) have to be developed rather than relying on one and their value also needs to be increased through organic or forest certification and niche marketing. Income sources such as eco-tourism and other environmental service payments need to be developed to ensure that agricultural land users do not out compete forestland use (Wood, 2005) as it is currently in Ontulili and Ngare Ndare forest adjacent communities.

The government should not expect continued participation of the forest adjacent community members in management of forest resources without any form of incentive in terms of benefits. As noted by Meinzen-Dick and Di Gregorio (2004), many governments are undertaking decentralization and devolution of programs to transfer responsibility for resource management to local governments and user groups such as CFAs after they have failed to effectively manage those natural resources centrally. Transfer of responsibility of forest management to local community organizations such as CFAs without transferring of corresponding rights is a common and unfair practice in most countries. Due to such occurrences, the user groups such as the CFAs may lack the incentive, and hence the authority to manage the resource.

Range of farm sizes of CFA members

A high level of participation was observed for CFA members with farm sizes in the ranges of 0.6-2.0 acres and 2.1-5.0 acres. Considering the community wealth characterization, this implies that the most active CFA members were the poor and the rich (all considered at times as middle income group) and that very few of the 'very poor' and 'very rich' were participating actively in PFM (Table 4.14). The average farm sizes for the CFA members with high (3.55 acres), Low (1.83acres) and No participation (17 acres) shows some low significant difference (F=2.859, p=0.06).

Table 4.14: Level of participation in relation to range of total farm size in both forests

Level of participation	% of respondents /range of total farm size				N
	≥0.5 acres	0.6-2.0 acres	2.1-5.0 acres	5.1 acres and above	
High	7.8	60.9	20.3	10.9	64
Low	20.0	53.3%	26.7%	.0	15
No participation	.0	.0%	.0	100.0	1
Total	10.0	58.8	21.3	10.0	80

In India, it was noted that lack of productive assets such as land and livestock was associated with low levels of influence of a household in decision-making processes (Adhikari *et al.,* 2004). The results of this study consent to some level to the general perception that ownership of more assets allows households to exploit more forest resources (Coulibaly-Lingani *et al.,* 2009) which possibly motivates them to participate more in forest conservation activities so that they can benefit from the forest in a sustainable manner. Woods (2007) also observed that the poor who are among the majority of the CFA members see forest as the source of that additional land, although wage labor opportunities for immediate cash are probably more attractive to them. The very rich may have enough agricultural production to support their livelihoods hence they view forest maintenance as a way of diversifying their

income-generating opportunities so as to reduce risks. Majority of the middle-income group are likely to participate in forest management because they are highly aware of the critical consequences of deforestation (Dolisca *et al.*, 2006).

Range of Homestead distance and level of CFAs participation

As pertains to distance of homesteads from the forest, most of the high level participants were at distance ranges of 0-0.5 km and 1.1-3 km (Figure 4.10). There was no significant association between level of participation and distance of homestead from the forest.

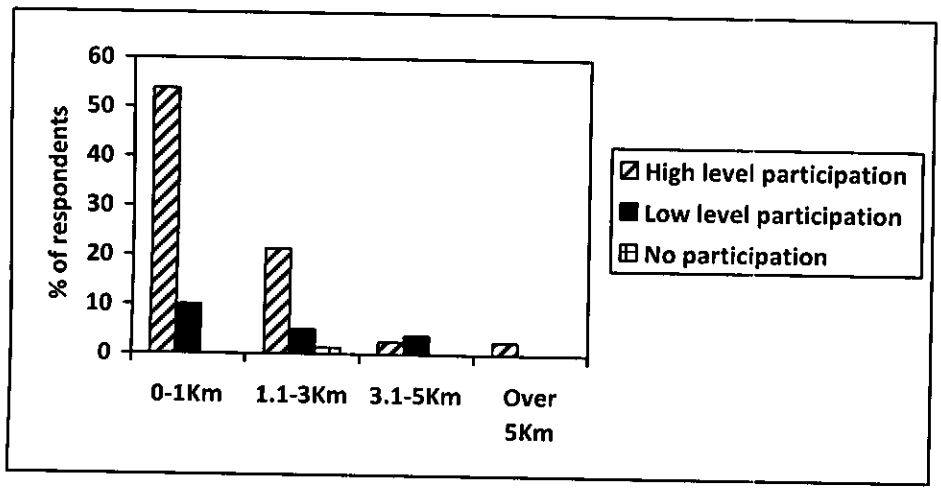


Figure 4.10: Level of participation under different homestead-forest distances

Nature of CFA members' household headship

Although nature of household head did not seem to influence the decision to join CFA, it had a significant influence on participation in forest conservation for all respondents irrespective of CFA membership ($\chi^2 = 29.955$, $p < 0.001$) with a greater number of male-headed households (62.5%) participating compared to female and other natures of household heads (Table 4.15). This calls for enlightening of the CFA members on the need to encourage gender equity in all CFA activities and decision-making. Women participation is very important hence need to be encouraged due to their productive roles in the society.

Table 4.15: Level of participation in relation to household headship in both forests

Level of participation	% of respondents / household headship nature				Total
	Male headed	Female headed	Single parent	Both parents	
High	62.5	12.5	3.8	1.3	64
Low	6.3	5.0	.0	7.5	15
No participation	.0	1.3	.0	.0	1
Total	68.8	18.8	3.8	8.8	80

Differences in participation level could be attributed to the differences in gender roles hence male headed households have a greater chance of participating than the female and single headed households in which sharing of domestic chores is limited. Sell (1997) found out that women co-operate more often in intact-female groups than where they are a minority in a mixed-gender group. However, men cooperate more in a largely female group since they are able to influence group decisions in such an environment than in all-male group where all other members are equally powerful. Therefore, the low social standing of female community members and more so the single women, and the limited participation of such women in leadership positions may limit the participation of women in forest conservation and access to its economic benefits.

Alternative source of livelihood, fodder and firewood sources

In this study, a highly significant relationship ($\chi^2 = 28.189$, $p = 0.001$) was observed between alternative sources of livelihood and level of CFA members' participation in PFM. Majority of the high level participants (62.3%) were those keeping livestock as an alternative source of livelihood. More so, fodder source was also noted to have some significant influence on the CFA members' level of participation ($\chi^2 = 23.952$, $p = 0.002$). Majority of high-level participants (43.3%) were those getting fodder from

the government forests. This can all be attributed to the issues of benefits gained from the forest motivating CFA members to participate at a higher level. It was also observed that, level of CFA members' participation was also influenced by source of firewood (χ^2 = 40.983, p<0.001). There was also a significant difference between mean fuel wood consumption for respondents with different sources of firewood (F = 9.062, p<0.001). The mean fuel wood consumption for respondents as per respective sources were: government forest = 2.97 head loads, own farm = 1.81 head loads, neighbors = 1.50 head loads and market = 1.10 head loads), Lise (2000) noted that forest dependency stimulated people's participation in forest management. Coulibaly-Lingani *et al.* (2011) attributed this to the fact that people with higher level of forest dependency have a higher stake in the forest, which is reflected in their level of participation in management.

Age and level of education of CFA members

The level of participation of the CFA members was not significantly influenced by participant's age range, level of education and the distance of their homestead from the forest. However, it was observed that most of the 64 CFA members with high level of participation (40.6%) were in the ranges of 36 to 50 years in age. Considering the average age of the high (45 years), low (48.years) and no participation (65 years), it was noted that there was no significant differences (F=1.414, p=0.25).

Most of the high level participants were of upper primary (35.9%), secondary school (31.3%) and lower primary (20.3%) levels of education (Table 4.16). Though the influence of education on level CFA participation in PFM seems to be insignificant in this study (χ^2 =10.829, p=0.2), it is still clear that consistent with other studies that illiterate farmers are less likely to participate in forestry programs. Literate people are

more aware of potential benefits obtained from well-managed forests than the illiterate. Respondents with primary education are more willing to participate than the illiterate (Dolischa *et al.,* 2006). Therefore, education played an important role though not significant in encouraging high-level participation for the CFA members in the two study sites.

Table4.16: CFA members' level of participation in relation to education

Participation Level	% of respondents/Level of education					N for participation levels
	Illiterate	Lower primary	Upper primary	Secondary school	Tertiary	
High	7.8	20.3	35.9	31.3	4.7	64
Low	0.0	53.3	33.3	13.3	0.0	15
No participation	0.0	100	0.0	0.0	0.0	1

Wellbeing categories of CFA members

High level of participation was indicated by a higher number of the CFA members in the rich wellbeing category and the poor (Table 4.17).

Table 4.17: CFAs Level of participation in relation to well being categories

Participation levels	% of respondents for Wellbeing categories			N for participation levels
	Rich	Poor	Very poor	
High	46.3	31.3	2.5	64
Low	12.5	6.3	0.0	15
No participation	1.3	0.0	0.0	1
Total	60.0	37.5	2.5	80

The level of participation was not influenced by the current well-beings of the CFA members (χ^2 =1.42 p=0.84). However, the data shows clearly that the PFM process in the two forest sites had the support of the rich households more than by the very poor households similar to what was observed in Haiti which was attributed to the fact that

they were aware of the effects of deforestation (Dolischa *et al.*, 2006). Adhikari *et al.* (2004) also noted that the poor households have a high opportunity cost of participation as the time spent on participation could be used for cash income. The observations of this study also consent to the observation that very poor households do not benefit as much as others hence they are not very interested in community participation (Malla *et al.*, 2003).

Key Indicators for perceived level of benefits

Key indicators for high-perceived benefits were indicated by 76.3% of CFA members from both Ngare Ndare and Ontukigo CFAs. These benefits include; firewood (75.4%), grazing (55.4%), PELIS (32.8%) and potential IGAs. Key indicators for low and no level of benefit perception were indicated as high fees charged for forest products (11.1%), lack of sharing of financial benefits (33.3%), low benefits and too much time taken to get the benefits (33.3%) and too much time spent in forest conservation work (22.2%). Factors leading to actual high participation were identified by 67 CFA members as; the general high benefits expected (67.2%), High PELIS benefits witnessed (46.3%), need to conserve forest (43.3%), PFM awareness (29.9%) and being in leadership positions (26.8%). Factors contributing to low and no participation were highlighted as low or no perceived benefits, lack of finance, and people being too busy to participate. The PFM paradigm that is currently in operation in Ontulili and Ngare Ndare forest is most likely benefit sharing since high-level participation is associated with high-level PFM benefits. Yemshaw (2007) describes this paradigm as characterized by having the forest adjacent community members more interested in accessing forest products.

4.2.5 Training on forest management and conservation

One of the expected benefits of joining PFM or living adjacent to a forest where PFM is in practice is training in forest management and other aspects related to sustainable land use and agriculture. Training can influence the level of participation in forest conservation activities and depending on the type of training provided; it can enhance participation in specific PFM activities, such as, tree planting and tree nursery establishment and management among other activities.

In this study, community participation in forest conservation was not influenced by education level but was positively influenced by training in forest management (χ^2 = 10.572. p=0.001, Gamma = 1.000). The positive influence of training on CFA participation in forest conservation agrees with the observation that knowledge about forest conservation issues make people more positive in their views (Heinen, 1996). Salam *et al.* (2005) also noted that community forest participants often lack the appropriate technologies needed in management of participatory forestry through which they can maximize the potential of sustainable forest development. Training on various aspects of PFM is needed for them to undertake PFM activities successfully. Salam Salam *et al.* (2005) proposed that training manuals based on field experiences and incorporating knowledge possessed by the local people should be provided. Training on different aspects of PFM is positively related to sustained participation of community members. Improving and updating the skills and knowledge in PFM can encourage community members to involve themselves in sustained participation.

Lack of sufficient knowledge of forest management has been mentioned as a reason for local community members' unwillingness to participate in forest management (Obua *et al.,* 1998), hence in the two areas this was sorted out through training. When considering factors that affect people's participation in PFM in Oromia region, Degeti and Yemshaw (2003) also found out that awareness creation contributed to the understanding of the importance of forests hence encouraging community members to participate in forest management actively. Having a better Knowledge about the social and economic impact of deforestation encourages people to take part in forest management actively. Training is one of the best ways to create awareness.

Training does not only help the community members manage the forest appropriately hence increase forest cover but it provides the appropriate environment for farmers to exchange views on better agricultural production technologies and issues related to other income generating activities. Training motivates farmers to adopt and adapt new technologies. Majority of the CFA members interviewed received training while majority of the Non CFA members were not trained (Figure 4.11).

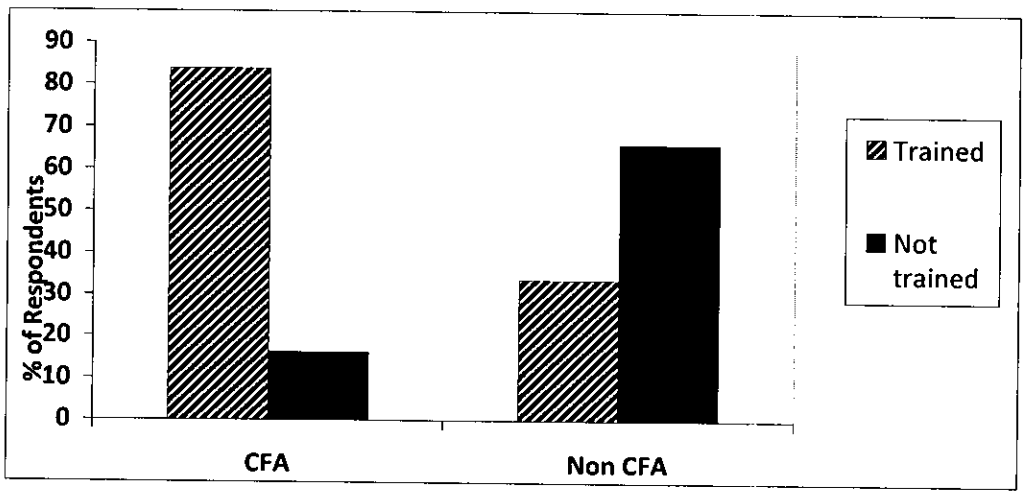


Figure 4.11: Forest management training for respondents in both forests

A strong positive association between CFA membership and training in forest management and other land use related aspects was observed (Gamma value = 0.820) and the association was highly significant (χ^2 = 41.264; p= 0.001). Training was therefore influenced positively by CFA membership hence joining CFA under the PFM process provides the community members with greater opportunities for training.

Types of training

Different types of training were provided to the community members living adjacent to the Ontulili and Ngare Ndare forest. However, in most of the training types offered, it was more of the CFAs than Non CFA who received the training. The main types of training obtained by CFA members included; tree planting and management, tree nursery establishment, training on PFM process, and in group organization and management. On the other hand, major training offered to Non CFAs included: tree nursery establishment and management and dairy farming. The first four types of training had significant differences among the CFA and Non CFA members. CFA membership had a strong positive association with the 4 main types of training, which are related to tree planting and general PFM organization (Table 4.18).

Table 4.18: Relationship between CFA membership status and training types

Pearson Chi-square values (χ^2)	Types of training offered in Ontulili and Ngare Ndare forest			
	Tree planting and management	Tree nursery establishment	PFM Process	Group organization and management
Computed χ^2)	51.627*	22.539*	32.107*	14.675*
P	0.001	0.001	0.001	0.001
Critical χ^2) at DF=1	10.83	10.83	10.83	10.83
Gamma value	0.887*	0.737*	0.922*	0.791*

Note* is used as a symbol for significant relationship (Computed χ^2 > Critical χ^2)

Training in soil conservation by Ministry of Agriculture (MOA) was associated with CFA membership status but it was not significant. Training in dairy farming and crop protection by MOA depicted very weak associations because the number of CFAs and Non CFAs trained were not significantly different while training in bee keeping by Ministry of Livestock Development had a perfectly strong negative association that was not significant because only 3 Non CFAs were trained and no CFA member was trained. Bee keeping being one of the key IGAs introduced among the two CFA members, there is need to train more of the CFAs on this aspect to enhance income generation under PFM. Lack of training could have been the reason for CFA members' indication that honey production, as an IGA had not so far benefited them.

4.2.6 On- farm tree growing status

Community members' involvement in on-farm tree growing activities

Both CFA and Non CFAs were involved in tree planting in their farms as indicated by 74.4% of the 160 community members in both Ontulili and Ngare Ndare forest sites. Growing trees on farm by both CFA and Non CFA members was positively influenced by their participation in forest conservation activities (χ^2 = 7.997, p = 0.005). Among the 119 community members growing trees in their farms, 95% of them were those participating in forest conservation. There were no significant differences in on-farm tree planting in the two sites. Out of the respondents growing trees, 52.9% of them were those living adjacent to Ontulili forest and 47.1% of them were those living adjacent to Ngare Ndare forest.

There was a significant association between CFA membership and planting of trees on farm (χ^2 = 3. 97, p = 0.05). More CFA members (81.3%) than Non CFA members

(67.5%) had planted trees in their farms (Figure 4.12). It was also noted that training of CFA members in forest related aspects influenced growing of trees positively (χ^2 = 7.652, p = 0.006, Gamma value=0.693). Therefore, majority of CFAs growing trees had been trained in tree planting and tree nursery establishment under PFM. The CFA members do also have free access to seedlings from their group nurseries for planting in their farms and this could have enhanced their adoption of on-farm tree planting practices.

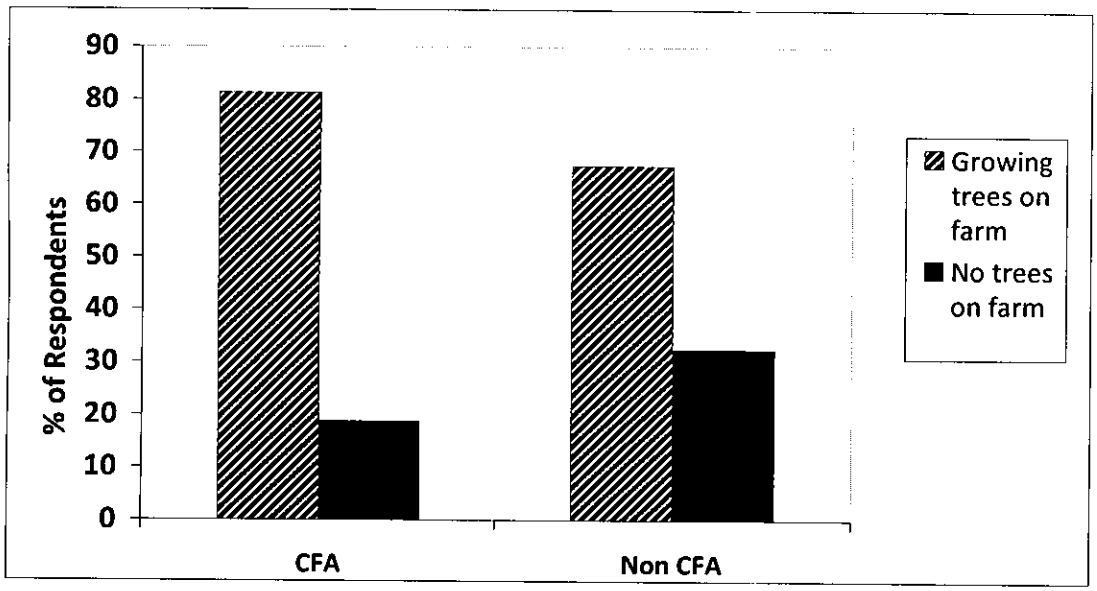


Figure 4.12: Ngare Ndare and Ontulili CFAs and NonCFAs growing trees

Tree species grown on farms adjacent to Ontulili and Ngare Ndare forest

The main tree species grown by the Ontulili and Ngare Ndare forest adjacent community members and the number of respondents growing these trees include: *Grevillea robusta* (72), *Eucalyptus camadulensis* (53), *Cuppressus lusitanica* (41), *Pinus patula* (23), *Juniperus procera* (15), *Acacia mearnsii* (11), *Fraxinus pennsylvanica* (Green Ash-4), *Podocarpus gracilior* (4), *Croton megalocarpus* (3), *Vitex keniensis* (3), *Cordia abbyssinica* (3) *Olea europia var africana* (1), *Azadirachta indica* and *Causarina equsetifolia* (1). Most of the tree species planted by most of the respondent were for provision of firewood, poles and timber. Green ash

was used for fodder while *A. indica* was for provision of herbal medicine. Some respondents indicated to have generated income by selling some of the tree species which include: *G. robusta* sold by 3 respondents earning them a total income of KES16, 150; Pine trees sold by 4 respondents earning them a total of Ksh130, 000; Blue gum sold by 3 respondents for a total of Ksh57, 500; and *A. mearnsii* sold by one respondent earning him KES 50,000. However, the respondents indicated that this was once after many years hence they could not indicate tree selling as a major or alternative source of livelihood.

4.2.7 Factors influencing planting of trees on farms

There was a significant association between homestead distance from the forest and growing of trees on farm by the respondents (χ^2 = 20.10, p= 0.001). The association was more significant for Non CFA members (χ^2 = 11.57, p = 0.009) than for CFA members (χ^2 = 8.73, p = 0.03) in both forests. As the distance of homestead from forest increased, the number of the CFA and Non CFA members growing trees decreased but the decrease was higher for the non-CFA members (Figure 4.13).

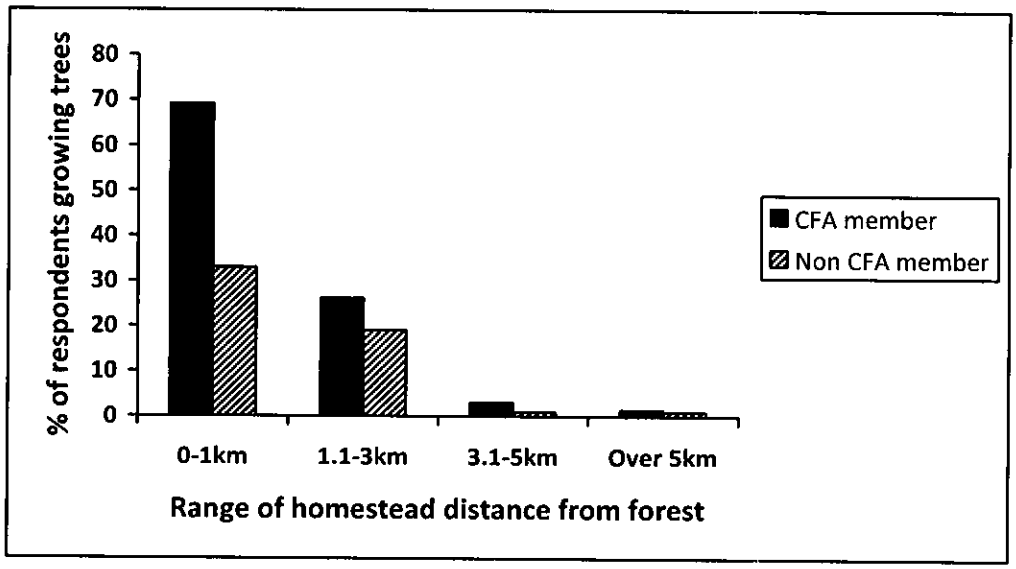


Figure 4.13: Growing of trees at different homestead distances from both forests

This could be due to farmers getting influenced to plant trees through their easy access to tree seedling from the forest nurseries as well as frequent interaction with fellow community members planting trees in the forest and participating in tree nursery establishment and management under the PFM process.

As the homestead distance from the forest increased, the number of trees planted by all community members interviewed decreased especially for the major tree species planted in the two study sites (Figure 4.14). There was a significant negative correlation between actual homestead distance from the forest and number of pine trees (r_s= -0.493, p=0.01) and a positive correlation for cypress trees (r_s= 0.569, p=0.01) planted in the homesteads. For pine trees, the number planted decreased as actual distance of homestead from the forest increased while for cypress trees the number planted increased as the distance increased. This could be related to the nurseries with different types of seedlings available at different sites from the forests and to the different groups managing the different nurseries.

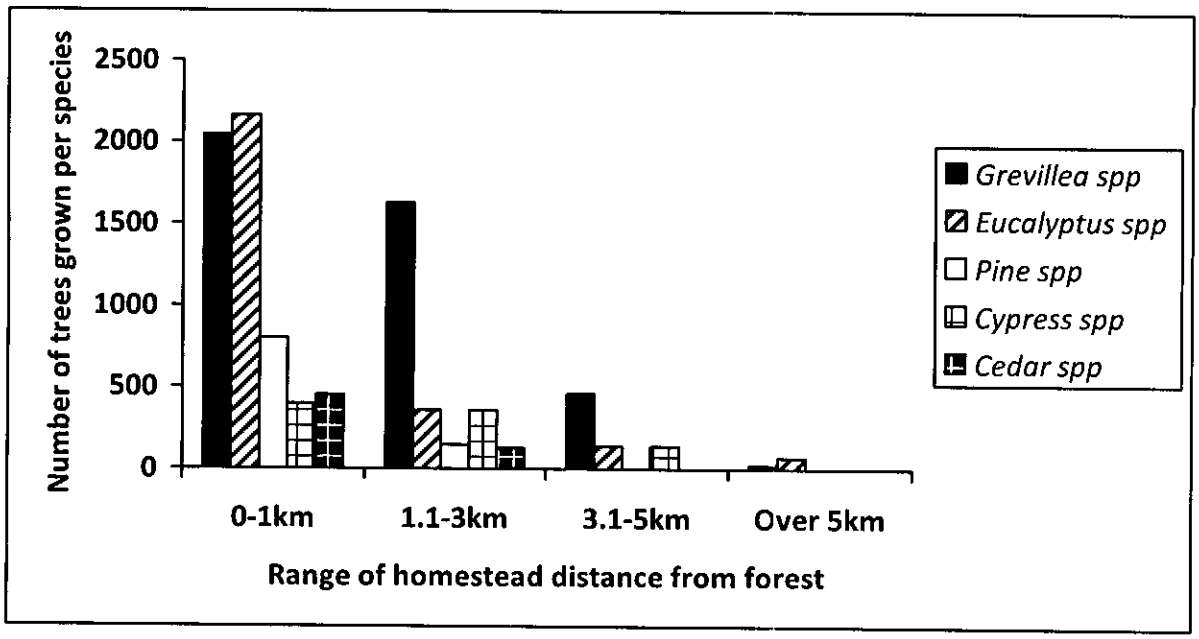


Figure 4.14: Trees grown per species at different homestead distances

It was also observed that most of the respondents growing trees were mainly having farm sizes of ranges 0.6-2.0 acres (57.1%) and 2.1-5 acres (21.8%). Very few respondents with farms < 0.5 acres and > 5 acres were growing trees. The same trend was observed for the total number of main tree species in the areas adjacent to the two forests. Respondents with the same farm size ranges (0.6-2.0 acres and 2.1-5 acres) had more trees than those with less than 0.5 acres and more than 5 acres. The mean farm sizes for the community members growing the 5 main tree species were: *Grevillea robusta* (2.74 acres), *Eucalyptus camadulensis* (3.15 acres), *Pinus patula* (2.97 acres), *Cuppressus lusitanica* (2.17 acres) and *juniperus procera* (1.59 acres).

Since the farm size ranges were based on the community wellbeing characterization, it is clear that, most of the respondents growing trees were in the categories of the poor (0.6-2.0 acres) and Rich (2.1-5.0 acres). Therefore very few of the members of the 'very poor' (0-0.5 acres) and the 'very rich' (over 5 acres) categories were planting trees (Figure 4.15).

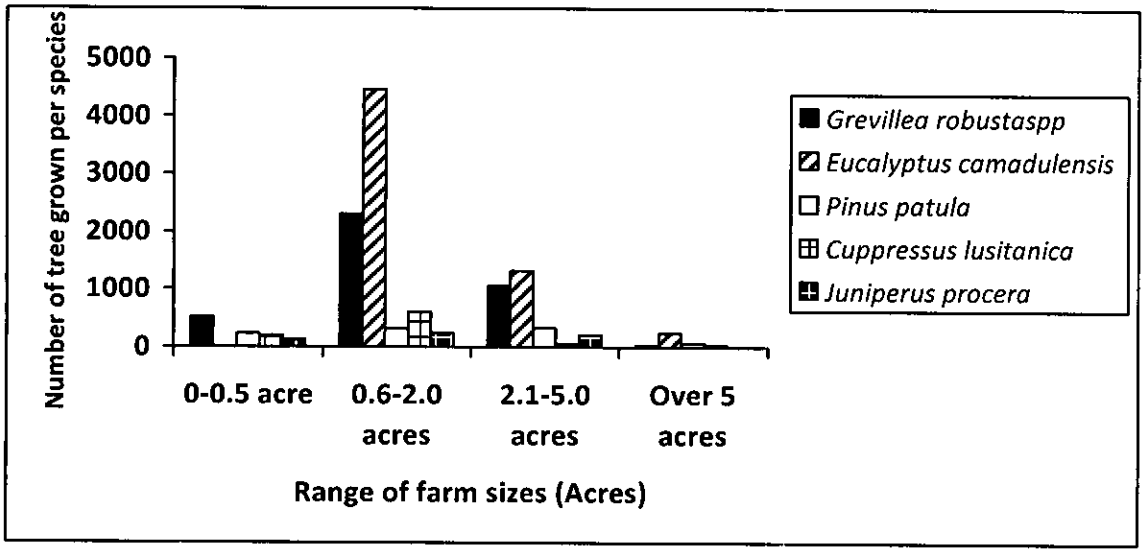


Figure 4.15: Number of trees grown in different farm size ranges

Further analysis of the number of trees planted on farms based on gender revealed that 83.7% of the male respondents interviewed and 59.7% of the female respondents interviewed were growing trees in their farms. Although more males seemed to be planting trees than the females, the mean number of trees planted indicated the females to be having more trees in their farms than the males except for *J. procera* trees (Table 4.19) which could be due to the species being indigenous and providing high income after sales. This implies that training women on tree growing will result in to a multiplier effect in planting of trees in the farms possibly due to their higher adoption of tree planting knowledge and skills and for the purpose of meeting their need for firewood.

Table 4.19: Number of trees grown dissagregated by gender

Tree species planted		Number of trees planted	
		Males	Females
Grevillea robusta	Total	2211	1946
	Mean	57	59
Eucalyptus camadulensis	Total	2945	3091
	Mean	95	140
Pinus patula	Total	247	702
	Mean	28	50
Cuppressus lusitanica	Total	593	305
	Mean	20	27
Juniperus procera	Total	560	25
	Mean	43	13

Analysis of CFA members indicated that 94.2% of 52 CFAs growing trees and participating in tree nursery management were those having a perception that the contribution of tree nurseries to better livelihood was highly significant. It was also noted that 86.8% of 53 CFAs growing trees in their farms and participating in tree planting were those having a perception that the contribution of tree planting to better livelihood was highly significant. More so, 83.1% of 65 CFAs growing trees were

those having a high level participation in PFM and a subsequent perception of getting high level benefits from PFM. Therefore, perception about the importance of contribution of trees to better livelihood determined to some level whether the CFA members would plant trees in their farms. Level of participation in PFM activities in the forest and level of perceived benefits were also important factors in determining adoption of on-farm tree establishment by CFA members.

4.3 Contribution of PFM to improved forest cover

4.3.1 Historical changes of Ontulili and Ngare Ndare forest cover

Historical Time line for Ontulili forest

A historical time line for Ontulili forest was done with 5 old members of the Ontulili forest adjacent community members each having an age of more than 60 years. The members provided information on the changes undergone as a community and the reduction in forest cover that has been experienced since independence.

1963: There were squatters living in the forest and allowed to cultivate in the forest for 3 years then plant trees and cultivate for 2 years before moving to a new site (Shamba system).

1967: Squatters started grazing in the forest while still cultivating. Paddock system was adopted whereby the forest was divided into several grazing portions.

1976-1978: First settlement after purchase of shambas by squatters from white settlers was in 1976 and a second settlement followed in 1978 by people from Katheri in Meru hence the name 'Katheri' for one of the villages. The original tribe was the Kikuyu living as squatters in the white settler farms. The state of the forest at that time was good. Grazing and cultivating in the forest continued.

1980 – 1984: Shamba system was stopped and all squatters having shelters in the forest were sent away from the forest. The houses were destroyed and cultivation in the forest was stopped.

1984: The community was faced with drought and consequent famine. The government was supplying food to the community to help them meet their food requirement in addition to their own purchases. Destruction of Ontulili forest was at its peak because the Maasai brought their cattle in to the forest and cut down trees to provide their livestock with fodder. As a result, the forest adjacent local community members started cutting trees illegally for their own use.

1986 - 1988: For 2 years the government planted trees in the forest but they did not survive because of weeds and destruction by elephants.

1997: There was a lot of destruction of food by El-Niño rains but there was no famine.

2000: The community members were allowed to cultivate in the forest under the condition that they form groups registered with the social services and start tree nurseries in the forest. This marked the start of the process of forming CFA, which has now been registered and is in the process of developing management plan.

2002-2003: The community members were stopped from building shelter in the forest and after the 2002 election, the Shamba system was stopped but tree nursery activities continued. Grazing in the forest was done under fee payment condition.

2008: The community members who joined CFA were allowed to start cultivating in the forest under Plantation Establishment and Livelihood Improvement System (PELIS). PELIS is a variant of Shamba system in which farmers are given small portions of land (0.5 to 1.0 acres) to cultivate then later plant trees, weed them and stop cultivating after 2-3 years. The community members are not allowed to construct

houses in the forest. This move was highly welcome by the community because they considered this as an opportunity to get enough food. The community members started assisting in patrol of the forest to control illegal cutting of trees, raising seedlings in tree nurseries and planting trees in the forest. However, there were some conflicts between those involved in forest management with those getting products from the forest illegally.

2009: Serious drought and famine occurred. Rivers dried up and water in-takes in the forest were closed. Most of the trees planted by the CFA dried up.

2010: Too much rain affected crop production for crops such as wheat, ordinary beans, French beans and potatoes. There was some forest recovery due to rains and good survival of trees planted by the CFA members.

The community members involved in the historical time line discussions emphasized that population growth has been contributing to reduction of forest cover with time. This is because farms have been fragmented in to small pieces and the number of young jobless people is increasing hence some of them are stealing from the forest for their livelihood. It was noted that since formation of CFA, the forest condition is improving. However, recurrent droughts were a big challenge leading to low survival of trees planted by the CFA members in the forest.

Historical time line for Ngare Ndare forest

A historical time line for Ngare Ndare forest was conducted with 3 men and 2 women aged above 55 years who are members of the community living adjacent to Ngare Ndare forest Information was provided on changes that the forest has undergone since independence.

1963-1973: People started settling in the areas adjacent to the Ngare Ndare forest. More people moved from Ndakongoro forest reserve to Ngare Ndare forest as from 1965 due to famine and increase in insecurity caused by shifters' attacks.

1977: The community composed of Kikuyu, Maasai and Meru settled around the forest and bought Sharati farm. These people were mainly those employed in the white settlers' farms and some from other reserves.

1979: There was a fire outbreak in the Ngare Ndare forest set by people harvesting honey.

1980: People from outside of the community as far as Kibirichia and Nanyuki started invading the forest and illegally cutting posts, poles and timber.

1982: Fire broke out and burned the Sharati farm and there was famine. Livestock died because the community were depending on the Ngare Ndare forest for grazing and it was not adequate. The community in unity banned grazing in the forest to allow the forest to recover from drought and allow the grass to grow for a period of 3 months.

1999: Kisima farm white man was driven away from the forest where he was getting poles and posts for his farm.

2002: The CFA/TRUST started controlling use of the forest. Illegal cutting of trees for commercial use such as timber, and firewood for sale was stopped. Formation of the CFA has helped a lot in reducing forest destruction by community members and outsiders.

2008-2009: There was drought and the community lost a lot of livestock due lack of adequate fodder in the forest. Trees planted by CFA in the forest were also adversely affected.

2010: the CFA has done beating up for trees that dried up during the drought and better survival is expected.

The community members involved in the historical timeline had a perception that the forest condition has improved since the formation of the Ngare Ndare CFA. They indicated that the CFA has played a key role in protection of the forest against illegal grazing and logging through the community scouts and formation of forest user groups managing the forest resources of their interest appropriately for sustainable use. They also commended the CFA management for control of fire outbreaks in the forest, which had contributed to a lot of destruction of the forest in the past. Degeti and Yemshaw (2003) noted that community members in Oromia region perceived that PFM played an important role in alleviating destruction of forests. The community members attributed this to reduction in deforestation, improvement in forest regeneration and improved growth of new young seedlings. It was also perceived that PFM enhanced community empowerment and accountability. The ownership feeling and positive expectation of using the forest in future encouraged active participation in forest management.

4.3.2 The impact of PFM on forest cover in Ontulili and Ngare Ndare forests

Interest of CFA members in PFM

CFA members' interests in joining PFM can indicate whether they are determined to contribute to improved forest cover. For a majority of the 80 CFA members interviewed in both forest sites, the main objective of joining PFM was to participate in forest resource conservation, protection and management (85%). This observation agrees with the outcome of focussed group discussions with CFA members and

interview schedule with the foresters in charge of the two forests as well as Ngare Ndare CFA staff. They all emphasized that the community members who joined the CFA under PFM process were motivated by the need to conserve the forests and rehabilitate degraded sites of the forests. Therefore, the CFA members' efforts towards achieving their objective of participation in forest conservation is obviously aimed at increasing forest cover.

The state of forest covers before and after PFM

The CFA members interviewed in the two forests (80) acknowledged the poor state of forest management and decreased forest cover before PFM was introduced. Information from interview schedule with the foresters in charge of Ngare Ndare and Ontulili forests supported this perception. The foresters attributed this to understaffing leading to inadequate patrol of the forest required to stop illegal activities and inadequate labour for management of forest tree nurseries and for tree planting. Under the PFM process, the foresters indicated that the CFA members' participation in forest patrol, tree nursery activities and tree planting had contributed significantly to better forest management and increased forest cover. The foresters commended the participation of CFA members and other PFM stakeholders as highly important in protection of the forest through forest patrol and in fire control. A case of Ngare Ndare CFA having employed thirteen community scouts to guard the forest was quoted as a great achievement in curbing illegal activities in the forest. This would not have been attained with 3 forest guards employed by KFS. In Ontulili forest, it was noted that CFA members played an important role in providing tree seedlings for planting in the forest from their own nurseries and participating in actual tree planting exercise hence saving KFS a lot of plantation establishment costs.

Lewa conservancy Community Development Manager (Mr. Kinoti) noted that the Ngare Ndare CFA was doing a good job as pertains to forest policing and protection of the wildlife. He also indicated that since formation of the CFA and commencement of PFM activities, the community members adjacent to the forest have started appreciating the forest as their own property. Analysis of perception of both CFA and Non CFA respondents on state of forest cover before and after PFM indicated that CFA participation in forest conservation and management activities under PFM had contributed to increased forest cover (Figure 4.16).

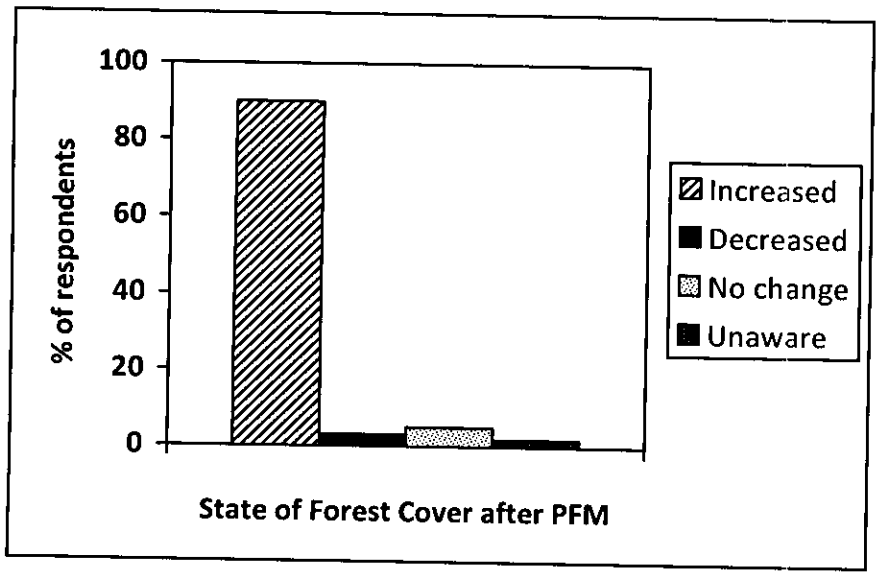


Figure 4.16: Community perception on change in forest cover after PFM

Further analysis of perception based on CFA membership status indicated that all the CFA members (100%) and 80% of the non-CFA members perceived an increase in forest cover after PFM. Therefore majority of the community members living adjacent to both Ontulili and Ngare Ndare forest associated improved forest cover with CFA membership (Figure 4.17).

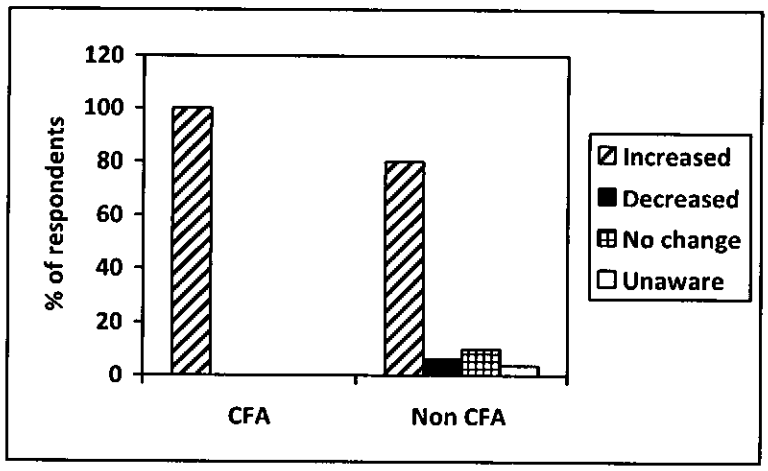


Figure 4.17: CFAs and Non CFAs' perception on state of forest cover after PFM

For other communities practicing PFM in Kenya such as Dida, Loita and Buyangu, there was also a general community perception that the forest condition had improved due to community participation. The community members in these sites indicated that they were able to notice any form of destruction during patrol (Mbuvi *et al.*, 2009).

All the CFA members (100%) indicated that the state of forest management had become better after PFM. Out of the 71 CFA respondents who gave reasons for their perception, the major reasons for better state of forest management after PFM were outlined by CFA members as; community involvement (47.9%), more knowledge gained through PFM process on forest management (45.1%) and controlled cutting of trees (7%).

Majority of the non-CFA members (87.5%) had the view that the Ontulili and Ngare Ndare CFA institutions were functional in terms of members' participation in forest management that directly lead to increased forest cover. In Ethiopia, it was observed that PFM resulted in better forest conditions due to improved seedling and sapling

densities. PFM was also associated with promoting awareness about forest and capacitating locals to form new institutional arrangement that increased their participation in forest management. PFM also helped to reduce open access to the forests and provided a regulated forest use (Gobeze *et al.,* 2009).

4.3.3 CFA contributions to improved forest cover in year 2010

During the interviews, the foresters' namely Danson Kamau in-charge of Ontulili and Robert Ngotho in-charge of Ngare Ndare forest commended the Ontukigo and Ngare Ndare CFAs for their contribution towards increased forest cover in the two forests, respectively. The two CFAs are involved in management of Ontulili and Ngare Ndare forests, which are about 33227.15 hectares and 5554.3 hectares, respectively.

In Ontulili forest, the CFA members were commended for their participation through provision of labour in: tree planting and silvicultural operations, forest protection/patrol, fire fighting, preparation of land for plantation establishment through PELIS, and adhering to the ban on cutting trees from the forest. The forester indicated that the CFAs were patrolling the forest consistently and they also assisted in collection of revenue from the PELIS plots hence making his work more manageable. He felt that the ban should be maintained to encourage the people to plant more trees in their farms hence reduce dependency on the forest.

Some of the CFA members were reported to be undertaking pruning and thinning activities free of charge except for the benefit of being allowed to use or sell the undesired wood after thinning and pruning. This would finally result in to a well-managed forest with good quality timber trees. For instance in 2010, the CFA did thinning for 125 hectares, which would have cost KFS 15 man days per hectare at a payment of KES 271.05 per man day (15*125 ha* KES 271.05 = KES508, 218.75).

The CFA also did pruning in 70 hectares in 2010 free of charge. This would have cost KFS 18 man-days per hectare at a charge of KES 271.05 per man-day (18*70ha* KES 271.05 = KES 340, 523). The only benefit CFA members obtained for this work was the pruned material that they used or sold as fitos at KES 2 per fito piece. Transporters who bought fitos in the forest from the CFA members participating in pruning and thinning paid KFS KES 1000 per lorry as movement permit. Low benefits from the forest can affect the sustainability of participation of the CFA members in forest management.

CFA contributed to improved forest cover through mobilizing the communities to participate in different forest conservation activities. The CBOs forming the CFAs were involved in establishment and management of tree nurseries and some of the seedlings raised in these nurseries were given freely and others sold to KFS to be planted in the government forest. Other seedlings were shared among the CFA members participating in nursery management to plant in their own farms. In Ontulili, CFA members participating in PELIS had established two group tree nurseries and a third one was in the process of being established (Plate 4.1).

Plate 4.1: Ontukigo CFA PELIS tree nursery

The PELIS groups' tree nurseries produce all these seedlings for establishment of plantations in the PELIS plots. KFS provided certified seeds and the PELIS groups purchased polythene tubes and provided labour. As at the end of May 2010, one nursery had 60,000 seedlings and the other had 20,000. The species in PELIS tree nurseries for plantation establishment were mainly *Cupressus lusitanica.* Other CFA members not involved in PELIS are managing a tree nursery in Ontulili forest station where indigenous trees have been raised for planting in the forest sites that require rehabilitation. The main species used for rehabilitation of the 100 ha of degraded forest sites include; *Podocarpus gracilior, Croton megalocarpus, Juniperus procera, Markhamia lutea* and *Fraxinus pennsylvanica (*green ash). The forester in charge of Ontulili acknowledged that tree nurseries managed by CFA members have been more reliable in providing seedlings for annual tree planting than before PFM began. It was noted that the Ontukigo CFA provided seedlings in April 2010, for rehabilitation of 100 ha of the forest and establishment of 70 hectares of plantations under PELIS. Trees planted are showing signs of successful growth. More so, in 2009, 50 hectares were established though the survival was quite low due to the effects of drought faced over the year. The forester noted that CFA participation was saving the government a lot of money due to reduced cost of seedling production, tree planting and tree protection. The forester indicated that to plant trees in 100 hectares of a forest, 70,000 seedlings were needed and these would have cost KFS about KES1.4 Million. However, KFS was only compensating the community KES300, 000 hence saving KES1.1 Million. This was an immense contribution from the CFA towards increasing forest cover at a lower cost on the side of the government.

As pertains to tree planting in Ontulili forest, the government had only provided KES54, 000, which could only be used for planting trees in 20 hectares. However, the

forester indicated that with CFA participation, he was able to establish trees in 100 hectares for forest rehabilitation, which could have cost KFS about KES 271, 050 given that one hectare requires 10 man-days for tree planting at a cost of KES 271.05 per man-day. For the PELIS, the forester was allocated money for establishment of 30 hectares but due to participation of CFA members, he was able to establish 70 hectares of plantations. Money allocated by the government could not cater for the seedlings and the station has only 2 staff working in the nursery. Hence, good relation with the CFA contributed towards achievement of these annual targets because they provided seedlings from their CFA nursery (Plate 4.2) and provided labour to plant the trees.

Plate 4.2: Ngare Ndare CFA tree nursery

In Ngare Ndare forest, the contribution of the CFA to improved forest cover was also attributed to participation of CFA members in forest protection, fire control, and tree planting and tree nurseries. As at 20th November 2010, the seedling stock of Ngare Ndare CFA nursery (Plate 4.2) was at 35,000 seedlings of mainly indigenous species. Some of the species planted in Ngare Ndare CFA nursery include; *C.*

Megalocarpus, J. Procera, Calondedrum capensis, Podocarpus gracilior, Acacia xanthophloea, A. drepanolobium, Acokanthera schimperi, Teclea simplifolia, Tamarindus indica, Caesalpinia decapetala among other varieties of species. Most of the seedlings are not sold but are issued to churches, schools and other institutions.

The CFA was commended for its contribution through reducing the cost of forest management through some of the projects and activities initiated in the forest. It was indicated that KFS had 3 rangers while the Ngare Ndare CFA/Trust had employed 13 community scouts to assist the KFS rangers in patrolling the 6 bits of the forest hence a saving on the KFS side. More so, the CFA were able to source for funding from organizations such as Safaricom to facilitate tree planting as done in April and May 2010 whereby rehabilitation planting was done using 6,000 seedlings from the CFA nursery.

The CFA provided seedlings for planting trees in 10.5 hectares over the period April to May 2010, and for beating up of 10.5 hectares in November 2010. KFS has a very small nursery managed by 2 casuals paid through Kazi Kwa vijana (KKV) programme and this nursery cannot meet these targets. The costs of beating up were estimated to include: KES 4, 200 for hole-digging, KES 50825.25 for tree planting and KES 63, 000 for seedlings was all paid for by the Ngare Ndare CFA. The CFA had also contributed to improved forest cover, by providing the CFA members with Top bar hives for bee keeping hence reducing fire hazards in the forest. The community scouts have also been effective in patrolling the forest hence reducing illegal poaching of trees The CFA/Trust owns a vehicle which helps the KFS rangers and community scouts to arrest those involved in illegal poaching of forest products. The CFA provided fuel for surveillance of the forest. The CFA had also purchased

good fire fighting equipment and were able to coordinate fire fighting in the forest successfully. Other extra benefits from CFA to KFS include provision of an office for the forester and equipment such as the Armoury box for keeping important things as well a permanent house for the KFS rangers. The planting of trees in the farms by CFA members has reduced pressure on the forest. The CFA manager Mr. Mwambeo pointed out that the CFA members helped to increase forest cover by planting more than 1.5 million trees in their farms hence reducing pressure on the forest in the future. It was indicated that since the CFA was formed, the members had been participating in rehabilitation of degraded forest sites and up to date they had planted trees in 62 acres of the forest. Apart from forest patrol by community scouts, the members protect the forest as they do patrol while they are grazing and collecting firewood.

In other PFM sites in Kenya such as Upper Imenti and Kereita, it was also noted that most PFM costs were borne by the CFA members due to patrolling for free and plantation establishment. Non-CFA members were incurring little or no PFM related costs and general forest management costs (Mbuvi *et al.*, 2009). Observations made during this study imply that community involvement in forest management may lower transaction costs incurred by the government but these costs are borne by the poor members of the community (Meshack, 2009)

4.3.4 The importance of PFM activities' contribution to improved forest cover

The CFA attached different levels of importance to the PFM activities they undertook in the forests in terms of how each activity contributed to improved forest cover. There were three levels of importance stated for each activity in both forests. Most of the PFM activities namely forest patrol, forest fire control, tree nursery activities, tree

planting, PFM training and PFM meetings had a highly important contribution to improved forest cover (Table 4.20).

Table 4.20: Contribution of CFA activities to improved forest cover

	Ngare Ndare Forest (%)			Ontulili Forest (%)			N per activity
	Not important at all	Moderately important	Highly important	Not important at all	Moderately important	Highly important	
Forest Patrol	5	12.5	32.5)	0	10	40	80
Fire Control	1.3	8.8	40	0	11.3	38.8	80
Tree nursery	4.2	5.6	33.8	0	15.5	40.8	71
Tree planting	4.3	5.7	32.9	0	7.1	50)	70
Training	9.4	3.1	25	4.7	25	32.8	64
Meetings	1.4	8.7	33.3	0	20.3	36.2	69
PELIS	0	0	0	0	0	100	8

This implies that for improved forest cover, the government through KFS needs to emphasize on increased participation of CFA members in forest patrol, forest fire control, tree nursery activities, tree planting activities, PFM training and PFM meetings. A similar observation was made in Uganda where forest activities such as fire protection, weeding and tending tree seedlings were found to be significant in increasing forest cover in forests jointly managed by the government and forest adjacent communities (Bahati and Mwangi, 2001).

Increase in forest cover due to PFM activities was also acknowledged in Tanzania in Duru-Haitemba, Mgori and Suledo forests. The PFM stakeholders witnessed close to a uniformly rapid recovery of natural forest cover due to improved protection and reduced harvesting effort. Villages involved in PFM in these forests reported important indicators such as reduced incidences of fire, reduction in encroachment of

the forests for agriculture, increase in natural regeneration in degraded areas, improvement in water discharge and quality from PFM areas and reduction in illegal activities in the forest among other indicators. Evidence has been increasing in Tanzania that PFM contributes to sustainable forest management whether in the form of Joint forest Management or Community Based Forest Management. Although scanty, evidence appears to be growing that PFM in both forms are leading to improvements in forest condition. In several cases, forest decline caused by open access, or state-controlled forest management appears to have been stopped or seriously reduced through community participation in forest management (Blomley and Ramadhani, 2007).

Contributions of PELIS and tree pruning and thinning were indicated as highly important only but by very few CFA members. Majority of CFA members could not give their views on contribution of PELIS (90%) and pruning and thinning (95%) possibly because most of them did not participate in these activities especially in Ngare Ndare forest. This could also be due to lack of adequate technical knowledge on how these two activities contributed to improved forest cover.

4.3.5 Role of stakeholders supporting Ontukigo and Ngare Ndare CFA

Stakeholders supporting Ngare Ndare CFA

This CFA gets support from various organizations such as:

(a) Kenya Forest Service: KFS was prioritised as the major stakeholder supporting the CFA by providing technical advice on nursery establishment and management and tree planting.

(b) **Green Zone Development:** They provide financial support for developing ecotourism, which has been waiting to commence after licensing and completion of structures being constructed.

(c) **Safaricom:** They have been providing finances to support enrichment planting and provide salaries for staff employed by the CFA and they are to continue providing this support for a period of five years. The finances provided enable the CFA to purchase seeds, nursery materials and pay for labour for planting trees in the nursery. Safaricom also supports other development projects related to environment.

(d) **Biodiversity Conservation Programme (BCP):** This programme is funded by European Union and it provided infrastructure by constructing offices and Boardroom, and purchasing a vehicle and bee hives for the CFA.

(e) **Ford Foundation:** This organization was the initial supporter, which provided initial funds for mobilization and founding, and registration of the Trust hence did a lot of groundwork.

(f) **Tourism Trust Fund (TTF):** They have been assisting the CFA in developing ecotourism facilities.

(g) **Global Environment Facility:** They have been funding development of the ecotourism infrastructure.

(h) **Lewa Conservancy:** This organization was quite instrumental in fund raising for establishing the Ngare Ndare CFA. It is in charge of installation and management of the electric fence line around the forest and the CFA pays the conservancy for repairs and replacement of fence posts. Lewa Conservancy is

interlinked with Ngare Ndare forest because of wildlife management, water and forest issues. Lewa is involved in ensuring security of the forest. They provide support during fire outbreaks by providing water boozers, vehicles, fire fighting equipment and staff to assist. The conservancy has several community programmes that cover 3 CBOs under the Ngare Ndare CFA namely Ngare Ndare CBO, Subuiga CBO and Manyagalo CBO.

(i) Other stakeholders working with Ngare Ndare CFA:

- Kisima Farm
- Northern Frontier Ventures
- Provincial Administration (Chiefs and Councillors)

Stakeholder supporting Ontukigo CFA

The CFA members outlined the various roles played by the different stakeholders in supporting them in implementing PFM.

(a) Kenya Forest Service (KFS): CFA and other stakeholders recognized KFS as the organization in-charge of management of the forest and co-ordination of all activities in the forest. They are generally in-charge of forest protection and fire control. They also provide technical advice and training on tree nursery establishment and management, tree planting and management in field. They also provide nursery materials especially pots. KFS is also in-charge of giving permits for access of forest products. They perceived that KFS was interested in enhancing forest management for a better environment.

(b) Kenya Wildlife Service: It was indicated to play an important role in training the community members on importance and management of wildlife. Their

major interest as PFM stakeholders was to protect the wildlife and the forests as the wildlife habitat. They fund CFA nursery establishment activities and provide a lot of support in times of fire control. They have also enhanced forest protection and protection of farms of community members living adjacent to the forest through installation of hot wire to control movement of animals out of the forest.

(c) **Provincial Administration:** As a government unit, it plays an important role in forest patrol to enhance protection of the forest against illegal tree cutting and poaching of wildlife. They also play a key role in disseminating information on PFM meetings and activities among CFA members and other community members. They also play a significant role in resolving conflicts among CFA members and other Non- CFA community members in the area.

(d) **Managers of Big Farms:** These managers had great interest in enhancing PFM because of the role forests play as water catchment areas. The better the forests are maintained the more water they will be able to provide for the irrigation of the big commercial farms. The managers have therefore been facilitating meetings of CFA officials to develop the forest management plan by paying fee for the meeting hall and drinks. They also provide technical advice on tree planting and other aspects through their technical staff. Big Farms also facilitate fire fighting by providing labour (their own workers), fire fighting equipments, food and transport for the community members involved in the process. The CFA members also acknowledged that these Farms provide their youths with jobs and this helped to reduce crime among youths

hence enhancing security within the community because the youth are no longer idle to engage in criminal activities.

(e) **Water Users Association (WUA)**: They have a lot of interest in protection of the water catchment for adequate supply of water hence they assist the CFA members in planting trees in water catchment areas as well as providing water for tree nursery management activities. During periods of drought, they also do water rationing to ensure that water is fairly distributed among the community members and other stakeholders within the area surrounding the forest. The WUA also participate in fire fighting and forest protection.

(f) **Green Belt Movement (GBM):** They are interested in environmental protection and conservation. Hence they are actively involved in environmental conservation by facilitating establishment of group nurseries within the area. Such groups have been providing seedlings to be planted in the forest by the CFA members and through them the GBM also transport seedlings to the planting sites in the forest. GBM has also been providing training on tree nursery establishment and management and potting material. The GBM supported groups have also been directly involved in planting trees in the forest and in public sites such as schools, dispensaries and along the road sides as well as in fire fighting in the forest.

(g) **Saw millers**: They are interested mainly in having adequate supply of trees from the forest for their industries. Therefore, as stakeholders they facilitate fire fighting by providing transport and food. They also facilitate tree-planting activities in the forest by providing CFA with means of transporting seedlings to the planting sites in the forest.

4.4 Contribution of PFM to improved CFA members' livelihoods

4.4.1 Economic wellbeing of CFA members after PFM

Most forest adjacent communities irrespective of CFA membership depend on the forest for their livelihood by accessing forest products for domestic and commercial use. Obua *et al.* (1998) demonstrated that there was a significant relationship between demographic /socioeconomic characteristics of households such as gender and education and their use of forest resource. Majority of Ngare Ndare CFA members (97.5%) and all Ontulili CFA (100%) indicated that their economic wellbeing was worse before PFM (Figure 4.18).

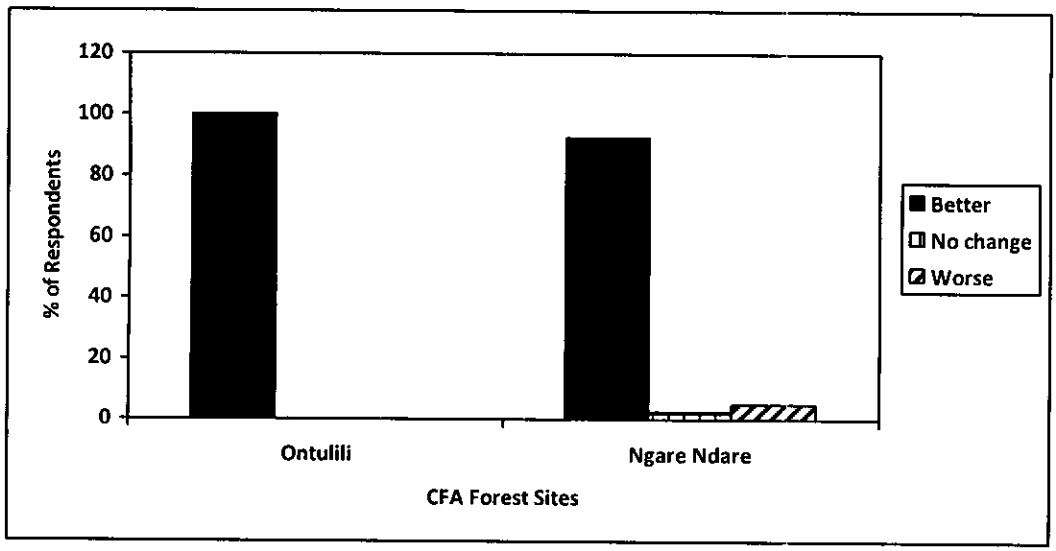


Figure 4.18: Change in CFA economic well being after PFM in forest sites

Majority of the Non CFA members in Ontulili ((75%) and Ngare Ndare (72.5%) acknowledged they had observed a positive change in the economic wellbeing of their CFA neighbors. Only a few of the Non CFA members indicated a no change and a worse change while 10 % of Ngare Ndare Non CFA members indicated that they had not taken keen interest in the wellbeing of their CFA neighbors (Figure 4.19).

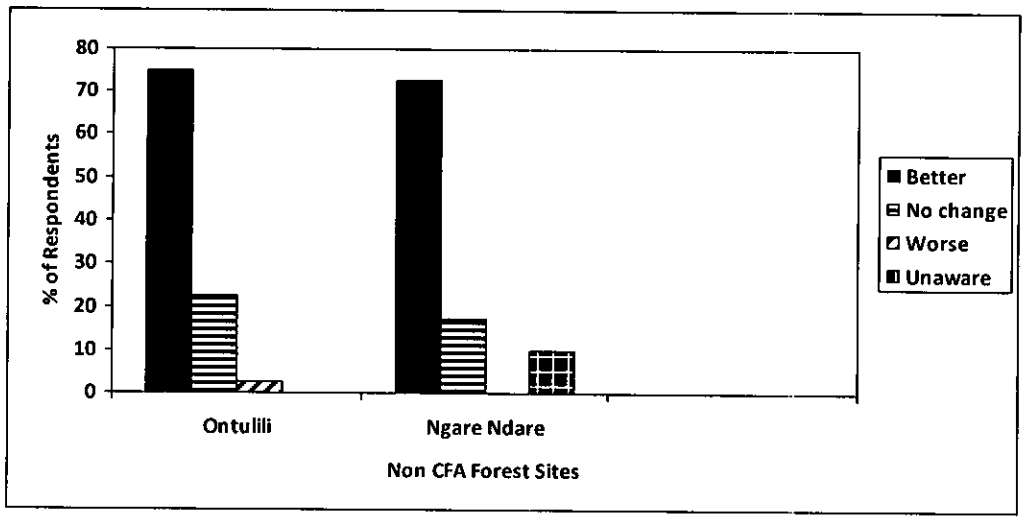


Figure 4.19: Non CFAs's perception on economic well being of CFAs after PFM

There was a significant change from worse economic wellbeing perception of CFA members before PFM to better economic well-being after PFM (Table 4.21). Improvement in CFA members' economic wellbeing was associated with their participation in PFM ($\chi^2 = 80$, P=0.001).

Table 4.21: State of economic well being of CFA members before and after PFM

Economic wellbeing before PFM (%)	Economic wellbeing after PFM (%)			Total for economic wellbeing before PFM
	Better	Worse	No change	
Better	0.0	1.3	0.0	1.3
Worse	96.3	0.0	2.5	98.8
Total for economic wellbeing after PFM	96.3	1.3	2.5	100.0

N=80

In Shinyanga region in Tanzania, it was noted that 64% of households admitted that their economic wellbeing at the family level had increased and improved as a consequence of values of benefits from forests managed under PFM process (Monela *et al.*, 2005). Real differences in terms of livelihood impacts under different PFM regimes have been recorded even though many communities are not able to capture forest benefits in economic terms (Kajembe *et al.*, 2006).

In Ethiopia, PFM was associated with contributing towards social equity in terms of gender and minority ethnic groups. When accompanied with complementary non-forest based livelihood activities, PFM helped to diversify income sources, increase household income level, and build household assets. This reduced dependence of communities on forests for livelihoods (Gobeze, *et al.*, 2009). The reasons for improved economic wellbeing varied from one forest site to another. In Ontulili, majority of the respondents reported that PELIS contributed most to better economic wellbeing after PFM, while in Ngare Ndare, financial gains from other PFM activities such as sale of tree seedlings and honey were considered to be contributing to improved economic well being (Table 4.22).

Table 4.22: Reasons for better economic well being after PFM

Reasons for better economic wellbeing after PFM in Ontulili	**No. of respondents**	**%**
PELIS	45	56.3
Knowledge and awareness through PFM training and participation in PFM activities	20	25
Financial gains from PFM activities	5	6.3
Access to fodder	3	3.75
Access to firewood	2	2.5
Community participation helps to access benefits and rights	2	2.5
Better management of the forest	1	1.3
Reasons for better economic wellbeing after PFM in Ngare Ndare	**No. of respondents**	**%**
Financial gains from PFM activities	34	42.5
Water availability for domestic use and commercial agriculture	11	13.75
Knowledge and awareness through PFM training and participation in PFM activities	7	8.75
Access to firewood	6	7.5
Access to fodder	4	5
Better management of the forest	4	5
CFA corporate responsibility e.g. educating children of Non CFA	2	2.5
Increased security	1	1.25
Access to loans from CFA	1	1.25
Community participation helps to access benefits and rights	1	1.25

4.4.2 Importance of PFM activities contributing to improved livelihoods

The perception of the CFA members on the level of importance of PFM activity's contribution to the better livelihood was assessed at three levels namely: not important at all, moderately important and highly important (Table 4.23). Most of the CFA respondents attached a level of highly important contribution to firewood, tree nurseries, tree planting, water, and PELIS.

Poles had a level of 'no importance at all' attached to it by most respondents (Table 4.23). This is most likely because it is not easily accessed especially in Ngare Ndare forest, which is a natural forest where no thinning is done for any poles to be obtained. Moreover, in Ontulili only a few CFA members interviewed were involved in thinning and pruning in the plantations to be able to get free poles for domestic and commercial use.

Firewood had the highest number of respondents attaching a 'highly important' level of contribution (Table 4.23) not only because of its domestic use but also because the respondents indicated that during famine and drought, they would sell firewood collected from the forest to get money to buy food.

Table 4.23: PFM contribution to improved livelihood as per CFAs' perception

PFM benefits	Not important at all (%)	Moderately important (%)	Highly important (%)
Firewood	1.3	8.8	83.8
Tree nurseries	0	6.3	66.3
Tree planting	0	8.8	65.0
Water	1.3	3.8	58.8
PELIS	16.3	1.3	45.0
Fodder	3.8	3.8	43.8
Honey	12.5	1.3	17.5
Poles	18.8	2.5	8.8

During focus group discussion, two Ontukigo CFA members who had no farms were reported to be depending entirely on PFM related benefits for their livelihood. One male CFA member was depending on sale of firewood from the forest to pay house rent and meet other needs and the other CFA member was a female who was a widow depending on PELIS for her livelihood. These findings show that Ngare Ndare and Ontulili forests contribute significantly to the livelihoods of the CFA members as well as to the other forest adjacent community members. This agrees with the observation that at the local level and especially in the rural areas in Kenya, most communities depend on the forests for provision of wood fuel and other wood and non-wood products for their livelihood. For example, in a report entitled "Kenya Forestry beyond 2000" (MENR, 1994), 530, 000 households living at a distance of five kilometers were reported to depend directly on forests for cultivation, collection of fuel wood, herbal medicines and other economic gains. Similarly, PFM activities were noted to be improving the livelihoods of participating community members in Arabuko Sokoke (Mbuvi, 2007). In this area income was gained from PFM activities such as selling seedlings and poles of *Casuarina equisetifolia*, bee keeping, butterfly farming and *Aloe vera* farming (Mbuvi, 2007).

4.4.3 PELIS potential in improving CFAs livelihoods

PELIS is a modification of Shamba system, which is used for establishment of forest plantations in Ontulili forest. It involves informal arrangements with farmers to grow crops in small parcels of land in the government forest hence in the process; the farmer prepares land for tree plantation establishment and removes weeds around the tree seedlings (Plate 4.3). PELIS is not practiced in Ngare Ndare forest because it is a natural forest where enrichment planting is done using indigenous tree species. In

Ontulili forest, it is only the CFA members who are permitted to participate in PELIS. Small parcels of land ranging from half an acre to one acre are allocated to an individual CFA member and they usually pay KES 250 for half an acre and KES 500 for an acre per year.

Plate 4.3: *Cupressus lusitanica* and potatoes under PELIS in Ontulili Forest

Majority of CFA members in Ontulili (56.3%) associated improvement in economic wellbeing after PFM to PELIS and this was also emphasized during FGD. PELIS provided extra farms for the CFA members who had small pieces of land at quite a fair price compared to the market rates of renting land, which were almost 12 times the KFS charges (KES 3, 000 per half an acre or KES 6, 000 per acre).

A participatory analysis of costs involved in managing PELIS was done during FGD. Cultivation is allowed for a total of 3 years. The main crop grown in Ontulili forest under this system was mainly potato, which required inputs such as planting material/seeds selected from own farm or purchased at a price of KES 2, 000 per bag and 6-9 bags were required per acre. Chemicals used include, Osthane and Dithane,

which would usually cost KES 700 hence 2 Kgs required were costing KES 1, 400. Total labour if hired would usually cost KES 6, 000. Most of the CFA members involved reported an average harvest ranging from 50-70 bags of potatoes (Plate 4.4).

Plate 4.4:Potatoes harvested from PELIS farms in Ontulili forest

The price per bag ranges from KES 1, 500 to more than KES 3, 500 depending on the season. The FGD participants involved indicated to be earning profits higher than KES 20, 000 per season especially during off-season when the supply of potatoes is low and the demand is high. PELIS was rated as highly important as pertains to its contribution to economic wellbeing improvement because of the financial gains. The PELIS members were participating in conservation of the forest through land preparation and weeding around planted seedlings thus increasing their survival. They also have tree nurseries where they raise seedlings for plantation establishment.

4.4.4 Ecotourism potential in improving CFAs livelihoods

For success in PFM, it is necessary to identify what forest-based activities can give livelihood benefits that can out-compete those enterprises involving the removal of forest products. It is important to explore other forest sources of livelihood benefits such as payment for environmental services, ecotourism and biodiversity conservation (Wood, 2007). Currently, it is only in Ngare Ndare forest where ecotourism is being practiced but it is still at its infancy level. Although Ontulili forest has some potential, ecotourism has not yet been tried. Ecotourism has a great potential for improving the livelihoods of communities living adjacent to Ngare Ndare forest because the forest has diverse flora and fauna. Potential tourism activities in this forest include camping, trekking, hiking, game viewing; rock climbing, trout fishing and swimming. Ngare Ndare forest forms the southern boundary of the Lewa Wildlife conservancy and it acts as a critical wildlife corridor between Mount Kenya and Laikipia –Samburu ecosystems.

Ngare Ndare Forest provides habitat for the "Big Five' namely Lion, Elephant, Buffalo, Rhino and Giraffe. The forest has a lot of rare brown olive (*Olea europia var africana*), pencil cedar (*J. procera*) and *P. gracilior* species. There are already several structures that have been developed for ecotourism purpose. These include; a game viewing plat form, 2 campsites, a nature trail, a wind power generator and solar, access roads, sport biking, office block, guard house, land cruiser and 3 motor bikes, communication equipment (12 VHF radios), firefighting engine and 6 Knapsack units among other facilities. The campsite that has toilet and bathroom facilities is already in use (Ngare Ndare CFA, 2008). A canopy walk way has been constructed by the Ngare Ndare Trust/CFA and it leads to a raised platform that provides visitors with an

impressive view of a natural swamp where elephants and buffaloes can be viewed while drinking but it is not yet ready for use (Plate 4.5).

Plate 4.5: A canopy walk way in Ngare Dare forest for game viewing

Other facilities in the process of being developed as observed during a visit to the forest include a Zip line, which is a structure of steel cable anchored on two pillars and slides at a certain angle. There is an agreement that once the ecotourism facility has started yielding income for the CFA, 60% of the proceeds will go to the community for bursaries, schools and improvement of health facilities. The remaining 40% of the proceeds will be used for maintenance of the facility. Tourists have started visiting Ngare Ndare forest but marketing has not yet been done because some of the structures are not yet complete. Currently community scouts and the extension staffs are doing tour guiding since the tourists are few. The CFA has already signed a

Concession Management Agreement, which is semi-autonomous; hence the CFA has to pay a fee of KES 1.2 million to KFS after 3 years of grace period.

The use of Ngare Ndare and Ontulili forests for social-cultural practices should also be considered while developing the ecotourism potentials of these two forests. Majority of the respondents (61.9%) indicated that the two forests had some socio-cultural values to the community members. The community members living adjacent to Ngare Ndare indicated such socio-cultural uses to include; use for modern worship by 45 % (36), traditional circumcision by 17.5% (14), traditional worship by 1.3% (1) and recreation by 1.3% (1). In Ontulili, it was indicated as useful for modern worship by 58.8% (47), traditional circumcision by 37.5 % (30) and traditional worship by 5% (4). Development of the forest to enhance its use for these socio-cultural practices can help to enhance ecotourism attracting both local and international tourists. The two forests have great potential for ecotourism, which can contribute, immensely to improvement of the livelihoods of the communities living adjacent to them.

4.4.5 Use of government forests in response to shocks

Most of the community members interviewed (77.5%), irrespective of their CFA membership status indicated that the adjacent government forests had a vital contribution to their livelihoods in times of shocks such as drought and famine. During times of shocks, the forest provided the community with fodder (64.4%), firewood (29.4%), water (18.1%) and food (11.9%). The community members indicated that during such times majority of Non CFA members accessed the forest illegally. More so, communities who are not settled in the area invaded the forest to graze the forest and no action was taken against such people. In Burkina Faso, it was noted that forest products play a vital role in helping the rural households to manage

risks associated with weather, crop losses and other unpredictable events (Coulibaly-Lingani *et al.,* 2009). During FGD, the community members indicated some of the very poor members sold firewood collected from the forest to buy food during famines. Similar incidences were also reported in Nepal whereby the poor and the landless were collecting firewood and selling in the local market despite the fact that it was outlawed. This implies that restraining community members living adjacent to forest from collecting forest products from the forest harms the livelihood of the poor who have no alternatives (Adhkari *et al.,* 2004).

Further analysis indicated that the number of CFA members depending on the forest during times of shocks were more than the number of Non CFA members depending on the same resource in both Ontulili and Ngare Ndare forest (Figure 4.20).

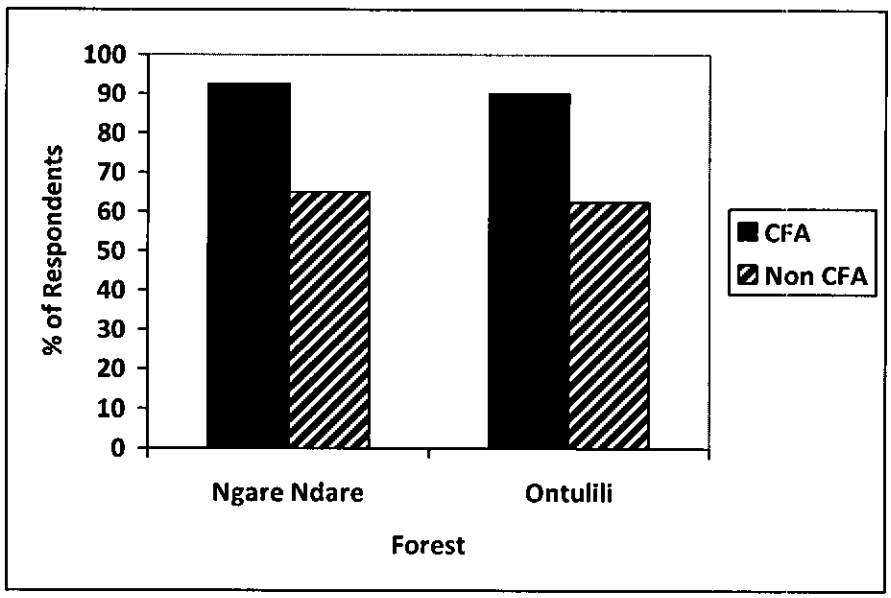


Figure 4.20: Use of forests by community members in times of shocks

Dependency on forests in times of shocks was significantly influenced by CFA membership (χ^2 =9.038, p=0.005). This could be attributed to the increased access to the forest products through CFA membership. There was no significant difference in dependency on the forests on the basis of forest sites.

4.4.6 PFM and other determinants on community access to forest products

Community access to forest products is an important aspect of forest contribution to improvement of livelihoods of communities living adjacent to forests. Therefore, it was considered necessary to assess the change in access due to PFM and other factors determining access to the forest products in the study sites.

CFA membership influence on access to forest products

Most community members (85%) involved in this study indicated to have access to forest products from the adjacent forest irrespective of CFA membership. However, a higher percentage of the CFAs members had access to forest products and services from the adjacent forests compared to non-CFA members (Table 4.24).

Table 4.24: Community access to Ngare Ndare and Ontulili forests

CFA membership status	Access to forest products and services		N
	Yes	No	
% CFA members	96.3	3.8	80
% Non CFA members	73.8	26.3	80
% Total	85.0	15.0	160

There is a positive strong association between CFA membership and access to forest products and services (Gamma = 0.803) and the association was highly significant (χ^2 = 15.882, p=0.001). This implies that joining CFA enhanced the community members' access to forest products, implying that PFM conferred high access to CFA members than Non CFA members. It was similarly noted in Nepal that households involved in various decision-making activities collect more fuel wood. This is associated to the information acquired through various forms of community meetings

concerning when to collect and where to collect firewood from the forest (Adhikari *et al.*, 2004).

Temesgen (2007) noted that unless communities access forest resources to support their livelihoods, the pressure will rise to breaking point and further forest destruction will follow. Therefore sustainable forest management is enhanced when communities are provided with clear and recognized access rights to the forest resources. It also calls for multi-stakeholder agreements on the objectives of the forest management including increased though sustainable use of existing non-timber forest products from the forest.

CFAs' perception on change of access to forest products

The CFA members were asked to express their perception on access to different forest products that have an important contribution to improved livelihood. This was to identify whether PFM influenced access to such forest products.

(a)Access to firewood

The 'more access ' to firewood category increased from 41.6% before PFM to 57.1% after PFM while less access category decreased from 53.2% before PFM to 40.3% after PFM while no access at all decreased from 5.2% to 2.6% (Table 4.25). PFM had a positive influence on access of firewood ($\chi^2 = 15.882$, p=0.001).

Table 4.25: Perception of CFAs on access to firewood

Access to firewood before PFM %	Access to firewood from forest after PFM %			% Total
	More accessible	Less accessible	No access at all	
More accessible	1.3	37.7	2.6	41.6
Less accessible	50.6	2.6	0.0	53.2
No access at all	5.2	0.0	0.0	5.2
% of Total	57.1	40.3	2.6	100.0

Total number of CFA respondents accessing firewood =77

The significant increase in access to firewood after PFM could be attributed to community participation in PFM activities such as thinning, pruning, patrol and fire control. As indicated during FGD, free firewood collection was allowed as an incentive to those participating in those activities hence increased access.

(b)Access to water

CFA members indicated that after PFM introduction, access to water increased, less access and no access at all decreased (Table 4.26). Participatory Forest Management had a significant positive influence on community access to water from Ontulili and Ngare Ndare forests (χ^2 = 61.886, p=0.001). Participation in PFM has enhanced access to water resources as a forest resource.

Table 4.26: Perception of CFAs on access to water

	Access to water from forest after PFM (%)			% Total (N=64)
Access to water before PFM	More accessible	Less accessible	No access at all	
More accessible	3.1	9.4	0.0	12.5%
Less accessible	62.5	3.1	1.6	67.2%
No access at all	7.8	0.0	12.5	20.3%
% of Total	73.4	12.5	14.1	100

The reasons given for less and no access to water before PFM were fewer trees because of low conservation of water catchment. Community participation in forest management and free entry in to the forest as provided for under PFM has played a major role in enhancing access to water resources in the forest. However, there were complaints concerning increased fees paid to access water under PFM.

(c)Access to fodder

More access to fodder in the forest increased while less access and no access at all decreased under PFM (Table 4.27). These differences in access to fodder before and

after PFM were significant (χ^2 = 35.394, p=0.001). Increased access to fodder from the two forests for CFAs was associated with PFM.

Table 4.27: Perception of CFAs on access to fodder

Access to fodder before PFM	Access to fodder after PFM (%)			% Total (N=58)
	More accessible	Less accessible	No access at all	
More accessible	8.6	29.3	0.0	37.9
Less accessible	50.0	3.4	1.7	55.2
No access at all	1.7	3.4	1.7	6.9
% of Total	60.3	36.2	3.4%	100.0

(d)Access to herbal medicine

Unlike for other forest products such as firewood, water, fodder and thatch grass, for which access was positively influenced by community participation, access to herbal medicine from the two forests decreased after PFM (Table 4.28).

Table 4.28:Perception of CFAs on access to herbal medicine

Access to herbal medicine before PFM	Access to herbal medicine from forest after PFM (%)			% Total access before PFM (N=28)
	More accessible	Less accessible	No access at all	
More accessible	0.0	32.1	3.6	35.7
Less accessible	25.0	0.0	3.6	28.6
No access at all	3.6	0.0	32.1	35.7
% of Total access after PFM	28.6	32.1	39.3	100.0

The decrease in access to herbal medicine after PFM was highly significant (χ^2 = 40.178, p=0.001). This could be attributed to the fact that in both Ontulili and Ngare Ndare forests, the herbal medicine user groups were not functioning at the time of survey. During FGD in Ngare Ndare, it was indicated that leadership wrangles among the herbal medicine user group members led to the dissolution of the group hence they were not active.

(e) Access to Thatch grass

The CFA members using thatch grass perceived that access to thatch grass increased after PFM as compared to before PFM (Table 4.29).

Table 4.29: Perception of CFAs on access to thatch

Access to thatch grass before PFM	Access to thatch grass from forest after PFM			% Total before PFM (N=25)
	More accessible	Less accessible	No access at all	
More accessible	0.0	24.0	4.0	28.0
Less accessible	20.0	0.0	8.0	28.0
No access at all	20.0	0.0	24.0	44.0
% of Total access after PFM	40.0	24.0	36.0	100.0

Although use of grass for thatching is decreasing, involvement of community members in PFM through CFA formation increased access to this forest product for the few using grass for thatching. The increase in access to thatch grass after PFM was significant ($\chi^2 = 22.114$, p=0.001).

Homestead distance as a determinant of access to forest products

Out of the 136 community members able to access forest products, 57.4% were within 0-1 km from the forest, 33.8% were within 1.1-3 Km, 6.6% were within 3.1-5Km and 2.2% of members had their homesteads beyond 5Km from the forest. Further analysis based on CFA membership revealed the same trend for CFA members and that more CFA members were accessing forest products compared to the Non CFA (Table 4.30).

Table 4.30:Homestead distance from the forest and access of forest product

CFA membership status	Accessing forest products and services	Range of home distance from forest				N
		0-1km	1.1-3km	3.1-5km	Over 5km	
CFA members	Yes (%	66.2	24.7	6.5	2.6	77
	No (%)	0.0	100.0	0.0	0.0	3
	Total %	63.8	27.5	6.3	2.5	80
Non CFA members	Yes (%)	45.8	45.8	6.8	1.7	59
	No (%)	57.1	38.1	0.0	4.8	21
	Total %	48.8	43.8	5.0	2.5	80

There was a highly significant relationship between CFA members' access to forest products and their homestead distance from the forest ($\chi^2 = 8.217$, p=0.05). However, for Non CFA members this relationship was not significant. The results of this study consent to the observation of Varughese and Ostrom (2001) that users who live close to the forest have a more secure and accessible supply of forest products regardless of where there are allocation rules in place or not. In this study, it was noted that as distances from the forest increased, the number of community members accessing forest products seemed to reduce gradually. This agrees with the observations of Obua et *al.* (1998) in Budongo forest in Uganda that local communities living within a range of 5 km from the forest boundary affect or is affected by the presence of a forest The furthest CFA homestead from the forest was 6km while for non CFA, it was 10 km hence the mean distances for CFA and Non CFAs were 1.227 km and 1.528 km, respectively.

Training as a determinant of access to forest products

Training in forest management was noted to have a significant influence on access to forest products and services for both CFA and non CFA members of the community members living adjacent to the two forests ($\chi^2 = 10.197$, p=0.001) about 64% of those accessing forest products and services were respondents trained in forest management. This relates to what was noted by Coulibaly-Lingani *et al.* (2009) that

agricultural extension services promote collection and processing of non-timber forest products. This training might have helped the community members to know what forest products they are allowed to access legally hence enhancing their access to products such as firewood, fodder and firewood.

Wellbeing Categories of community members

There was a significant relationship between wellbeing category of community members and their sources of firewood (χ^2 = 39.068, p<0.001). The rich had the highest access (60.3%), then the poor (36%) and very few of the poor (3.7%). Adhikari *et al.* (2004) similarly observed that the income category "Rich" had positive influence on fuel wood collection. Households belonging to this income category were noted to be collecting more grass and fodder from community forests. It was concluded that the less poor were benefiting from the community forest more than the very poor.

Major and alternative livelihood sources as determinants to access to forest products

In this study, there was a significant relationship between major source of livelihood and access to forest products and services (χ^2 = 16.570, p=0.005) as well as alternative source of livelihood and forest products' access (χ^2 = 15.451, p=0.009). Majority of those who accessed forest products and services were respondents having cash crop as their major livelihood source (76.5%) and livestock keeping as their alternative source of livelihood (61.1%). Coulibaly-Lingani (2009) also noted that respondents involved in either farming or livestock husbandry thus generating income from selling cash crops or cattle are more likely to access the forest for fuel wood collection and

grazing livestock. In other studies, it has been noted that households with more land and cattle spend more time gathering tree and grass fodder and mulching materials from the forest than those with little or no land and cattle (Adhikari *et al.*, 2004).

Sources of major forest products for CFA and Non CFAs

Sources of firewood

Out of the 160 households surveyed irrespective of CFA membership, 75% of them were getting firewood from government forest, that is, Ontulili and Ngare Ndare forests. There were more CFA members (81.3%) than Non CFA members (68.8%) getting firewood from the two forests (Figure 4.21).

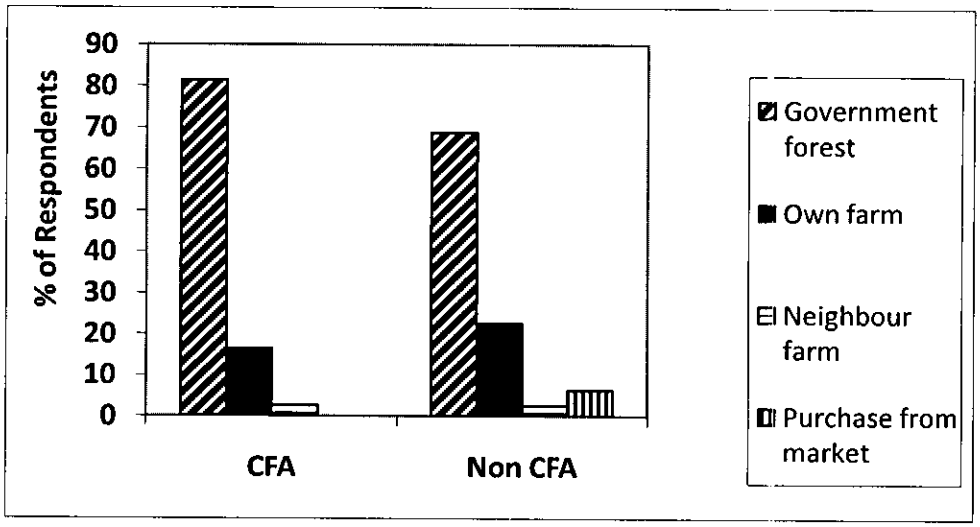


Figure 4.21: Sources of firewood for CFA and Non CFA members

In Budongo forest in Uganda, it was similarly observed that majority of the community members living adjacent to the forest were harvesting firewood from the forest (Obua *et al.*, 1998). From analysis of firewood sources based on the sites, it was noted that there were more of the Ontulili community members depending on the Ontulili government forest for firewood compared to the number of Ngare Ndare community members depending on Ngare Ndare forest for firewood (Figure 4.22).

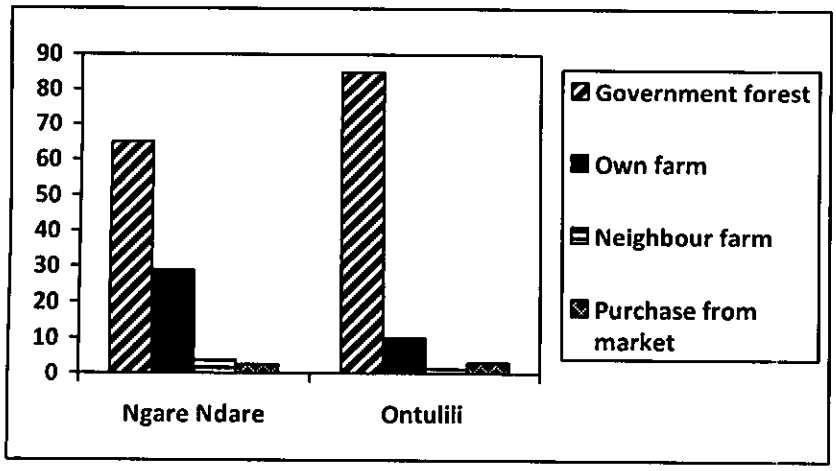


Figure 4.22: Sources of firewood in Ngare Ndare and Ontulili

The difference between the two forest communities in terms of their sources of firewood was significant (χ^2 =10.591, p=0.05). Ontulili forest is a source of firewood to most of the CFA and Non CFA members living adjacent to it.

Household Fuel wood consumption

The two government forests are major sources of firewood to the community members living adjacent to them. However, the community members indicated that a monthly fee of KES 100 was paid to KFS for each household to collect one head load of firewood per day within the weekdays for a whole month. The average number of head loads used per week for all community members is 2.6. The 160 respondents used an estimated total of 423.50 head loads of firewood within a week (Figure 4.23).

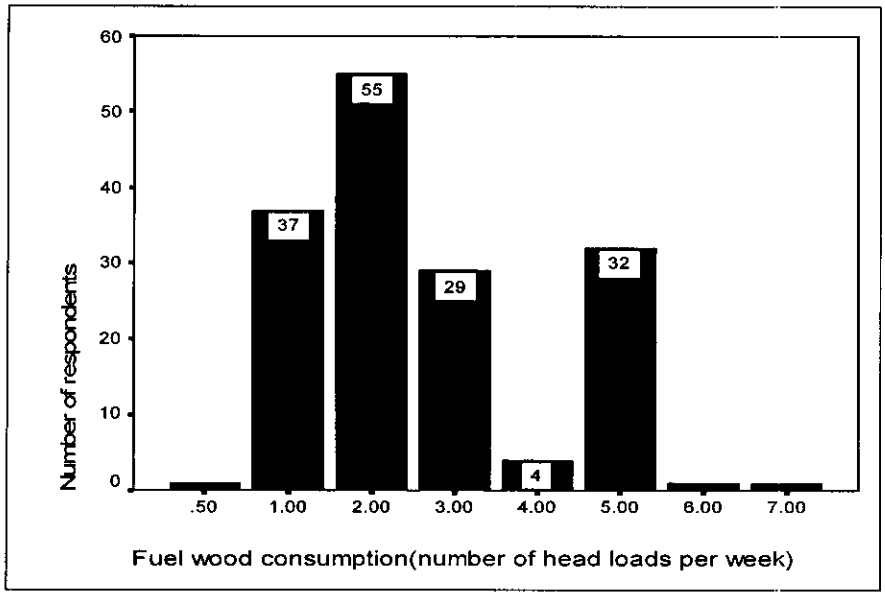


Figure 4.23: Fuel wood consumption in Ontulili and Ngare Ndare

Most of the respondents used 2 head loads of firewood per week. In the FGD, the communities reported that indigenous species provided good quality firewood hence these species were the most preferred. Such species include; *Olea europia var africana* (Miteero), *Juniperus procera* (Mutarakwa) and *combretum molle* (Murema ngigi). They recommended that these species should be planted in the government forest and in the farms. The community members indicated that during times of shocks, they were able to sell surplus fuel wood collected from the forest to purchase food and other basic household supplies.

The mean number of fuel wood head loads consumed per week for CFA households is 2.8 while for Non CFA households is 2.5. There was significant difference between the CFA and Non CFA households in terms of mean number of head loads of fuel wood consumed per week ($t=0.991$, $p= 0.05$). However, there was a significant correlation between household size and fuel wood consumption ($r_s= 0.156$, $p=0.05$). This implies that for all the community members interviewed, as the household size increased, the number of fuel wood head loads consumed per week increased as well.

During the FGDs in both forest sites, the community members reported that procuring firewood from the forest was cheaper. This is because an estimated total of 20 head loads per month were being charged KES 100 while in the market the price of one head load ranged from KES 150 to KES 200. Therefore community members collecting one head load every day for the whole month for sale were able to make a profit ranging from KES 2,900 [(20 head loads * KES150 per head load) – KES100 charged by KFS per month)] to KES 3, 900 [(20 head loads * KES 200 per head load) – KES100 charged by KFS per month)]. Even for the community members who were not selling firewood, they were able to attach a value on the firewood obtained from the government forest hence understand how much they would spend when purchasing the same amount or less in their local markets.

Household consumption of withies

Withies (fitos) are very important to these two communities living adjacent to Ontulili and Ngare Ndare forests because they are used for supporting various types of cash crops including snow peas and French beans among others. For both CFA and Non CFAs, the government forest was the main source of withies. A total of 109 community members were using withies from the mentioned different sources out of whom 56% were CFAs and 44% were Non CFAs (Figure 4.24).

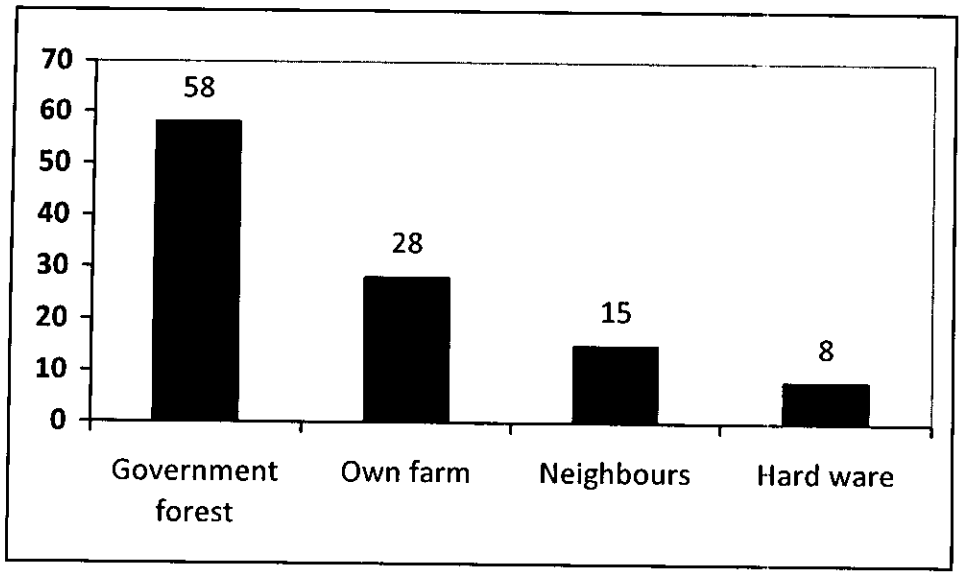


Figure 4.24: Sources of Withies for forest community members

Further analysis was done based on forest sites to determine which forest community was using withies from the government forests. It was noted that 48.6% of those using withies from the forest were community members living adjacent to Ontulili forest. Only 4.6% of community members living adjacent to Ngare Ndare forest were getting withies from the forest and they indicated that they purchased pruned materials from Ontukigo CFA members working in the Ontulili forest and other forests and not from Ngare Ndare forest. Majority of Ngare Ndare community members using withies obtained them from their own farms (50.9%), 28.3% from their neighbours, 11.3% from hardware and 9.4% from the forests. For Ontulili community members 94.6% of those using withies were getting it from the forest, 3.6% from hardware and 1.8% from their own farms.

The CFA members getting withies from the forest formed 32.1% and the Non CFAs formed 21.1% of all the respondents using withies. The CFA members who indicated the amount of withies they were using were 48 consuming a mean of 3236 withies per household while 38 Non CFA members were using a mean of 1216 withies per

household. There was a significant difference between the mean number of withies used by the CFA and Non CFA members (t=1.380, p=0.01).

A total of 201,582 pieces of withies from different sources were consumed as specified by 86 members of these two communities and 52.3% of them had specified that the Ontulili government forest was their main source of fitos. Total cost of fitos supplied by the government forest both Ontulili and others totalled to KES 537, 300 giving a mean of KES 11, 940 gained or spent per person. The CFA members involved in pruning and thinning were allowed to use freely thus saving on costs involved and they were also allowed to sell and share the money. For Non CFA members, they were buying from the CFA members or other sources hence spent money to purchase withies. The prices of procuring fitos from other sources such as purchasing from neighbours and the markets ranged from KES 5 to KES 30 KFS was selling fitos to non-CFA buying directly from them at KES6 per piece. However, the CFA members were selling cheaply to other community members, that is, KESH2 per piece as informed during the FGD in Ontulili.

Sale of withies by various CBOs under Ontulili CFA

Majority of the CFAs accessing withies from the Ontulili forest were not charged for it because withies were given freely to any CFA member who participated in thinning and pruning in the Ontulili forest. The CFA members would do this work and get free thinned materials and pruned materials as incentives for labour provided. The pruned materials provided the fitos and the CFA members involved in the work were allowed to get these fitos freely for domestic use or even sell them to others from outside the forest. In case of selling to outsiders, the KFS would issue a permit of transportation

to those purchasing the fitos at a cost of KES 1000 per lorry. Discussion with the Ontukigo CFA members revealed that one lorry is filled by 7,500 withies and each piece is sold at KES 2 per piece hence a single lorry earns them KES 15, 000. From records obtained in Ontulili forest station, it was noted that as from 17th to 30th August 2009, several members of 10 CBOs under Ontukigo CFA were allowed to sell 24 lorries of withies after participating in pruning in the Ontulili forest. It can therefore be estimated that withies sold might have earned the CFA members a total of about KES 360, 000. The records also indicated that KFS earned a total KES 24,000 in terms of money paid as movement permits by the clients purchasing the withies from the CFA members. There were no such operations in Ngare Ndare forest because it is an indigenous forest hence it is quite possible that the few members using fitos from government forest among the Ngare Ndare forest adjacent communities were getting these fitos from Ontulili forest or other plantation forests and not from Ngare Ndare forest.

Homestead distance from the forest and sources of withies

Majority of the community members using withies were those living within 0-1 Km from the forests (Table 4.31). There was a significant relationship between use of withies from different sources and homestead distance from the forest ($\chi^2 = 25.559$, p=0.05).

Table 4.31: Use of withies in relation to homestead distance from the forest

Sources of withies	Range of home distance from forest (N=109)				% of N
	0-1km	1.1-3km	3.1-5km	Over 5km	
Government forest	58.5	52.9	33.3	0.0	53.2
Own farm	23.1	29.4	0.0	75.0	25.7
Purchase from Neighbors	7.7	14.7	66.7	25.0	13.8
Hardware	10.8	2.9	.0	.0	7.3

Livestock production and sources of fodder

CFA members own majority of the livestock in both forest sites. Types of livestock owned include cows, goats and sheep (Figure 4.25). This is possibly the reason why it is the majority of CFA members who were using the government forests as source of fodder compared to the Non CFA members.

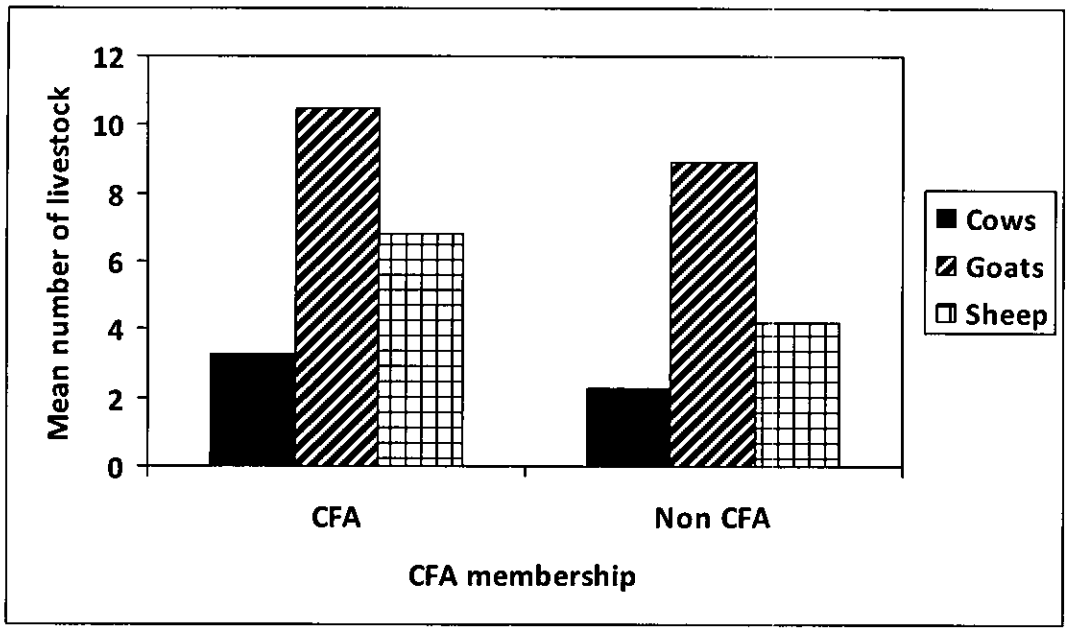


Figure 4.25: Mean number of livestock owned by CFA and Non CFA members

There were 75 CFA members owning livestock out of whom 68 CFA members owned cows, 21 owned goats and 26 owned sheep. Out of 62 Non CFA members having livestock, 49 of them owned cows, 12 owned goats and 27 owned sheep. There was significant difference between the mean number of cows ($t = 2.804$, $p=0.005$) kept by CFA (3.2) and non-CFA (2.2) as well as for mean number of sheep ($t = 1.656$, $p=0.01$) owned by CFA (6.8) and Non CFA (4.2). Hence number of livestock is an important determinant in household decision to join CFA. This could be more attributed to increased access of CFA members to government forest for fodder and grazing. Similarly, Cchetri (2005) observed that households with more livestock are more inclined to use community forest resources for their higher demand

for fodder and ground grass. It was also reported by Adhikari (2004) that households who keep more livestock are benefiting more from the community forests.

A comparative analysis of the number of CFA and Non CFA who keep livestock revealed that more of the CFA members kept more livestock than the Non CFA except for sheep, which were kept in Ngare Ndare where more of the non-CFA kept sheep compared to the CFA (Figure 4.26). This shows why the Ontulili and Ngare Ndare forests are very important sources of fodder for livestock especially for the CFA members. All Ontulili CFA and non-CFA members did not own any goat (Figure 4.26).

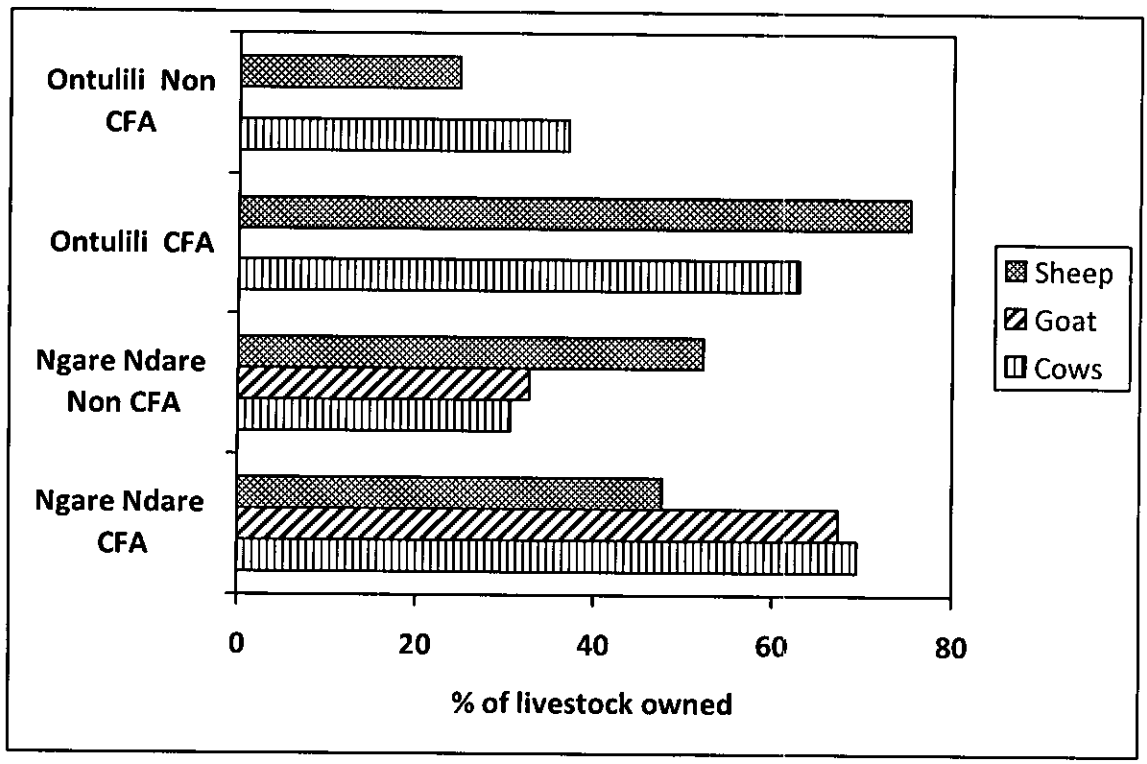


Figure 4.26: Livestock types kept in Ontulili and Ngare Ndare sites

Majority of CFA and Non CFA members having livestock had their own farms and government forest as the major sources of fodder (Figure 4.27). Therefore, it is important to enhance fodder production in both government forests and own farms to

ensure sustainable supply. There was significant association between CFA membership and sources of fodder ($\chi^2 = 20.277$, p=0.001). More CFA members are in need of fodder than the Non CFA members because CFAs have more livestock than Non CFA.

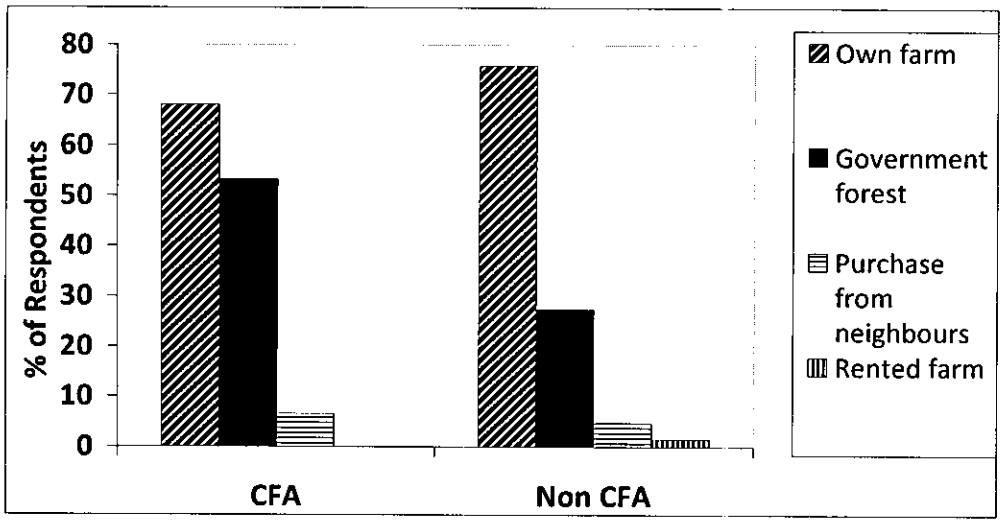


Figure 4.27: Sources of fodder for CFA and Non CFA members

Analysis of sources of fodder based on each forest site revealed that 37.5% of the CFA members in Ontulili were using the government forest as the only source of fodder and 37.5% of them were using both the government forest and their farms as source of fodder hence giving a total of 75% CFA members depending on the Ontulili government forest for fodder. More so, 30% of the Ontulili Non CFA members were depending on the government forest as the only fodder source and 7.5% of them were depending on a combined source. This confirms that most of the Ontulili community members graze their animals in the government forest as legally required hence do not keep goats which they cannot be allowed to graze in the forest.

4.4.7 CFA's corporate responsibility in improving community livelihood

During the household surveys and FGDs in Ngare Ndare, the Non CFAs, KFS staff and other stakeholders commended CFAs for their contribution to improvement of the

state of roads in the villages surrounding the forests. The CFA members were involved in grading of roads directly and at times the CFA management were paying the community members to prepare the roads manually. The level of Ngare Ndare CFA in corporate responsibility to the forest adjacent community members was highly commended especially for the provision of their vehicle for emergencies such as taking sick people to hospital at night. The CFA was also commended by the community for having selected orphans from several villages and educating them in spite of the affected families being non-CFA members. The CFA was also involved in handling insecurities such as cattle rustling by joining forces with Lewa Conservancy to rescue attacked families.

The CFA/Trust was also purchasing seedlings from the CFA groups with tree nurseries to enhance income generation by such groups as well as encouraging them to plant trees in their farms. Through the CFA support, the CFA members had planted about 1.6 million trees in their farms as indicated by the CFA extension staff. The CFA was also commended for provision of jobs by employing young people as community scouts and as casuals to plant trees in the forest. The CFA was also commended for helping women groups in 2005 to buy hose pipes in order to access water for their tree nurseries and for irrigation farming hence improving their agricultural production which is their major source of livelihood. The CFA nursery managed by CFA staff provided trees for planting in the water catchments within and outside the forest hence conserve water resources. Trees planted in the water catchments include *Ficus* species, and *Podocarpus* species. The livelihood of the community members was also considered to have improved due to the introduction of upgraded livestock with higher milk production by the CFA.

4.5 Community attitudes on government PFM requirements

Determining communities' attitudes towards forest management practices and their commitment to participate is crucial to the success of any collaborative or participatory forest management. Genuine involvement of local communities in decision-making process and management of forest resources has several advantages. It serves to promote public interest and confidence in forest activities. More so, it helps to build credibility and transparency in forest management. It also reduces management costs and forest degradation and increases benefit flow to local communities. Forest managers and the state stand to benefit from local involvement in forest management (Obua *et al.* 1998).

4.5.1 Adequacy of current government PFM requirements

The results of household survey indicated that most CFA members were highly motivated to participate in PFM hence; they did not recommend many changes towards the current government policies as individuals. For majority of the CFA members, the current government PFM policies were adequate and for a few of them the conditions are inadequate hence require a change (Table 4.32).

Table 4.32: Government PFM conditions motivating CFA participation in PFM

Conditions/policies motivating CFA participation	% of CFA respondent (N=80)
PELIS/farming in the forest	23.8
Nursery seedling production	3.8
Participate in forest conservation activities	2.5
Access forest products at lower fee than market price	3.8
Controlled illegal cutting of trees/less destruction	3.8
Concession agreement between CFA and KFS	16.3
Forest protection	5
Planting of trees	13.8
Participating in IGAs in the forest	1.3
Dealing with poachers	1.3

Although household survey data suggests that CFA members were very comfortable with the current government PFM conditions, important changes were proposed during focused group discussions. The disparity between household data on this question and the FGD output could be probably due to the farmers having gone through a lot of changes especially with the Shamba system allowed in the forest in the past and then banned later. There was a fear that a demand for a change could interfere with the PELIS system, a variant of the Shamba system which was among the most important government PFM conditions motivating them to participate in forest management and conservation. All the non CFA respondents (100%) recommended several changes required to enhance forest management and conservation under PFM while only a few of the CFA members perceived a need for change of some of the policies (Figure 4.28).

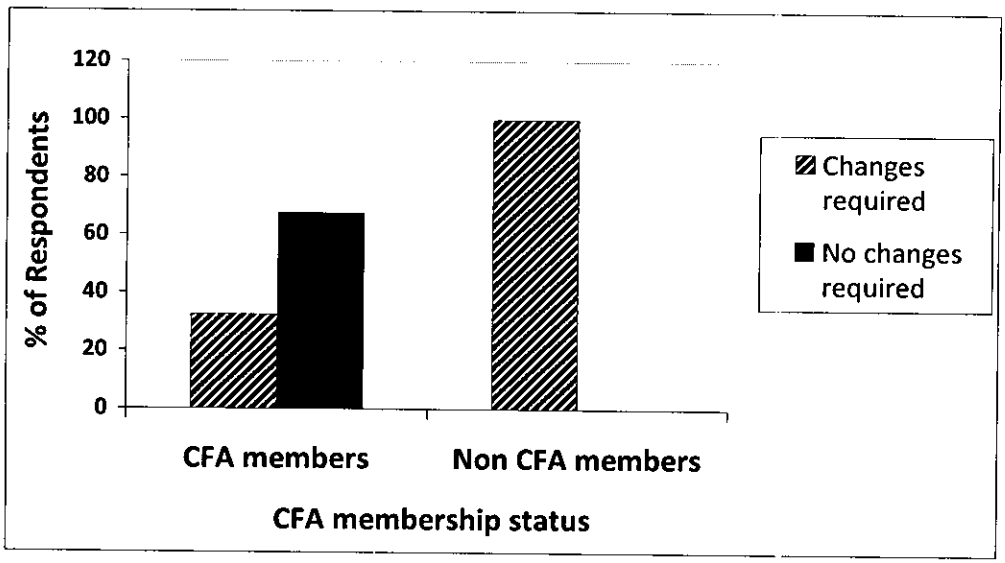


Figure 4.28: Community views on government PFM conditions

The Non CFAs who are not engaged in income generating activities in the forest under PFM were able to express their views as external observers of the PFM process. For PFM initiatives to be successful it is important to gather support across as many sections as possible of the forest adjacent communities. A good majority of these

communities need to be supportive. PFM processes must include all interest groups and try to understand the perspectives and motivating of the different user groups (Wood, 2007). Therefore, it is important for the Government through KFS to involve the Non CFA members of the communities living adjacent to the forest in decision-making where community participation is required.

On comparisons based on the adjacent forest sites, it was noted that in both sites, majority of the community members recommended for change with a higher number recommending for changes in Ontulili than in Ngare Ndare (Figure 4.29).

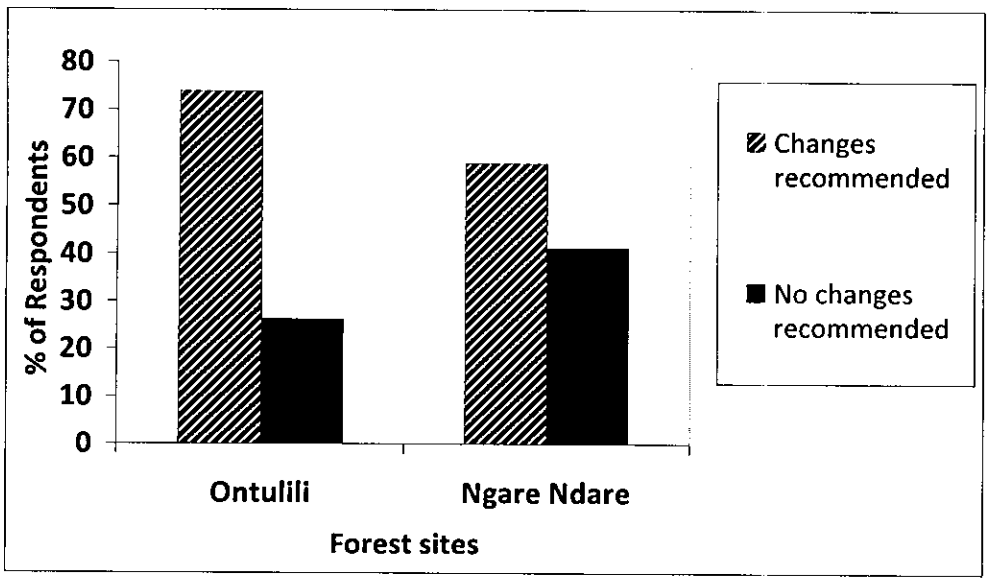


Figure 4.29: Community recommendations on government PFM conditions

This could be attributed to the fact that the Ngare Ndare community already had more opportunities to air their views in the process of developing the forest management plan in the past and the plan was already operational at the time of survey. However, Ontulili forest management plan development was underway hence the community members had a lot of views on the need for change of the conditions which they had not yet shared by the time of this survey. Out of the 160 community members

interviewed irrespective of CFA membership and forest sites, 66.3 % (106) recommended for a change while 33.7% (54) did not recommend for any change.

4.5.2 Challenges faced by Ontukigo and Ngare Ndare CFAs

Challenges facing Ontukigo CFA

The CFA members expressed their view that charges for accessing forest products and services were quite high for CFA members participating in forest management and conservation. They felt that, it was not fair for them to pay the same price the Non-CFAs were paying for the forest products and services. More so, they were faced with the challenge that they were not well empowered to stop illegal access of forest products by Non-CFA members.

The CFA members also find it a challenge to deal with forest invaders from outside the district who graze large flocks of livestock during the dry periods causing soil erosion in the forest and destruction of indigenous trees such as Indigenous Olives (*Olea europia var Africana*). These flocks exceed the agreed twenty sheep and 10 cows per person. In 2009, this kind of invasion brought animal diseases in the area mainly foot and mouth diseases that lead to death of livestock of the community members adjacent to this forest. This invasion also brought insecurity within the area surrounding the forest. The CFA members had no power or authority over these herders revealing that these were herders of very rich people with political influence hence even the KFS staff were not able to question them.

The CFA members also indicated they had observed cases of unfairness on the KFS side where by conditions were made more difficult for CFA members than for non-CFA members to access forest products. For instance, limitations based on the

diameter size for fire wood materials were placed for CFA members while the same was not being implemented for non-CFA members and other outsiders.

Challenges facing Ngare Ndare CFA

There has been lack of adequate funds for running the CFA especially meeting recurrent expenditures, which many donors are not willing to pay for. However, it is hoped that once the license is obtained, the community will be able to sustain their activities. Development of ecotourism structures in the forest will help to get finances and reduce donor dependency. However, the concession fees set is an ambitious figure that may be difficult for the CFA to meet if business does not go the way expected.

The process of registration is quite long and is hindering initiation of some of the income generating activities by the community members in the CFA. The license to operate ecotourism has been delayed though the community has done their part. A board within KFS is trying to quicken the process.

Currency fluctuation has also affected some of the activities. For instance money provided by the donors for canopy construction has not been able to complete the work. Climate change has posed a great challenge to the efforts of CFA in improving forest cover. Rainfall variability has affected tree planting activities and crop production. Community members' illegal activities in the forest such as honey harvesting and charcoal burning has been contributing to fire out breaks in the forest.

4.5.3 Community members' recommendations for improvement of PFM

The community members made several recommendations to the government on the changes required on PFM conditions and other general forest management activities (Table 4.33).

Table 4.33: Changes recommended by respondents for better PFM

Recommended changes	Number of respondents	% (N=160)
Stiffer penalties for offenders	17	10.6
More benefits to PFM participants (CFAs)	16	10.0
More assistance to forest community members	13	8.1
Improve security of the forest	12	7.5
Empower the CFAs	9	5.6
Protection of farms from elephants (Electric fence)	8	5.0
Lower charges for CFA access to forest products	8	5.0
Increase tree planting in the forest	7	4.4
Increase PELIS for more planting trees	4	2.5
Recognition of CFA members	4	2.5
Prioritization of CFA needs	4	2.5
Reduce charges for grazing and for firewood	3	1.9
Allow shamba system in the forest	3	1.9
Stop entry of Non CFAs in to the forest	3	1.9
Promotion of tourism activities in the forest	2	1.3
Limit number of livestock allowed in the forest	1	.6
Take action against white settlers in the area	1	.6
Increase number of wild animals in the forest	1	.6
Government to take up ownership of the forest	1	.6
Good relationship between KFS, KWS and CFA	1	.6

CFA empowerment for forest protection

Empowerment is defined as a process of increasing control and influence over decisions and is achieved by a number of means. Such include increasing community

members' security of land tenure, enhancing their incomes and improving their participation in land use decisions. Empowerment allows the local people to exercise their rights to self-determination. However, there may be limits to the degree of empowerment achievable at the local level while working through Forest Departments (Hobley, 1996).

During the FGD, the CFA members made several other recommendations in addition to those identified through the household survey. These recommendations were on changes they would need to enhance their participation in participatory forest management. The CFAs had a view that the government through KFS should enforce policies that enhance forest protection without partiality. This was mainly focusing on illegal herders invading the forests from within and outside the district. On the same issue, they felt that the CFA members need to be well empowered to handle the illegal herders and be able to take them to court to compensate for damages caused in the forest. Local community members need to be empowered to co-manage and benefit from forest resources in their vicinity (Obua *et al.*, 1998).

Yemshaw (2007) points out that, forest adjacent local communities get demoralized when agreed upon rules and regulations are broken and they have no means of enforcing them. Despite the fact that Ontulili and Ngare Ndare CFAs are leaning towards benefit sharing paradigm, members are interested in power sharing which may make them feel that they are truly the forest owners. Therefore, the government should consider changing towards power sharing paradigm of the PFM. This is because the amount of community trust substantially increases when more and more power is transferred to them. It is important for the government to avoid dumping

responsibility of managing forest resource to the local community without empowering them. Coulibaly-Lingani *et al* (2011) noted that meaningful transfer of power to the local people especially to the direct forest users is crucial for participation.

Forest benefit sharing among PFM stakeholders

The CFA members also felt that there was a need for KFS to set lower charges for the CFA members to access forest products and services due to their high participation in forest management and conservation activities. Currently, they were paying the same charges as the non-CFA members and felt that considering their roles there was need to have a difference. More so, they also felt that they not being given a priority in accessing the forest products and services especially where tenders were involved. They proposed that in a case of a product being needed by a non-CFA and CFA, it would be better to give the CFA members a priority because of their active participation in forest conservation activities. The CFA members suggested that the government through KWS should ensure fair compensation for human life and destruction of crops in the farms by elephants and other animals. In this matter, they felt that if one of the community members was attacked and killed by wildlife while in the forest legally either by having paid for access of forest products or by virtue of being a member of a CFA participating in forest patrol or other activities, it is justice to compensate for such lost lives fairly.

They also proposed that the government through KFS and KWS should support the CFA to start ecotourism services in some of the sites in Ontulili forest to enhance income generation for poverty alleviation. More so, the CFAs also felt that there was

need to institute a method of sharing financial benefits from the forest between the KFS and the CFA to motivate them in their participation in forest management. They suggested a percentage could be agreed on for sales of different forest products such as timber and poles and posts to be given to the CFA. Like other forms of decentralization of natural resources, PFM offers great opportunities for increased equity and improved forest management. However, most central governments rarely transfer authority over commercial timber extraction to local communities. The central governments usually delegate administrative responsibilities to the CFAs such as protection of water catchments or conservation areas, rehabilitation of degraded landscapes and management of community forests. They commonly maintain control over forest management through extensive bureaucratic procedures such as forest management plans, price controls, marketing and permits for cutting, transport and processing (CIFOR, 2006).

The CFA and other members of the community living adjacent to Ontulili forest proposed that infrastructures such as tarmac roads, electricity and hospital and school facilities be provided in this community to enhance their standard of living. At the time of the household survey, the roads to the villages were impassable especially during the rains. The community therefore emphasized the need for KFS to enhance their corporate responsibility to the forest adjacent areas through provision of lacking infrastructures such as electricity and improvement of the existing infrastructures such as roads and schools. Coulibaly –Lingani *et al* (2011) noted that active participation of local people could be enhanced if State Forest Service does not limit their participation in decision-making on sharing of benefits from the forest management

activities. It was also noted that all members should agree on distribution of management and village development funds and its use should be assessed strictly.

4.5.4 Changes recommended by KFS foresters and other stakeholders

The forester in-charge of Ontulili indicated that KFS needed to be careful about PELIES. This was because the government through KFS requires 200 hectares to be opened each year but they are not providing the seedlings to be planted in the open land and they are also not meeting the costs for planting. There is need for the government to facilitate planting of trees in every forest area opened under PELIS. It is important for the government to keep pace with the opening of the land. KFS should ensure that forestland allocated under PFM agreement is planted with trees as agreed before opening up new land. It was also noted that politicians should not be allowed to interfere with issues of PELIS.

Concerning the government PFM conditions, the forester indicated that both KFS and CFA members involved in PELIS agreement should meet their obligations. Agreements or protocols need to be developed for all other activities undertaken in the forest including bee keeping, ecotourism and other activities in the forest. The government PFM policies still lack clarity on sharing of benefits from various forest products. Therefore, it is important for the government to put up clear regulations on how KFS should share benefits with the community for forest products intercepted by the community from those getting in to the forest illegally. The KWS community warden (Mr. Mwoka) pointed out that sharing of the benefits between KFS and the CFAs was not clear. He also emphasized that KFS should give a priority to the CFA members when giving tenders for sale of forest products.

The KWS community warden also commented that those participating in PFM activities should be prioritised as pertains to the forest benefits. Prices for access to forest goods and services should be lower for CFA and higher for the Non CFA because CFA members are more involved in forest conservation and management. It was also noted that it is the CFA's responsibility to raise this matter during the development of the Forest management plans. KFS should also provide expert advice to the CFA to be able to attain some of the forest benefits, which require a higher amount of capital such as for forest industries. KFS need also to work together with the CFA to develop forest-based industries and agree on sharing of the benefits. CFA may need to be assisted to develop proposals to source for funding for activities such as ecotourism and the purchase of recreational facilities. There is need for foresters who are in-charge of forests where CFA are operating to be trained on the PFM model and how to implement it successfully.

The forester in charge of Ngare Ndare forest and the CFA manager proposed that issues on revenue sharing between KFS and the CFA be stream lined. There was an idea that KFS should give the community a certain percentage of the revenue collected. Modalities of sharing the benefits need to be put in place because the CFA is incurring a lot of costs in managing the forest on behalf of the KFS. The concession fee to be paid by the CFA was considered to be high hence review was considered necessary. The Lewa conservancy Community development manager (John Kinoti) also consented that KFS was too much profit oriented based on the high Concession fee they had charged Ngare Ndare CFA/Trust. He felt that KFS should focus on the conservation work being done by the CFA instead of putting too stringent rules that can discourage development of other CFAs. He noted that KFS has placed sanctions on Ngare Ndare CFA for unknown gains or benefits not yet attained. He felt that KFS

should work in partnership with the CFA and develop appropriate modalities on sharing all the benefits obtained from the forest. KFS should not treat the CFA as a business intruder but as a partner encouraging communities living adjacent to the forest to participate in forest conservation and reducing pressure on the forest by undertaking forest extension activities. He recommended that KFS should partner with the CFA in creating awareness among community members on protection of the forest against fires which have been rampant due to illegal honey harvesting and charcoal burning activities in the forest. He also advised that KFS should consider using the government annual allocation to build essential infrastructure in the forest. It was further noted that, there is need to reduce pressure on the forest by reducing number of animals grazed in the forest and introducing energy saving cooking stoves. There is also need to complete construction of wildlife corridor in Ngare Ndare forest to reduce destruction of trees by elephants.

The Ngare Ndare CFA manager (Mr Mwambeo) observed that the Non CFA need to be kept off the forest completely and they should only be allowed to access forest products by buying them from the CFA members. The forester recommended that KFS put up houses for the community scouts in each bit to discourage them from working in the bits near their village. Currently only Kisima and Mbuju bits have houses for scouts. To improve forest policing, KFS also needs to put up a house for the forester. He also noted that the trust / CFA was overshadowing KFS in the Ngare Ndare forest hence KFS need to put up boards showing its activities/ roles and that KFS should facilitate the forester and other staff with a vehicle because they are currently depending on the CFA which has its own programmes.

The CFA manager considered the contract between the CFA and KFS to be good but not quite fair to the CFA members. For instance, the CFA is sharing its offices with KFS without charging them but CFA members are being charged for all products obtained from the forest as well as for protecting the forest, which is a responsibility of KFS. He noted that the CFA would mainly benefit from their self-initiated activities. He also considered it important to streamline issues related to community double payment for water to both WARMA and KFS and felt that this was unfair given that it is the community protecting the water catchments. The Lewa Conservancy Community development manager also commented that KFS should not charge CFA members for water leeway per meter and annual fee for using forestland for construction of tanks in the forest while WARMA was on the other side charging for water supply. Reviewing of the rates for accessing forest products for CFA members and non-members in which case rates for members need to be lowered was proposed. Like the CFA members, he emphasized on the need for KFS to play a key role in maintaining the forest roads without leaving the responsibility entirely to the CFA.

CH APTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The first objective of this study was to identify household factors associated with the decision of households to join Community Forest Associations in Ontulili and Ngare Ndare Ndare forests. Factors found to be significantly associated with household decision to join CFA were household size, age, possession of animals, farm size, access to forest products, awareness about PFM under new Forest Act and access to training in forest management aspects. The age of household heads positively determined the household decision to join CFA with likelihood of more aged households joining CFA than the younger ones.

The difference in average farm sizes for CFA and Non-CFA members was not very significant. The major and alternative sources of livelihood for community members in both sites were cash crop growing and livestock keeping respectively. The CFA members owned most of the livestock in both forest sites. Majority of CFA and Non CFA members having livestock had their own farms and government forest as the major sources of fodder. There was significant association between CFA membership and sources of fodder. There were significant differences in the average number of cows and average number of sheep for the CFA and Non CFA members. Therefore number of livestock and sources of fodder are important determinants in household decision to join CFA.

Majority of Ngare Ndare CFA members had secondary school level of education while majority of the Non CFA had upper primary level of education. However, there was no significant relationship between CFA membership and the level of education. Majority of the CFA members in both sites were categorized as in 'rich' and 'poor'

wellbeing categories. In Ngare Ndare, there was only one Non CFA member in very rich category and none of both CFA and Non CFA members was in the 'very poor' wellbeing category.

The second objective was to identify the differences between CFA and Non CFA members in their level of participation in forest conservation activities. A significant relationship between CFA membership and participation in forest conservation was identified where by more CFA members were participating than the Non CFA. More so, there was also a significant association between CFA membership and access to information on the Forest Act 2005, which provides for community participation in forest conservation and management. The major sources of information on the Forest Act 2005 were CFA officials and KFS staff which influenced household decision to join CFA positively. Community members' participation in PFM through joining CFA increased their opportunities for interaction with CFA officials and KFS staff hence motivating them to participate in forest conservation activities. There was a significant relationship between CFA membership and participation in forest patrol, tree planting, fire fighting and tree nursery activities. There was a significant relationship between respondents' awareness of forest conservation activities as CFA operations and their actual participation of CFA members in those identified activities such as tree nursery activities, tree planting and forest patrol. However, participation in fire fighting was by all the CFA members irrespective of whether they recognized this activity as one of their CFA operations or not. This is because fires in the forest are emergencies that call for the attention of all CFA members who recognize the forest as an important resource for the community members.

There were more of the Ontukigo CFA members participating in forest patrol, tree planting and tree nurseries than Ngare Ndare CFA members. PELIS is not practiced in Ngare Ndare forest. Very few of Ngare Ndare CFA members were participating in PFM training. Ontukigo CFA members provided labour directly for PFM activities such as tree nursery establishment and tree planting activities, forest patrol, tree pruning and thinning while Ngare Ndare CFA employed community scouts to undertake patrol and other community members to plant trees in the forest.

The third objective was to assess the relationship between the level of participation of CFA members in PFM and their perceived benefits. The level of participation of CFA members in PFM was positively related to the level of perceived benefits. A high level of perceived benefits encouraged a high level of CFA participation in PFM activities. The level of participation was also influenced positively by farm size whereby high level of participation was observed for CFA members with land ranging from 0.6 to 5 acres. Using the community wealth rank characteristic of farm size, none of the CFA members under the category of very poor (less than 0.5 acres) and of the very rich category (more than 5 acres) were participating in PFM activities at a high level. Majority of the households participating at a high level were headed by males hence nature of household headship influenced the level of CFA members' participation in PFM activities.

The major forest benefits that encouraged high participation in PFM were identified as firewood, grazing, and other income generating activities in both forests and PELIS in Ontulili forest. Other factors motivating CFA members to participate at a high level in PFM include; the need to conserve forest, PFM awareness and being in CFA leadership. Training was influenced positively by CFA membership hence joining

CFA under the PFM process provided the community members with greater opportunities for training. The main types of training accessed by the CFA members included; tree planting and management, tree nursery establishment, training on the PFM process and group organization. Training in forest conservation and management was identified as one of the factors contributing to high level participation of CFA members in forest patrol, fire control, tree nursery activities and tree planting. Planting of trees on the farms was positively influenced by training and the CFA membership status.

The level of CFA participation and their level of perceived PFM benefits influenced tree planting on the farms positively. The female community members irrespective of CFA membership status had a higher average number of trees in their farms than male community members. Tree planting was also influenced positively by the CFA members' perception that tree nursery establishment and tree planting have a significant contribution to their improved livelihood.

The fourth objective of this study was to assess community perceptions on the contribution of CFA to improved forest cover. There was a general observation that population growth over time had affected forest cover. Community members reported to have observed a remarkable improvement in forest condition since formation of the CFAs in both forests sites. Currently, the main challenge in improving forest cover in both Ontulili and Ngare Ndare forests is drought that has been contributing to low survival of trees planted by the CFA members in the forest. Majority of the CFA members indicated that they joined PFM to participate in forest resource conservation; protection and management hence increase forest cover. The foresters in charge of the two forests and Ngare Ndare CFA staff also consented to this by

commending on the role played by the CFA members in conservation of the forests and rehabilitation of degraded forest sites.

Majority of all community members (90%) interviewed in this study irrespective of their CFA membership status perceived an increase in forest cover due to CFA involvement in forest management and conservation under PFM. This increase in forest cover was also attributed to more knowledge on forest management acquired through PFM training and controlled cutting of trees through community policing in the forests. More so, majority of all the Non CFAs (87.5%) interviewed acknowledged the CFA in their neighbourhood as being quite functional in terms of their participation in forest conservation and management. Majority of CFAs participating in forest patrol, fire control, tree nursery activities, tree planting, PFM training and PFM meetings attached these activities a highly important level of contribution to improved forest cover.

There were very few CFA members participating in PELIS in Ontulili forest. PELIS was attached a 'highly important' perception concerning its contribution to improved forest cover through plantation establishment and in enhancing survival of established seedlings through weeding. Therefore, it is important to increase the number of CFA members participating in PELIS due to its vital contribution to improved forest cover. It is also necessary to incorporate technical training on thinning and pruning in PFM training programs for CFA members to enhance appropriate management of trees planted in the PELIS plots and other parts of the forest.

In 2010, Ontukigo members had participated in thinning and pruning of trees in 125 hectares and 70 hectares respectively in Ontulili forest. It also provided 70,000

seedlings for rehabilitation of 100 hectares in Ontulili forest. The Ngare Ndare CFA made an important contribution to the protection of the Ngare Ndare forest by paying 13community scouts to patrol the forest and providing good firefighting equipment used in the forest. The CFA paid for all costs required in planting trees in 10.5 hectares of the forest and undertaking beating up in an area of 10.5 hectares. The CFA also provided seedlings for the beating up and enrichment planting of trees in the forest. The CFA contributed to increased forest cover through other indirect ways such as providing Armory for storage of other important forest equipment, and providing an office to the forester in-charge of the forest and a vehicle for forest patrol among other important things.

The fifth objective of this study was to assess community perceptions on contribution of PFM to improvement of CFA members' livelihoods. Majority of all the community members involved in this study irrespective of their CFA membership status indicated that the economic wellbeing of those participating in PFM through CFA institution had improved due to PFM. Majority of the respondents in Ontulili forest attributed this improvement to PELIS under PFM. It was indicated that PELIS provided adequate food for domestic use and surplus crop for sale hence enhancing food security and generating income for the CFA members participating in it. Majority of Ngare Ndare forest community members associated better economic perception after PFM with financial gains from PFM activities such as IGAs on farm. Other important reasons were outlined as; water availability for domestic use and commercial irrigated farming, knowledge and awareness through PFM training and participation in PFM, access to firewood and fodder, better management of forest, CFA corporate responsibility such as educating children of poor Non CFAs, increased security in the

forest sites, access to loans from trust and community participation helping members access PFM benefits and rights. Most of the CFA respondents attached a level of 'highly important' contribution of firewood, tree nurseries, tree planting, water and PELIS to the improvement of their livelihood. The CFA members perceive a remarkable improvement in their livelihood due to their participation in PFM.

There was a significant positive relationship between CFA membership and access to forest products and services such as firewood, water, and fodder and thatch grass. More so, as the CFA member's homestead distance from the forest increased, the access to forest products decreased. Majority of CFA members obtained their firewood from the government forests. There was significant difference between mean number of fuel wood head loads consumed per week by the CFA and Non CFA members. For all community members, there was a significant correlation between household size and fuel wood consumption per week. As the household size increased, the number of fuel wood head loads consumed increased. Community members accessing firewood from the forest were paying cheaply compared to those getting it from the market. Majority of Ontukigo CFA members using withies were getting it from the forest while for Ngare Ndare CFA members, the main source of withies was their own farms.

Majority of community members recommended for a change in PFM conditions to enhance its contribution to increased forest cover and improved livelihoods. Major changes proposed included; stiffer penalties for forest offenders or those undertaking illegal activities in the forest, more benefits to PFM participants (CFAs), more assistance to communities living adjacent to forests (corporate responsibility),

improving security in the forest and empowering CFAs. It was also proposed that the government should put up an electric fence around the forest to stop elephants from destroying crops in the farms and that high charges be instituted for Non CFA members' access to forest products while also encouraging the CFAs to plant more trees in the forest among other changes.

5.2 Recommendations

Based on this study of CFA and Non CFA members living adjacent to Ontulili and Ngare Ndare forest sites in Timau region, the following recommendations are considered to be vital in enhancing PFM.

- In promoting formation of CFAs, the government should seek ways of encouraging the participation of the youth to enhance sustainability in implementation of PFM activities. They should also focus on households with a great number of members and livestock especially cows and sheep. This is because household sizes and number of livestock are associated with household decision to join CFA. Creating awareness about the new forest Act and its PFM requirement is also important in encouraging households to join CFA hence need to be prioritised at the initial stages of CFA formation.
- CFA membership is associated with more participation in forest conservation and management. Therefore joining CFA as an institution encourages community members living adjacent to the forests to participate in forest conservation activities in the government forests. The government through KFS and other stakeholders should therefore mobilize community members living adjacent to forests to form such institutions for more participation in forest management.

- A high level of participation of CFA members in forest patrol, fire control, tree nursery activities and tree planting was associated with high PFM benefit perception and training. It is important for the government to provide adequate training on all forest conservation and management issues to all CFA members to increase their level of participation in all PFM activities. The government should also assist the CFAs involved in PFM to develop good business plans to enhance income generation from both on-forest and off-forest income generating activities they are engaged in. The contribution of PFM activities to better livelihood is assessed by the forest communities on the basis of the few benefits the CFAs have been receiving since they joined PFM and those benefits expected in the future. Therefore, the government should work closely with the CFAs to seek ways of sustaining income generation from PFM because such benefits whether financial or in kind, they act as incentives to community participation in PFM activities.
- Increase in forest cover was associated with CFAs participation in forest conservation and management in PFM by both CFA and Non CFA members. The government should perfect the PFM process to enhance CFA participation in forest conservation and management because this has a high potential in improving forest cover. When assessing the roles of CFAs in forest conservation and management, the Non CFAs should be involved because they highly value the forests and their views can contribute immensely to improvement of CFA roles in PFM.
- PELIS was considered to be having a highly important level of contribution to improved forest cover in the government forests and to improved livelihoods for the Ontulili CFA members involved. An intensive analysis of the environmental impacts of PELIS in the plantation forests and its impacts on the

livelihood/economic wellbeing of the forest adjacent communities should be undertaken. The output of such a study should be used to decide on whether to formalise the use of PELIS in plantation establishment in government forests through CFAs.

- For a better understanding of PFM contribution to improved forest cover and improved livelihoods of the community members involved, it is important that baseline survey be done before starting PFM in any forest. This will provide socio-economic data for comparative analysis.
- Improving community livelihoods through PFM will require the government to assist the communities to develop appropriate market oriented strategies for management of tree nurseries and trees planted on farm. It is also important to enhance participation in forest activities geared towards protecting water catchments. This is because water is a very important forest product which is not only a basic need for life but it has a great potential to contribute to improved community livelihood through irrigated commercial farming.
- Ontulili and Ngare Ndare forests are the main source of firewood for the communities living adjacent to them. It important to reduce pressure on the two forests by increasing establishment of fast growing fuel wood species in the farms of both CFA and Non CFA members. It will also be important to introduce energy saving cooking stoves to reduce waste of wood due to poor utilization as well as introducing new sources of energy for domestic use such as solar stoves for further reduction of pressure on the forests. Assessment of the impact of firewood collection on the forest cover and health among other environmental impacts is also important.

- Ngare Ndare and Ontulili forests have a great potential for enhancing community livelihood through ecotourism. Therefore, the Ontukigo and Ngare Ndare CFAs require partnerships to exploit the vast ecotourism potentials of the two forests. Bee keeping is an important PFM benefit for the two forest communities hence it is important to train majority of the community members about it and promote its adoption.
- Based on the changes recommended by the forest adjacent community members, it is important for the government to address carefully the issues of forest product access by both CFAs and non-CFAs. The CFAs felt that paying the same fee to access forest products as paid by the Non CFA was not fair given that the CFAs are more involved in management and conservation to increase forest cover and improve forest condition. Currently, the CFAs have no power to arrest forest offenders and take them to court hence feel incapacitated to protect the forest appropriately, a challenge that should be addressed. Modalities for sharing forest benefits and forest management costs between KFS and the CFAs should be developed to enhance and sustain PFM.

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APPENDICES

Appendix 1: Interview Schedule

KFS and KWS staff in Ontulili and Ngare Ndare forests

Key Informant	Number
Zonal Manager	1
Forester in-charge of forest station	2
KWS	1
CFA staff (If any)	2
Other stakeholders	1
Total	**6**

Interview Guide

Name of officer..... Sex.....

Name of Organization/CFA.....

Position in the organization.....

Forest block.....

District.....Division.....

1. How many CFAs are in this forest site?
2. What is their current status? Are they all registered?
3. Are the CFA(s) functional?
4. What interests and needs motivated the community members to form CFA?
5. How are the organizational structures of these CFAs?
6. What CFA institutional structures have contributed to success or failure in attaining PFM objectives in this forest site?
7. Do you have forest user groups within the CFAs?
8. What activities are forest user groups responsible for in the forest?
9. What are the general activities of all CFA members in the forest sites?
10. Under what conditions has your institution allowed the CFAs to participate in forest resource management?
11. Are the CFA(s) meeting those conditions?
12. If not, what are the hindrances either related to the CFA organizational structure, the government legal demands placed on them or other factors?
13. Have the CFAs activities/operations contributed to better forest management in the allocated site? If yes or no explain why?

14. How many acres of the forest are they managing/conserving/protecting?
15. How many trees have they planted and what are the species planted?
16. What are your roles in enhancing CFAs participation in forest management?
17. What opportunities and challenges are you encountering in playing your roles in PFM implementation?
18. Are there any conflicts between your organization and the CFA/forest user group members? If yes, what are the sources of conflicts and how are the conflicts resolved?
19. What are the main sources of livelihood among the community members living adjacent to the forest?
20. What PFM activities and operations have contributed to livelihood improvement among these community members? (PELIES SYSTEM, Ecotourism, firewood collection, grazing and fodder collection etc). Are there any economic gains from these activities?
21. What are your perceptions concerning the fairness of the deal / contract between your organization (e.g. KFS/KWS) and the CFAs? Are the interests of both being met?
22. What would you recommend concerning the government legal system/conditions as well as the CFA organizational structure in order to enhance the contribution of PFM to improved forest management and improvement of livelihoods of the CFAs members and other FAC members (government legal requirements)?

Appendix 2: Participatory Rural Appraisal with community members

PRA tools used include historical timeline, focussed group discussions and wealth ranking. These tools provided understanding of the local perceptions on their forest resources and changes over time. CFAs activities in the forests were identified and key forest resources in the study sites recorded. Improvements made by CFAs on the forests through PFM and the prevailing opportunities and challenges faced by CFAs in their effort to implement PFM will were documented. PRA was carried out with at

least 10 members of the community both CFA and non-CFA members in each forest site.

Historical time line analysis checklist

Through historical time line tool the group presented a historical analysis of the patterns and changes that have taken place in the forest natural resource use in the past 20 years. They were able to describe how these changes have impacted on their livelihoods and the environment.

The historical time line was supplemented by focused group discussion. In a mixed group of old men and women, changes in management of forest resource in the past 20 years were discussed.

1. What is the structure and nature of forest resources within the community?
2. What changes have taken place with regard to forest resources in this area in the past 20 years?
3. What major changes did you observe in terms of forests, water and agricultural production (e.g., land use change, invasion of forests, expansion of cropping, rangeland rehabilitation)? What were the influencing factors (e.g. human population growth, new infrastructure, policy changes)? What were the key innovations and who were the actors involved?
4. What has happened to people's access to forest resources (grass, pods, timber, poles, posts, fitos etc) since the introduction of PFM in this forest site?
5. What in terms of livelihood activities and land use do you consider to have got better or what got worse?
6. How would like to see the situation in 10 years time and how would you achieve this vision as a community?

Focussed Group discussion: CFA and other stake holders' activities Checklist

1. Apart from CFAs who are the other key stakeholders in the PFM process?
2. What roles does each stakeholder play in the PFM process
3. How can you rank the stakeholders in order of their level of contribution to forest management in the area?

4. Which organizations support the CFAs and how can you rank them in order of their level of support?
5. What are the interests and needs of other CFA partners and stakeholders?
6. Are these interests being met?
7. How do you relate with other stakeholders? Are there any conflicts? If conflicts are there, how are they being resolved?
8. What should the other stakeholders including KFS / government do to ensure that these PFM objectives are attained?
9. How would you assess your level of participation and contribution to forest management as a CFA in the forest management process in the following aspects?
10. What benefits do you gain by participating in PFM in this forest?
11. How do you share the benefits among the CFA members and among other stakeholders?
12. What benefits go to men and what benefits go to women?

Appendix 3: Household survey questionnaire

Questionnaire No. ..... Date.....

District.....Division.....

Location.....Sub location.....

Household Biographic data

1. Name (optional) of respondent: .....
2. Sex of respondent (1) Male (2) Female
3. Nature of household headship (Tick)
   (1) Male headed (2) Female headed (3) Single parent
4. Age of respondent.

Age range	**Actual age**
21-29	
30-39	
40-49	
50 yrs and over	

5. Level of education of respondent (1) Lower primary (2) Upper primary (3) Secondary school (4) Tertiary (5) Others (Specify.....)
6. Household size

Household Members	**Male**	**Female**	**Total No.**
Active members			
Inactive members			

7. Wellbeing category as perceived by interviewer: (1) Very Rich (2) Rich (3) Poor (4) Very Poor
8. Forest station adjacent to the homestead.....
9. Distance of homestead from the forest.....

Distance range (KM)	**Actual distance**
0-0.5	
0.6 -1	
1.1 -2	
2.1- 3	
3.1-4	
4.1 - 5	
Over 5	

Socio-economic data

10. Type of house (1) Temporary house (2) Semi-permanent (3) Permanent
11. Major source of livelihood (1) Cash crop growing (2) Livestock keeping (3) Selling timber/poles/posts/firewood/medicinal plants (4) Other businesses
12. Alternative source of income (1) Cash crop growing (2) Livestock keeping (3) Selling timber/poles/posts/firewood/medicinal plants (4) Other businesses
13. Food and Cash Crops grown.

Food crops	Prioritisation (1-First, 2-Second, 3-Third, 4-Fourth, Fifth)	Cash crops	Prioritisation (1-First, 2-Second, 3-Third, 4-Fourth, Fifth)
Maize		Wheat	
Beans		Coffee	
Potatoes		Tea	
Bananas		Arrow roots	
Arrow roots		Bananas	

14. Place where they are grown

(1) Own Farm (2) government forest (3) Rented farm (4) Others (specify.....)

15. Types and number of Livestock /poultry

Type of livestock	Number	Source of feed/fodder

Land tenure and land use issues

16. Total Farm size (include grazing area) (1) 0.1 - 0.5 acres (2) 0.6- 1 acres (3) 1.1-2acres

(4) 2.1-5acres (5) above 5 acres.

17. What type of land do you have access to (land tenure system)? (1) Communal (2) Title deed land (3) Free hold land (4) Squatter (5) Others (Specify).

18. How did you acquire access to this land? (1) Inherited (2) Purchased (3) Given free (4) Forest land allocated by KFS (5) Others (Specify).....

19. Which year did the household acquire access to this land? .....

20. What do you use this land for? Proportion of land used for different activities

Land use	Land size
Cash crop production	
Food crop production	
Grazing/fodder	
Tree growing	
Horticulture (vegetables and fruits)	

PFM and other Forest issues

21. Are you a member of any CBO/self-help group? (Tick)

(1) Yes (2) No

22. If yes give the name of the group.....

23. If not a member, explain why.....

.....

24. For how long have you been a member of that SHG/CBO?

.....

25. Why did you join the SHG/CBO?

.....

(1) To assist each other financially.....

(2) To assist each other through labour provision.

(3) To buy household items for each other

(4) Others (Specify .....)

26. What activities does your SHG/CBO undertake? .....

(1) Merry-go round

(2) Tree planting and environmental conservation activities

(3) Tree nursery activities

(4) Others: specify.....

27. Are you aware of the provision for community participation in management of government in Forest Act 2005 through formation of CFAs? (1) Yes (2) No

28. If yes, what was the source of information on this matter? (1) KFS (2) CFA officials (3) Others (specify.....)

29. If, no give reasons. .....

30. What information do you have about PFM as emphasized in forest Act 2005?

(1) Community are allowed to participate in forest management (1) Yes (2) No

(2) Formation of CFAs for forest management (1) Yes (2) No

(3) Income generating activities in the forest (1) Yes (2) No

(4) Community rowing specific crops in the forest (1) Yes (2) No

(5) Community tree nursery and tree planting activities in the forest (1) Yes (2) No

(6) Community Forest patrol (1) Yes (2) No

(7) Community Forest protection (1) Yes (2) No

(8) Others (Specify.....) (1) Yes (2) No

(31) Is your CBO/ SHG a member of CFA involved in PFM activities? (1) Yes (2) No

(32) If yes why did you join this particular CBO or CFA involved in PFM?

(1) To access forest products for domestic use (1) Yes (2) No

(2) To access forest products for commercial use (1) Yes (2) No

(3) To access water (1) Yes (2) No

(4) To grow crops in the farm under PELIES system (1) Yes (2) No

(5) To be allowed to undertake in income generating activities in the forest (1) Yes (2) No

(6) To participate in forest resource conservation, protection and management (1) Yes (2) No

(7) Others (Specify.....) (1) Yes (2) No

(33) What are the operations or activities of your CFA in relation to participatory forest management?

(1) Forest patrol /protection (1) Yes (2) No

(2) Forest fire control (1) Yes (2) No

(3) Tree nursery activities (1) Yes (2) No

(4) Tree planting activities (1) Yes (2) No

(5) PFM training (1) Yes (2) No

(6) PFM meetings) (1) Yes (2) No

(7) Tour guiding (1) Yes (2) No

(8) Others-Specify.....) (1) Yes (2) No

(34) How can you rate your level of participation in the above PFM activities?

PFM activity	Level of participation (1) No participation (2) Low level (3) Medium (4) High level	Does activity contribute to improved forest cover and forest management (1) Yes (2) No	How does this activity contribute to improved forest cover and improved forest management?
1. Forest patrol			
2. Forest fire control			
3. Tree nursery activities			
4. Tree planting activities in the			

forest			
5. PFM trainings			
6. PFM meetings			
7. Tour guiding			
8. Others (Specify .....)			

(35) How significant is the contribution of each of the CFA operations to improved forest management and forest cover?

PFM activity	Level of significance of CFA operations' contribution to improved forest cover (1) Not significant at all (2) Moderately significant (3) Highly significant	What are the reasons for your level significance?	Size of forest protected/number of trees planted	Financial gain/ benefit in kind for participating in the activity
1 Forest patrol				
2 Forest fire control				
3 Tree nursery activities				

4 Tree planting activities in the forest				
5 PFM trainings				
6 PFM meetings				
7 Tour guiding				
8 Others (Specify ..)				

(36) How do you compare the state of forest management before PFM and after PFM introduction?

PFM Activities	Forest management Before PFM	Reason for perception	Forest management After PFM	Reason for perception
1 Forest patrol	1. Better 2. Poor 3. No change		1. Better 2. Poor 3. No change	
2 Forest fire control				
3 Tree nursery activities				
4 Tree planting activities in the forest				
5 PFM				

trainings				
6 PFM meetings				
7 Tree pruning and thinning				
8 Others (Specify .)				

(37) How do you compare the state of forest cover before PFM and after PFM introduction?

Forest cover Before PFM 1. Increased 2. Decreased 3. No change	Reason for perception	Forest cover After PFM 1. Increased 2. Decreased 3. No change	Reason for perception	Estimate increase in forest cover (Acres of trees planted per year after PFM

(38) As a member of this community, do you have access to the forest products and services from the government forest? (1) Yes (2) No

(39) Under what conditions do you access the above goods and services from the government forest?

(1) Pay a specific fee (KSH.....)

(2) Be a member of CFA/Forest User group (3) others (Specify .....)

(40) If you don't access forest products and services from the government forest, explain why. (1) Has trees in own farm (2) Too far from the government forest

(3) Not a CFA /forest user group member

(4) Too old/physically challenged to access the government forest

(5) Cannot afford the fees charged to access the government forest products

(41) How do you perceive your access to forest goods and services before and after PFM?

Forest good/services accessed	Before PFM 1. More accessible 2. Less accessible 3. No access at all	Reason for perception	After PFM 1. More accessible 2. Less accessible 3. No access at all	Reason for perception
Fire wood				
Herbs				
Thatch Grass				
Water				
Fodder				
Herbs				

(42) How do you perceive the relationship between the level of participation and the perceived benefits?

Level of participation in PFM 1. High 2. Low 3. No participation	Level of perceived benefits 1. No change 2. Low benefits 3. High benefits	Key indicators of level of perceived benefits

(43) What factors determine the level of participation?

Level of participation	Factors contributing (1-Perceived benefits, 2-leadership position 3-awareness about PFM, Others specify.....
High	
Low	
No participation	

(44) How do you perceive change in your economic wellbeing before and after PFM introduction?

Economic wellbeing Before PFM 1. Better 2. Worse 3. No change	Reason for perception	Economic wellbeing After PFM 1. Better 2. Worse 3. No change	Reason for perception

(45) What PFM benefits have contributed to better livelihood for you?

PFM benefits	Level of contribution to better livelihood (1) Not significant (2) Highly significant	Estimate level of contribution in KSH per month	Reason
Tree nurseries		(Number of seedlings and price)	
Tree planting			
Fire wood			
Fodder/grazing			
PELIES/Shamba			

system			
Tour guiding fees			
Water from forest			
Honey from forest			
Timber/poles/posts			
Others Specify.....			

(46) What are the government legal conditions under which your CFA/CBO is participating in forest management currently?

.....

(47) Are these government legal conditions adequate for effective implementation of PFM? (1) Yes (2) No

(48) If yes, which conditions encourage you to participate in the PFM process?.....

.....

(49) If no, what changes do you recommend for improving PFM implementation by CFAs? .....

(50) If not a member of a CFA, are you aware of any CBO/CFA involved in PFM in your neighbourhood? (1) Yes (2) No

(51) Mention the name if known.....

(52) Are these organizations functional in forest management? (1) Yes (2) No

(53) In what ways are these organizations contributing to forest conservation?

.....

(54) Is the government forest important to you even though you are a non-CFA member? (1) Yes (2) No

(55) If yes, explain why it is important to you? (1) It provides forest products for domestic use (2) It provides forest products for commercial use (3) It protects water catchment (4) It provides opportunity for participating in income generating activities (5) Others Specify.....)

(3) If no, give reasons. (1) Household far from the forest (2) Forest is not legally accessible (3) Household has adequate trees on-farm (4) (Others- Specify .....)

(56) What are your sources of the following non- wood forest products?

Product	Source	Consumption per week (head loads/pile/grams	Unit Price/fee paid if purchased (KSH)
Fire wood			
Medicinal herbs			
Fodder			
Thatching grass			
Honey			
Other (Specify)			

(57) If there are any cultural and social uses of the forest adjacent to your household, mention them. (1) Traditional circumcision ceremonies. (2) Traditional wedding ceremonies

(3) Traditional worship (4) Modern worship (5) others specify.....

(58) What amounts of the following timber forest products do you consume per year and what are the sources?

Product	Source (1(Own farm (2) Government forest (3) Neighbours farm (4) Purchase hard ware	Consumption per year	Unit Price if purchased (KSH)
Poles			
Posts			
Timber			
Fitos			

(59) Does the forest adjacent to you help you respond to shocks? (1) Yes (2) No

(60) If yes, explain how.....

(61) Tree species planted in the farm and compound and their uses

Tree species planted	No. of trees	Place planted (crop land, boundary, grazing land, homestead compound etc)	Uses (Fire wood, timber, Poles, medicinal herbs	Money obtained if ever sold

(62) Have you been trained on any issues related to forest management and conservation? (1) Yes (2) No

(63) If yes specify issues trained on and the organization involved.

Type of training	Organization involved	Actions taken after training

Type of training: Tree planting and management ((1), Tree nursery establishment and management (2), PFM process (3), Group organization and management (4), Dairy farming (5), Soil conservation (6), Crop protection(7) , Others (Specify .....(8)

Organisation involved: KFS (1), KEFRI (2), KWS(3), NEMA (4), Ministry of Culture and Social Services (5), Others (Specify .....(6)

Action taken after training: Tree planting done (1), Group or individual Nursery established (2), Increased participation in PFM (3), Joined PFM (4), Practicing Dairy farming (5), Soil conservation structures constructed in own farm (6), Crop protection practiced (7), Others (Specify .....(8)

Appendix 4: Work Plan

Activity	Time frame
Consultations on research methods, statistics &Proposal editing	August to Dec 2009
Questionnaire/checklist development and Secondary data collection	December 2009
Proposal Presentation at department level (KU)	December 2009
Correction of proposal and consultation with Supervisors	Jan to May 2010
Data Collection (PRAs with Ontukigo and Ngare Ndare CFAs, Interview schedule and household survey)	May 2010, November 2010- March 2011
Data entry and analysis	March to April 2011
Report/Thesis writing	May to June 2011
Submission of 1st and 2nd Thesis Draft to Supervisors and correction	July to December 2011
Submission of Thesis Draft for examination	January 2012
Defence	September 2012
Submission of final thesis	September 2012
Graduation	December 2012