SOCIO-ECONOMIC GAINS FROM PARTICIPATORY FOREST MANAGEMENT AND THEIR INFLUENCE ON REDD IMPLEMENTATION IN IRINGA DISTRICT

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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This study was conducted to assess the potentials of forests under PFM to local communities and their influence on management of the REDD initiative in Iringa District. Specifically, it aimed at assessing the community members' access to different forest products and analyzing contribution of the resource to total household income. Data from 120 households were collected in four villages of Itagutwa, Kiwele, Kitapilimwa and Mfyome in Kalenga Division. Purposeful and random sampling techniques were used to select the forests and households respectively, where their information was captured by structured questionnaire and key informant interview. Descriptive statistics and Gini coefficients were used to analyze the collected data. Results show that forests contributes about 12.4% of household income and more than 97% of household use forest resource mainly as a source of energy and building poles. No household confirmed to depend on forest as the only source of income rather they involve themselves in other activities like farming, livestock keeping, business and wage laborers. Households use and harvest forests products differently, those who are considered to be wealth are able to harvest and process timber and non timber products while the poor only depend on it as a source of subsistent foods and medicine. It has been also found that women earn less compared to men from forest resource because more income comes from honey, timber and charcoal activities that are largely undertaken by men. The study concludes that that the existing type of forest management has not been efficient and equidistributional enough to serve as a motivation for REDD implementation, coming into the recommendation that more awareness is needed to the households to be well informed about REDD requirements and what it entails.
DECLARATION

I, Peniel John Titus, do hereby declare to the Senate of Sokoine University of Agriculture, that this dissertation is my original work and that it has neither been submitted nor being concurrently submitted for degree award to any other institution.

Peniel John Titus
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The above declaration is confirmed

Dr. F. T. Kilima
(Supervisor)
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DEDICATION

This work is dedicated to God the almighty for his faithfulness. To my family for their well wishes throughout the period of my study.
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LIST OF ABBREVIATIONS

CBFM  Community Based Forest Management
CCIAM  Climate Change Impacts, Adaptation and Mitigation
CO₂  Carbon Dioxide gas
DANIDA  Danish International Development Assistance
DFO  District Forest Office
DLNREO  District Lands, Natural Resources and Environment office
FBD  Forest and Beekeeping Division
GDP  Gross Domestic product
GHGs  Green House Gases
JFM  Joint Forest Management
MEMA  Matumizi Endelevu ya Misitu ya Asili
NGOs  Non-Government Organizations
NTFPs  Non Timber Forest Products
PFM  Participatory Forest Management
REDD  Reduced Emission from Deforestation and forest Degradation
TZS  Tanzanian Shillings
UNCED  United Nations Conference on Environment and Development
URT  United Republic of Tanzania
VFMA  Village Forest Management Area
VLFR  Village Land Forest Reserve
VNRC  Village Natural Resource Committee
CHAPTER ONE
INTRODUCTION

1.1 Background Information

Recent global climate change campaigns have enhanced our understanding of the fundamental issues involved in forest management. The environmental conservation and climate programme provide management tools, advice and knowledge to reduce emissions of greenhouse gases from deforestation and forest degradation (Kajembe et al., 2011).

The threat of deforestation is widely recognized to be a major constraint to the efforts aiming at reducing CO$_2$ gas in the air hence combating global warming. Notwithstanding their contribution to the economy, Tanzania’s forests face enormous challenges, deforestation being the biggest (Blomley and Ramadhani, 2006). According to FAO (2009) deforestation is more severe in unreserved than reserved forests. Tanzania is reported to be among the countries with the largest forest loss per year in Africa. The rate of deforestation is estimated to range between 100 000 to 500 000 hectares per annum. Tanzania contributes higher CO$_2$ emissions per annum through deforestation (77 903 442 tones) and forest degradation (48 492 402 tones), amounting to a total of 126 395 843 tons of CO$_2$ emissions per year (Kajembe et al., 2011) and on occasions substantially more, making it appropriate for its inclusion in the international REDD mechanism. REDD stands for Reduced Emissions from Deforestation and Forest Degradation and is a form of payment for environmental services and has the potential to not only help address climate change by reducing greenhouse gas emissions, but also make a positive impact on forest management, biodiversity and sustainable development, including poverty reduction (URT, 2009). It is obvious that when considering the local levels, adjacent communities in the forests are expected to play a significant role in the implementation of REDD, given
the enormous socio-economic advantages expected from Participatory Forest Management (PFM), an approach that underscores empowering local communities in managing nearby forests (Mbwambo and Nshubemuki, 2009).

Recent global trends in forest management have focused on the devolution of forest tenure and management of state authorities to local communities through community based approaches to securing and managing forests, generally referred to as PFM (Vyamana, 2008a). The PFM became a central strategy to ensure sustainable management and conservation of Tanzania’s forests since the 1990s. Tanzania forest policy (URT, 1998) and Legislation (URT, 2002) recognizes two forms of PFM which are Community Based Forest Management (CBFM) and Joint Forest Management (JFM). These forms differ in terms of forest ownership and cost-benefit flows. Community Based Forest Management takes place in the village or private land, and trees are owned and managed by village government through Village Natural Resources Committees (VNRC), a group or an individual. In this case the owner incurs most of the cost and reaps most of the benefits related to forest management and utilization. On the other hand JFM takes place on reserve land that is owned and managed by either central or local government. Villagers typically enter into management agreements to share responsibilities for the management with the forest owner.

There are three stated policy objectives of PFM in Tanzania which include: Improved forest quality through sustainable management practices; improved livelihoods through increased forest revenues and secured supply of subsistence forest products; and improved forest governance at the village and district levels through effective and accountable natural resource management institutions (URT, 2003). In addition to improving the overall management of forests in Tanzania, the main goal and focus of PFM has been to
improve the livelihoods and wellbeing of poor rural communities who live close to, or inside forests and woodland areas; and these are the stated PFM beneficiaries. It is from these objectives that REDD initiative builds on.

In Tanzania, forest interest groups’ including international development institutions present in the country, have been engaged in REDD through development framework and the implementation and evaluation of a range of pilot projects (Peter, 2011). The Climate Change Impacts, Adaptation and Mitigation programme in Tanzania (CCIAM) has a total of 12 projects approved to work in REDD pilot areas in the year 2010/14. Also attempts are underway to shape the REDD agenda to suit Tanzanian conditions in terms of the nature of its forests and forest management systems. This initiative has potential to support the forestry sector and to leverage benefits of individual, community and global levels.

1.2 The Importance of Linking PFM and REDD

According to Schmidt (2009), deforestation is mainly driven by economic system, which in turn, is linked to global and national policy frameworks. Deforestation is mainly driven by agricultural expansion, wood extraction and infrastructural development. Agricultural expansion, the main source of deforestation, and wood extraction are driven by consumption of products whose production and fabrication require forests to be harvested or forest land to be cleared. Logging, both legal and illegal, is the principal driver of forest degradation and indirectly a driver of deforestation. Additionally, lack of secured land-tenure rights or property rights facilitate exploitation of forests, as there is little incentive for sustainable forest management. Apart from these main sources of deforestation, fuel-wood extractions are other sources of deforestation and forest degradation. The main drivers are poverty (itself a result of other factors), demographic development and a growing urban population (FAO, 2007).
Given the policy objectives of PFM, it is evident that deforestation must be addressed by changing or enforcing policy frameworks that reduce deforestation. When managed effectively this strategy can significantly reduce deforestation and emissions of GHGs (URT, 2009). The strategy can also contribute to environmental goods and service through conservation of water sources and biodiversity as well as reducing of carbon stock.

In Tanzania, PFM is increasingly being seen as a foundation for developing a national REDD Programme (TFCG, 2009b). Bringing about these changes will require embedding REDD into overall development planning. In summary, REDD as a catalyst in developing and implementing a more sustainable development model, it requires synergies with others, sometimes closely linked, development goals such as biodiversity conservation and poverty alleviation. It is increasingly recognized that REDD should be relevant to both people (impacts on livelihoods) and forests (reducing emissions of GHG from deforestation). Unless the local (forest-adjacent) communities realize benefits such as the improved livelihoods, the long-term viability of PFM and REDD is questionable. Thus PFM is a REDD – related initiative (URT, 2009).

1.3 Problem Statement and Justification

The REDD initiatives that are being discussed within international climate negotiations; propose to pay developing countries for the carbon value of their forests. It is believed that these payments could shift the balance away from the economic incentives currently favouring deforestation, thus making sustainable forest management a more profitable alternative. However, issues surrounding the design and implementation of such a mechanism are complicated and contentious. Among several outstanding questions is the issue of distribution of benefits within the community to generate incentive among actors to participate and realize meaningful emission reductions. According to Blomley and Iddi
(2009), forest resources play a fundamental role in the economy and peoples’ livelihoods in Tanzania. Despite this potential been confirmed by the few studies conducted in Tanzania (Hamza et al., 2007; Vyamana, 2008a and Malemi, 2008), little is known about the intra community equity, i.e. the proportion of benefits that go to different categories of community members, especially the intended poor. This study intends to examine the benefits accruing to each group given that different wealth classes in the villages under PFM are likely to embark on REDD.

The study also intends to establish whether the benefits are shared equally between men and women to be significant enough for the management of REDD initiative. Therefore, unless preventive measures are taken there is a risk of the poorer members of a given community losing out from the direct benefits of PFM and hence REDD. This study was conducted in an area where the REDD initiatives are piloted and was expected to inform policy, whether the target communities will benefit from this intervention. The study also identified critical issues for successful implementation of the REDD initiatives.

1.4 Objectives of the Study

1.4.1 Main objective

The general objective of this study was to assess the income potentials of forests under PFM to local communities and their influence on management of REDD initiative

1.4.2 Specific objectives

Specific objectives of this study were:

i. To assess community members’ access to different forest products;

ii. To identify the contribution of forest under PFM to total household income, and;

iii. To determine the effect of income from different sources on income distribution.
1.4.3 Hypothesis of the study

This study attempted to test the maintained hypothesis that all community members have equal access to forest products and have equal chances to derive benefits from the PFM approach upon which the REDD initiatives rely.
CHAPTER TWO
LITERATURE REVIEW

2.1 Forests and Livelihood

Forests are important for a country, region or person because they provide benefits such as environmental amelioration, water and soil conservation, fodder, outdoor recreation and income from sales or use of timber products (Nautiyal, 1988). Economists have traditionally established the impact of forests on economic welfare by incorporating easily quantifiable values, which include benefits accrued from forest marketing and values from industrial activities. It is generally noted that forest resources, support both the national and local livelihoods. At the national level, plantation forestry is the main source of industrial forest materials, including telecommunication posts, logs for timber, paper products, wood based panels and poles. At the local level, communities depend on forests to meet a wide range of domestic needs, including fuel wood, poles/posts, medicines and wild game.

According to (FAO, 2002) land, water, livestock, and forests remain the main sources of livelihood that are available to the rural poor. The livelihoods of most rural communities depend in part on forest products such as poles, fuel wood, fodder\(^1\), timber and non-timber forest products. Most families depend on agriculture as the main source of income. However, with diversified income portfolios they are often involved in more than one principal activity. In general, forest-based activities are part of a household's income. The income earned from forest-based activities may contribute to a household's food supply situation in several ways: most directly, it provides cash for food purchases. It may further provide savings for investment in agricultural assets (e.g. Livestock) or inputs, e.g. seeds.

\(^1\) In many countries cattle are often allowed to graze in the forests (Skutsch 2010).
In many rural community farmers cannot produce enough to be food self-sufficient all year-round. A report by URT (1985) shows that only 17% of the population could grow all the maize they consume. Households need to earn cash income from formal or informal sources of income to buy other foods and life necessities. Many households' income generating strategies are limited by scarce resources (e.g. land) thus farming alone does not provide sufficient means of survival (Ellis, 2000). Most rural households rely on diversity activities and income sources in order to survive and to improve their standard of living. According to FBD report (2000), Tanzania forests and forest resources play an important role in supplementing and diversifying farm incomes. It is estimated that more than 90 percent of the population uses biomass energy for cooking and heating. Forests and woodlands also provide various non-wood products, such as fruits, nuts, medicinal plants, honey, beeswax, tannins and gum arabic. In addition, a number of rivers rise in the forests in the Eastern Arc Mountains. Among these are the Pangani and Ruaha rivers, which supply water for hydroelectricity.

2.2 Forest Products

2.2.1 Timber products

Forests provide watershed protection, wildlife habitat, recreation and wood products. Timber harvesting provides useful materials demanded by society, jobs for communities who are employed in the primary and secondary manufacturing and income from sale of timber and timber products (Tormoehlen et al., 2000). Trees absorb CO$_2$ from the atmosphere and store in the form of timber. In natural forests, trees mature, become senile fall and decay. The process of decomposition results in wood being converted back to CO$_2$. Foresters can intervene in this natural pattern in two ways. First, they can improve the rate at which CO$_2$ is absorbed by increasing the growth rate of the crop. Secondly, they can reduce the amount of CO$_2$ eventually returned to the atmosphere by removing wood in
the form of timber. Furthermore, by ensuring that the timber is put in long lived uses, such as furniture or construction timber they can help to extend the time the carbon is stored well beyond the natural life of the tree crop. Recently, timber business is highly growing; records show that Tanzania, Gabon, the Democratic Republic of Congo, and Mozambique are the major African suppliers of timber to China (Munishi et al., 2009).

2.2.2 Non timber forest products
Non timber forest products (NTFPs) are goods of biological origin, derived from forests, woodlands and trees outside forests (Munishi et al., 2009). These products play a crucial role in the daily life and welfare of people all over the world. The products encompass a wide range of food, fodder, fibres, fertilizers, organic construction materials, non-wood lignocelluloses products, natural dyes, tannins, gums, resins, latex and other exudates, waxes, essential oils, spices, edible oils, medicinal extracts, phyto-chemicals, aroma chemicals, decorative articles, horns, bones, pelts, plumes, hides, and skins. Many of these products are referred to as “extractive”, “secondary” and “minor” forest products (Hamza, 1997).

Wood fuels provide income for many people through its sale/trade. It is argued that many of the landless and very poor people harvest and sell wood as fuel. Wood fuel retailing is a major source of income for the poor and can be one of the main sources of income from forests (Anorld and Persson, 2003). Charcoal which has high energy content and is relatively more portability than wood can be an important income for producers and employment opportunity for many (Kantai, 2002). Poor households rely on wood as their energy source. In developing countries alone, some 2.4 billion people (more than a third of the world population) rely on wood or other biomass fuels for cooking and heating (IEA, 2002). For example, nearly all rural households in Tanzania, Kenya, Mozambique and
Malawi use wood for cooking, and over 90% of urban households in these countries use charcoal sourced from the countryside (Kantai, 2002).

2.3 Community Participation in Natural Resource Management

According to Campbell *et al.* (2002), the meaning of participation ranges from the almost complete outside control, with the involvement of local people, to a form of collective action in which local people set and implement their own agenda without being influenced by outsiders such as conservators and facilitators. Thus, maintaining forests as a group property by local and indigenous communities and allowing them to participate in its management or control is pre-requisite to the sustainability of forests (Chiumia, 2003).

Participation has had its roots from the international legal instruments such as the 1986 United Nations General Assembly which declared public participation in forest management a central development objective. The Rio Declaration of the United Nations Conference on Environment and Development (UNCED) in its tenth principle, states that environmental issues are best handled with the participation of all concerned citizens at the relevant levels. It calls for states to facilitate and encourage public awareness and participation by making information widely available. Pretty (1995), highlighted seven categories/forms of participation along a gradient of community involvement and empowerment as follows; a) passive participation, b) participation in giving information, c) Participation in consultation, d) participation for material incentives, e) functional participation f) interactive participation and g) self-mobilization. At the least participatory end of the spectrum, people are merely informed and do not contribute information or views. At the most participatory end, participation is self-initiated. He further suggests that to avoid confusion in the use of the term participation, reference should always be made to
the type of participation as most types threaten rather than support the goals of sustainable development.

2.4 The Need to Promote Community Forest Management

Local people with established patterns of forest use are a key to sustainability if they are organized into effective communities. This organization empowers them to be most appropriate managers and regulators of forest uses (Ascher, 1995). Ascher (1995), also argues that control over forest uses by a well-defined group of people with user rights, would retain exclusive use of the resource and this may lead to implementation of sustainable practices. Moreover, traditional forest users living in or near the forest site have an interest in the long term sustainability of that forest as long as they know that they can continue to reap the benefits of the forest. If governments permit local forest users to police the forest, then effective regulation can emerge because people with strong interest in preventing others from abusing the forest will devise effective regulations to guide the uses of such forest. Community forestry can improve the well-being of low income people, but more importantly, it can create and maintain a system of forest practices that are both ecologically and economically sustainable (Ascher, 1995).

2.5 Attitudes Towards Forests Resources

People's decisions on whether to degrade the forest or conserve it are determined by their attitude towards forest resources as well as the benefits they get from the forests. The relationship between human societies and their forest environments has always been shaped by varying individual and collective aspirations towards forests (Byakuntha, 2002). The strength of this link is expressed in concrete social attitudes that are influenced by cultural and technological development. However, people can change their attitude over time due to awareness campaigns. The values one place in the forests influences one's
attitude towards forests and actions they undertake. The positive actions lead to conservation while the negative ones lead to degradation. The level of education, availability of extension services, the presences of awareness group can also change people’s perception about the value of forests (Ntholo, 2003).

2.6 Overview of Participatory Forest Management (PFM)

In addition to improving the overall management of forests in Tanzania, a key focus of PFM is to improve the livelihoods and wellbeing of rural communities living close to, or inside the forests and woodland areas. According to Agrawal and Clark (2001), if local communities were effectively involved in conservation, the benefits they receive would create incentive for them to become good stewards of natural resources - this is the central concept of PFM which is consistent with the objective of the Tanzania Forest Policy of 1998. This policy provides an opportunity to involve communities, non-governmental organizations (NGOs) and other private stakeholders in the monitoring of national forest reserves and establish their own village based reserves. Often it can be demonstrated that local communities reap significant benefits from the ecosystem, and should therefore be ready to protect it. Hence PFM is the most viable alternative to forest protection (Kajembe, 2002).

2.6.1 The Statutory basis for PFM

In view of the forms of participation explained in section 2.4 above the motives and objectives of initiating either CBFM or JFM in Tanzania could range from participation for material incentives, functional participation, interactive participation and self-mobilization. The JFM in Forest reserve was initiated by central government to reduce catchment’s forest project expenses by involving communities in forest management.
Thus, the initiation of CBFM was largely central and influenced local government response to rapid degradation of the woodlands (Vyamana, 2008a).

Community-based management of forest resources (CBFM), empowers the authority of village governments to set aside areas for forestry within their village. Such areas must be on common land, i.e. land owned by the community as a whole. An environment or natural resources committee appointed by the Village Assembly or the Village Council may manage such forests on behalf of the entire village. According to the Forest Act of 2002 (s. 38) the legal status of this village-based forest management plan and internal compliance with management rules and regulations can be enhanced through: Approving relevant village by-law and eventually announcing such a forest in an official gazette as a Village Land Forest Reserve (VLFR) as per forest Act of 2002 (s. 42-45). Two or more villages may decide to manage jointly a forest resource that covers parts of their respective territory (Forest Act 2002, s. 38).

The JFM entails the authority of the National and Local Governments to share management rights and responsibilities over their forest reserves and plantations with forest adjacent communities. The division of rights and responsibilities, including sharing of costs and benefits, is subject to negotiations in each specific case and details in a written joint forest management agreement (Forest Act 2002, s. 16). Accordingly, JFM represents a contractual relationship between the relevant government institutions and local communities. A local community may become the designated manager with extensive management authority on a specified area within a government forest reserve, known as a Village Forest Management Area (VFMA) or in collaboration with the statutory authority to manage the government forest reserve. Ownership of the forest resource under JFM rests with the respective governments, and JFM agreements are subject to renewal/re-
negotiation at least every five years in accordance with the general planning cycle for national and local government forest reserves (Forest Act 2002, s. 13.7).

Backed by the legal framework provided by the Forest Act (2002), PFM aims to address the following two main problems as identified in the Forest Policy of 1998 (s. 4.1.1 and 4.4.11):

i. The low capacity of government institutions to manage central and local government forest reserves to meet the growing demands for forest products and services, which has resulted in destruction, degradation and conversion of forest resources to other land uses.

ii. Conversion of unreserved forests of communal and public lands (mostly on village lands) to other land uses due to previously unclear land and tree tenure, particularly for indigenous trees. This has undermined economic incentives for sustainable forest management by local communities and, hence, resulted in management of forests and trees.

Socially, economically and environmentally sound forest management plans are considered to be the means to ensure sustainable protection and utilization of forest resources.

2.7 Dependency on Forest Resources

In order to understand the role forest products play in households, it is important to understand the nature of rural households and the characteristics of forest products. Forest products are often a source of livelihoods or can be used to earn cash during emergencies.
Moreover, forest products do not need high skills to bring them into production. It is likely that the poorest of the poor will rely more on forest products than the “economically” advantaged people in society. Poor households are more likely to be engaged in low income forest-based actions such as wildlife hunting, charcoal production, fish smoking, tobacco curing, and gathering of fuel wood, poles, fruits and vegetables. These prove to be low skill and open access activities with low returns. Forest or other activities with low returns become an employment of last resort for poor people. Forest dependence is a function of their poverty as they do not have access to more lucrative income opportunities (Vedeld et al., 2004).

Several factors influence the extent to which a household depends on forest resources. Such factors include the distance to the forest, infrastructure, wealth, household size and level of education of members of the household (Kambani, 2005).

i. *Distance from the forest* will mainly dictate whether a household depends entirely on the forest for its needs. The cost of travelling to a distant forest to collect daily provisions for the household may be high if the forest is not in a walking distance. This reduces the users’ willingness to participate in the management of the forest resource. However, where people have no choice, they still walk long distances in order to access the forest products.

ii. *Age* can also affect forest dependence in many ways. Many studies have shown that young people depend more on forest resources. They can also clear more forest to build up a sufficient amount of cropping land. Older people may have less time and physical strength for forest work. However, some young people consider forest product harvesting as old fashioned and may even lack necessary skills (Vedeld et al., 2004).
iii. *Education* is expected to be negatively correlated with forest dependency, since better educated households have access to a wide range of income opportunities and may find forest activities less rewarding (*Ibid*). Existing literature shows that people with a minimum level of education can easily understand things. Both males and females can be forest dependents. However, women and men collect different forest products, often for different uses. Men, for instance, are more likely to hunt forest animals, collect and build with poles and work as carpenters. Women, on the other hand, are primarily involved in the collection of thatching grass, mushrooms, and fruits; using traditional medicines and collecting and controlling the use of firewood (Byakuntha, 2002).

### 2.8 Carbon Credits

According to Skutsch *et al.* (2010), the prospect of carbon credits is an additional non timber forest product which could be exploited by communities. Theoretically, it is known that community forest management can result into two effects with regards to climate change and carbon markets; lowering the rate of degradation which reduces emissions and brings about an enhanced forest biomass growth that increases sequestration. Under REDD both processes could in principle be rewarded if they can be measured (Kajembe *et al.*, 2011). Carbon credits reflecting increases in forest biomass and decreases in emissions could be registered by communities and individual forest owners and exported, giving forest dependent people an additional source of income and an additional reason to manage forests well. Zahabu (2008), provides cost estimates and benefits for six participatory forest management projects in the four study villages; Gwata, Ludewa, Mgambo and Ayasanda. The study found that PFM projects (managed forests) sequester and store considerably more carbon than unmanaged forests. Zahabu (2008), also estimated the net carbon benefits from both sequestration and avoidance of degradation
and found that the net benefits are as much as $31 for villages with larger forests compared with those with small forests, which receive only $5 per tonne of CO$_2$ sequestered. The study also reveals that villages with 156 and 550 ha of forests could earn about $12 and $18 per household per year, respectively. With the price of at $40 per tonne of carbon sequestered, which is the prospective selling price, villages with small (20 to 50 ha) forests could earn about $30 per household, whereas those with better forests (with more than 1000 ha) might earn up to $438. Lastly, carbon credits could give new impetus to the movement towards decentralization of forest management.
CHAPTER THREE
METHODOLOGY

3.1 Description of the Study Area

The study was conducted in Iringa district. The district is located between latitudes 7.00’ – 8.30’ South of Equator line and longitudes 34’ – 37’ east of the Greenwich Meridian. It is bordered by Mpwapwa District (Dodoma region) to the North; Kilolo District to the East, Mufindi District to the South; Chunya District (Mbeya Region) to the West and Manyoni District (Singida Region) to the North West. Iringa region has been implementing PFM projects since its commencement in the late 1990s and its local people are also aware of the programme. Currently there are three on going REDD researches in pilot areas within the district and there is a prospect that local people in these areas will adopt some of the practices upon approval for use or further testing under field conditions.

Iringa district has a total area of 2 858 200 ha out of which 159 100 ha is under forest conservation and 155 302 ha is catchment’s forests, which gives about 11% of the total area. This study was mainly focused on three PFM forests, namely; Kidundakiyave (4904 ha), Gangalamtumba (6300 ha) and Kitapilimwa (3699 ha). The PFM in Iringa district established in 1999 and to date, a total area of 292 394 ha equivalent to 93% of forest land is under this management approach (DFO, 2010). Following the long-term experience in PFM and benefits that communities get, Iringa constituted an ideal place to explore the socio economic potentials of PFM to communities and other environmental benefits from the REDD initiative. REDD initiative is intended to build on PFM.
Figure 1: Map of Iringa District
3.2 Motivation for PFM establishment in Iringa District

Iringa District Council in collaboration with Danish International Development Assistance (DANIDA) launched a PFM scheme in 1999 to 2003, through the Iringa District Lands, Natural Resources and Environment Office (DLNREO). This scheme was called MEMA and dealt with Natural Woodland and Catchments Conservation. To match with the administrative set-up, the MEMA project encompassed two separate projects. One of the projects focused on the implementation of JFM in montane evergreen forests in government reserves while the other focused on CBFM in miombo woodlands found in villages' and general/public land (Lund and Boiesen, 2003). The MEMA Projects supported the implementation of PFM in several other areas including the Kitapilimwa area, where five villages implemented CBFM in 12,000 ha of woodland on village land. The JFM was implemented in another 3685 ha of the Kitapilimwa Forest Reserve. The objective was to develop a long-lived monitoring scheme that enables managers to implement sustainable management of natural forests (Table 1). During the implementation period, the MEMA Projects facilitated the election of Village Natural Resource Committees (VNRCs) as natural resource management bodies which were responsible to the village government. Many of the VNRCs formed during the implementation phase still existed when this study was conducted. In summary, community that were adjacent to these forests were aware of proper forest management practices and were consulted to provide information to meet the study objectives.
Table 1: Motivation for establishing PFM in the case study villages in Iringa District

<table>
<thead>
<tr>
<th>PFM type</th>
<th>Community</th>
<th>Date of start of PFM process</th>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>JFM</td>
<td>Kitapilimwa and Itagutwa</td>
<td>Took off from MEMA project that ended June 1999</td>
<td>To reduce catchment’s forest project expenses by involving communities in forest management</td>
</tr>
<tr>
<td>CBFM</td>
<td>Mfyome and Kiwele</td>
<td>2002</td>
<td>Response by government (Local &amp; Central) to serious degradation of the woodlands</td>
</tr>
</tbody>
</table>

3.3 Research Design

A cross sectional design was used in this study. The study targeted community members with adequate information on PFM issues, especially; economic gains and their distribution among the communities as well as community perception about REDD. This design allows data to be collected at a single point in time and is useful for descriptive purposes as well as for determination of relationships between variables (Bailey, 1998). The design is ideal when resources are limited to permit longitudinal studies.

3.3.1 Sampling procedure and sample size

The sampling frame for this study included men and women in the selected PFM forests. Both purposive and simple random sampling procedures were adopted. Purposive sampling technique was used to select villages in which a random sample of respondents was drawn to provide specific information on the subject. The villages selected included Itagutwa, Kiwele, Kitapilimwa and Mfyome in Kiwele ward, Kalenga division. The same method was used to select three PFM forests— two forests (Kidundakiyave and
Gangalamtumba) under CBFM and one (Kitapilimwa) under JFM. Although these forests are located in the same area they differ in terms of management approaches, thereby impinging differently on nearby communities. The differences in forest management imply that people might be affected differently with respect to access to forest products and how they benefit from such products.

The sample size consisted of 120 respondents from four villages, that is; 32 respondents from Kiwele village, 38 respondents from Mfyome, 30 respondents from Itagutwa and 20 respondents from Kitapilimwa making a sum of 56 males and 64 females. The number of respondents in each of the four villages reflects the proportions out of total population in the four villages. The total sample of 120 is generally considered to be sufficiently large to have a representative sample and meaningful statistics (Bailey, 1998).

3.4 Data Collection

A structured questionnaire to guide primary data collection was designed and administered to households adjacent to the forests. The questions included in the questionnaire aimed to solicit information related to: the socio-economic characteristics of the households (sex, age, marital status, and household size, education level, farming experience, land holding i.e. size of farms), available forest products, forest product prices and returns.

Other data collection tools apart from the household questionnaire were checklist and key informant interviews. Village natural resources committees were involved in key informant interview. The survey involved field visits to selected villages of Itagutwa, Kitapilimwa, Kiwele and Mfyome. During this process both qualitative and quantitative data were collected.
3.5 Data Analysis

Both qualitative and quantitative methods were used to analyze the data in SPSS software. The qualitative method entailed the use of descriptive statistics such as means, frequency distribution, and percentage and cross tabulation that were adopted to assess how different community members participated in forest management and influenced the use of forest resources. It was expected that variables like distance to the forest, individual wealth and forest management type would influence people’s involvement in forest management and earnings/benefits they realize from forests and hence members’ participation in REDD initiatives. Thus, wealth indices were computed and used to test whether there was a link between wealth status and engagement in forest-based activities. Annual income was used to rank respondents into income groups that reflect local perspectives about poverty and poverty classes. This classification was based on agreed upon criteria during focused group discussions and key informant interviews. A group of respondents with annual per capita income of less than TZS. 600 000 per year was considered as poor class, people with income of TZS. 600 001 – 2 000 000 were considered to be moderately poor, whereas those with more than TZS. 2 000 000 were classified as rich people.

The percentages were used as preliminary statistics to gauge the contribution of forest under PFM to household income. Gini coefficient was then used to assess the effect of different activities on income distribution. To identify individual effects on income, the analysis of income was disaggregated by income sources.

3.5.1 Analysis of income and its distribution

Several measures of inequality exist. According Adams (1994), cited by Malemi (2008), the measures include; Theil’s entropy index (T), Theil’s second measure (L), the
coefficient of variation (CV) and the Gini Coefficient (G). These measures are used as decomposition techniques to pinpoint the contribution of different sources of income to total income inequality. The two Theil’s measures are not decomposable when sources of income are overlapping and not disjoint. Ideally, an inequality measure can be regarded as a source decomposable if the inequality can be broken down into a weighted sum of inequality by various income sources like crops and livestock income. However, activities that influence a particular source of income are likely to have an impact on other activities; any inequality measure that is the source decomposable must address the problem of covariance among the income sources. Coefficient of variation (CV) is a ratio of standard deviation of a variable to its expected value, the mean. Its value assumes any number from zero to infinity, making it an unacceptable measure as there is no universal standard that defines reasonable value of the coefficient of particular phenomena.

Any decomposable inequality source measure should conform to five basic properties, namely:

i. The Pigou-Dalton “principle of transfers”: which requires that more weight in the inequality assessment should be attached to transfers taking place lower down in the distribution;

ii. Symmetry requirement: which holds if the measure of inequality depends only on the income values used to construct it and not additional information such as who the person is with a particular income;

iii. Mean independence: which holds if a proportionate change in all income leaves the measure of inequality unchanged

iv. Population homogeneity: which holds when increasing or decreasing the population size across all income levels has no effect on the measured level of inequality, and;
v. Decomposability: which allows inequality to be portioned either over sub populations or by sources

Gini Coefficient is one of the measures that meet the five properties. The Gini coefficient as a standard measure of income inequality ranges from 0 (when everybody has identical incomes) to 1 (when all income goes to only one person).

The Gini coefficient \((G)\) of total income is calculated as:

\[
G = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} |x_i - x_j|}{2n^2 \mu} \tag{1}
\]

Where:

- \(n\) = sample size
- \(\mu\) = sample average income from all sources
- \(x_{i,j}\) = income pairs
- \(G\) = Gini coefficient

Since total income is the sum of income from different sources, the covariance between total income and its corresponding ranks is taken as equal to the sum of covariance between each source income and rank of total income. Then the total Income Gini can also be expressed as a function of the source Gini as:

\[
G = \sum \mu_i / \mu; R_jG_j \tag{2}
\]

Where;

- \(R_j = \frac{\text{cov} (y_{ij}, r) / \text{cov} (y_i, r_i)}{\text{cov} (y_i, r_i)}\) = Correlation ratio
- \(G_j\) = Gini coefficient of \(i^{th}\) source
The decomposition corresponding to *Gini coefficient* was expressed using the following equation:

\[ \sum w_i g_i = 1; \quad w_i = \mu_i / \mu; \]  

\[ \sum \]  

\[ (3) \]

\[ 0656650902 \]

\[ g_i = R_i (G_i / G), \quad R_i = \frac{\text{cov}(y_{ij}, r_i)}{\text{cov}(y_{ij}, r_i)} \]  

\[ (4) \]

Where; \( w_i g_i \) = the factor inequality weight of the \( i^{th} \) source in overall inequality:

\[ g_i = R_i (G_i / G), \quad R_i = \frac{\text{cov}(y_{ij}, r_i)}{\text{cov}(y_{ij}, r_i)} \]

\( g_i = \) the relative concentration coefficient of the \( i^{th} \) source in overall inequality

\( G_i = \) the Gini coefficient of the \( i^{th} \) source of income

\( G = \) total income *Gini coefficient* and

\( r_i = \) Series corresponding ranks

\( y_{ij} = \) series of income from the \( i^{th} \) source

\( r = \) Correlation ratio

\( \mu_i = \) mean income from \( i^{th} \) source

\( \mu = \) mean sample income

Based on this analysis an income source can either be is inequality-increasing or inequality-decreasing according to whether \( g_i \) is greater than or less than 1.

**3.5.2 Empirical application of the proposed measure of income inequality**

Typical examples of income decomposition used the Gini coefficient include Adams (1994) cited by Malemi (2008), who examines the impact of non-farm income on inequality in rural Pakistan. Adams (1994) decomposed total income into non-farm, agricultural, livestock, rental and transfer and found that non-farm income represented an
inequality decreasing source of income. This approach has also been adopted to assess the role of non-farm income generating activities and urban agriculture in poverty alleviation in Kibaha District and Morogoro Municipality (Malemi, 2008).

3.5.3 Comparison of mean income of household of the participating villages

The analysis of comparing mean income to different participating villages under the two forms of PFM was done using One way Analysis of Variance (ANOVA) for the null hypothesis that the mean incomes of households’ from the study villages were equal. The fixed effect considered for the analysis was form of PFM of participating village and incomes from different products obtained from the forest resource. This analysis was based on the assumptions that the response variable was normally distributed (or approximately normally distributed); the samples were independent of one another and their population variances were equal. In addition the test assumes that the responses for a given group were independent and identically distributed normal random variables. The ANOVA produced an F-statistic, the ratio of the variance calculated among the means to the variable within the samples. A higher ratio therefore implies that the samples were drawn from populations with different mean values.

Econometric model

\[ Y_{ij} = \mu + T_i + \epsilon_{ij}, \]  

Where by,

\( Y_{ij} \) = Observation of final mean income

\( \mu \) = Overall (general) Mean unknown constant

\( T_i \) = Effect of \( i^{th} \) population or treatment (unknown constant)

\( \epsilon_{ij} \) = Error term (random variation) – they are normally distributed with mean 0 and variance \( \sigma^2 \)
3.6 Pair Wise Comparison

The ANOVA F-test answers the question whether there are significant differences between two categories in the population means. However, it does not provide any information about how they differ. Therefore pairwise comparison analysis was used to determine what drives the difference in means.

The samples were in groups of *sex, wealth status and income generating activities* and the test was computed between these groups to identify which group differed significantly from the other.
CHAPTER FOUR
RESULTS AND DISCUSSIONS

4.1 General Characteristics of Respondents

It has been established in section 3.3.1 that data were collected from 56 male and 64 female households' heads. Results in Table 3 show that 87.5% of the sampled residents had formal education out of which 79.2% attained primary education. Education may help to build interest and increase the willingness of people to adopt and participate in the implementation of REDD (Hessel ink, 2007). Manyisye et al. (2011), argue that to ensure full participation in PFM programmes, stakeholders at community levels need essential skills and sensitization about their rights, responsibilities and expected returns. Furthermore, Kalineza et al. (1999), argue that knowledgeable farmers are expected to adopt new techniques quicker than those who are unknowledgeable.

This study established that 90.8% of the sampled residents were directly or indirectly involved in PFM activities such as patrols and tree planting (Table 2). About 86.6% of respondents with education above primary level and 4.2% of those with no formal education were involved in PFM.

Table 2: Level of education and Community Involvement in PFM activities

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>Involvement in PFM activities</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (%)</td>
<td>NO (%)</td>
</tr>
<tr>
<td>No Formal Education</td>
<td>5 (4.2)</td>
<td>10 (8.3)</td>
</tr>
<tr>
<td>Primary Education</td>
<td>94 (78.3)</td>
<td>1 (0.83)</td>
</tr>
<tr>
<td>Secondary Education</td>
<td>9 (7.5)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Higher (University or Similar)</td>
<td>1 (0.8)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Total</td>
<td>109 (90.8)</td>
<td>11 (9.2)</td>
</tr>
</tbody>
</table>

NB: Figures presented in brackets represent percentages
Table 3: General Characteristics of households

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>56</td>
<td>46.67</td>
</tr>
<tr>
<td>Female</td>
<td>64</td>
<td>53.33</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Formal Education</td>
<td>15</td>
<td>12.5</td>
</tr>
<tr>
<td>Primary</td>
<td>95</td>
<td>79.2</td>
</tr>
<tr>
<td>Secondary</td>
<td>9</td>
<td>7.5</td>
</tr>
<tr>
<td>Higher (university or similar)</td>
<td>1</td>
<td>0.83</td>
</tr>
<tr>
<td><strong>Age groups</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Youth (18 - 30 years)</td>
<td>16</td>
<td>13.3</td>
</tr>
<tr>
<td>Adult (30 – 55 years)</td>
<td>87</td>
<td>72.5</td>
</tr>
<tr>
<td>Old (Above 55 years)</td>
<td>17</td>
<td>14.2</td>
</tr>
</tbody>
</table>

Considering the age categories presented in Table 3, many of the respondents (72.5%) were adults while 14.2% and 13.3% were older and youth, respectively. About 54% of the respondents acknowledged that they had stayed in the villages for more than 30 years while 20% of these respondents stayed in the village for 21 – 30 years; 14 % stayed for 11 – 20 years and remaining 12% for less than 10 years. Old people are more likely to be engaged in the implementation of REDD as they have accumulated sufficient experience with respect to the adverse effects of deforestation over the long period they stayed in the villages. It is known that people who live in a certain area for longer periods acquire knowledge and experiences on problems related to deforestation and perceived needs of afforestation (Nduwamungu, 2001). Kajembe (1994), argue that people who stay longer are more likely to provide more reliable data on climate and forest management practices.
Table 4: Number of years the respondent stayed in the village

<table>
<thead>
<tr>
<th>Years of residence</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10 years</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>10 – 20 years</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>20 – 30 years</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>Above 30 years</td>
<td>65</td>
<td>54</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>100</td>
</tr>
</tbody>
</table>

4.2 Income Generating Activities

People in Itagutwa, Kiwele, Kitapilimwa and Mfyome villages were engaged in many activities amongst which agriculture was the most important as reported by almost 99% respondents (Table 5). Other activities undertaken included livestock keeping, logging, sale of other forest products, small business, casual labour, local brewing, brick making and carpentry. While some of these activities provided sufficient income to some households involved, others were important sources to meet specific requirements of the household such as food, medicinal uses and construction needs. According to Michael et al. (1998), most of rural livelihoods are forced to involve in non farm activities in part-time because by farming alone, they cannot raise enough to be food self sufficient year round.

With respect to agriculture, crops grown included tobacco, maize, paddy, beans, sunflower and vegetables. Livestock kept included cattle, pigs and goats. These animals were mainly meant for the production of one or more of the following products; milk, meat and manure. The animals also served as a source of income through sales of milk from cattle as well as meat from pigs and goats.
Sales of timber and other forest products like poles, firewood, medicine, wild meat and honey were also important sources of income to people engaged in such activities. Furthermore, non-farm sources of income, including petty businesses, casual employment, brick making and carpentry also contributed to the household income.

**Table 5: Income Generating Activities**

<table>
<thead>
<tr>
<th>Income generating activity</th>
<th>1st Most</th>
<th>2nd Most</th>
<th>3rd Most</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Farming</td>
<td>119</td>
<td>99.2</td>
<td>0</td>
</tr>
<tr>
<td>Sale of forest products</td>
<td>0</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td>Livestock keeping</td>
<td>0</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>Business</td>
<td>1</td>
<td>0.8</td>
<td>15</td>
</tr>
<tr>
<td>Wage labour</td>
<td>0</td>
<td>0</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td><strong>120</strong></td>
<td><strong>100</strong></td>
<td><strong>96</strong></td>
</tr>
</tbody>
</table>

NB: Figures presented here were generated from multiple response variables.

### 4.2.1 Agriculture

Crop production is central to improving the livelihood and remains an important source for income generation and rural growth in sub-Saharan Africa (Ellis, 2000). Results from this study show that agriculture is not only the main activity, but also the main source of cash income for most of the households. Based on multiple responses (Table 5) almost all households (99%) were involved in agriculture producing food crops like maize, beans, potatoes, paddy and sunflower. Few households (6%) were involved in tobacco production as a cash crop. The average annual income from agricultural crops was the highest with a mean of TZS 450 525 per household. It is estimated that agriculture provides livelihoods for 82% of the population in Tanzania and the sale of agricultural products has been the main source of cash income for many households (World Bank, 2008).
4.2.2 Forest products

Communities adjacent to forests can consume some of the forest products such as mushroom and wild fruits and earn income upon selling forest products such as timber Malemi, (2008). Sustainable forest management must tangibly improve local economic welfare by generating sufficient economic benefits and in appropriate forms to counterbalance the opportunity costs incurred by sustainable instead of conventional forest management (FAO, 2009).

The focus of this study was to identify social and economic gains from forest under PFM. Thus, it was important to identify the types and uses of products the communities are able to get from the forest reserve. The results showed that the communities derived several products from the reserved forests (Table 6).

Table 6: Responses on availability of various forest products (n = 120)

<table>
<thead>
<tr>
<th>Item</th>
<th>Abundant</th>
<th>Fair</th>
<th>Scarce</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Count</td>
<td>Count</td>
<td>Count</td>
</tr>
<tr>
<td>Firewood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>7</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Fruits &amp; vegetables</td>
<td>65</td>
<td>13</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Poles</td>
<td>44</td>
<td>10</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Medicinal plants</td>
<td>23</td>
<td>12</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Mushroom</td>
<td>21</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bush meat</td>
<td>3</td>
<td>13</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>Charcoal</td>
<td>2</td>
<td>8</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Honey</td>
<td>0</td>
<td>6</td>
<td>10.8</td>
<td>25</td>
</tr>
</tbody>
</table>

NB: Figure presented here was generated from a multiple response variable.
4.2.2.1 Firewood and Charcoal

All the households interviewed, indicated that they relied on firewood as their main source of cooking energy. About 91.7% of the respondents used firewood for both heating and lighting as many could not afford the cost of other sources of energy such as kerosene, gas and electricity. These results are similar to those found by Lord (2012), that many of the people in rural areas rely on firewood, charcoal and residues for cooking, heating and lighting. In Itagutwa and Kitapilimwa villages firewood was also used to cure tobacco. It was estimated that each household used firewood worth TZS 72 000 per annum.

With reference to charcoal burning, permits were obtained from the village officials at a fee; however, most people did not seek these permits. Some of the reasons for people’s failure to seek the permits stemmed from the reportedly corrupt acts to solicit bribes from some users and; allegations that some village officials in charge of the CBFM and forests assistants in JFM did not issue genuine permits and people were suspicious that their money did not go into the right confers. It was reported that they occasionally gave permits to some while letting others to collect firewood for free. However, others claimed they were poor and could not manage to pay every time they want to make charcoal from the forest reserve. Most of the charcoal produced was sold to earn income and very little was used at home. It was found that the average income accrued from sales of charcoal was TZS 100 000 and TZS 245 000 from CBFM and JFM forests respectively.

Under both forest management approaches, if people are caught collecting firewood and burning charcoal illegally, their products as well as tools are confiscated. Sometimes, depending on how serious the case is, they are taken to the district council or the police and ultimately fined. However, fines from illegal collection of firewood were rare because communities were allowed to pick dropped dried woods once every week.
4.2.2.2 Poles and building materials

More than half of respondents (64.7%) indicated that they could get poles from the forest reserve. However, only 36.2% were able to get them in abundance because there were restrictions on harvesting poles from the forests (Table 6). Most of the harvested poles were for immediate home consumption and few were sold to earn cash income. Poles and other building materials like thatch grass are used for construction of houses, fences, livestock enclosures, bed, hoes and axe handles. Other studies reveal that trees are also cut for producing other wooden products such as dug – out canoes, ladles, ornaments and poles of a variety of thicknesses (Monella et al., 2000; Turpie, 2000). Average income from sales of poles was TZS 75 680.

4.2.2.3 Wild fruits, meat and mushrooms

The current study has identified that mushrooms were among the forest products obtained for free in study areas. About 34.2% of the households interviewed indicated that they were involved in mushroom collection and/or use and 17.5 % of these households were able to get sufficient amounts of mushrooms (Table 6). Mushrooms mainly grow in termite mounds, dead wood and in gardens. The study shows that most of the collected mushroom was for home consumption and only a small proportion was sold to generate income. However, income from this source could not be established because the sales activity was restricted to peak rain seasons and quantities sold were small. Furthermore, some might refrain from engaging in this activity to hedge against the risk of collecting poisonous specie that resembles edible ones (Phiri, 2000). Further the availability of domesticated vegetables such as eggplants, cabbage, and spinach could affect the use of mushrooms. FAO (1992), report shows that some forest foods, especially leafy vegetables and wild animals are consumed throughout the year by rural households, especially during peaks of seasonal food shortages.
About 52.5% of the people said that they collected fruits from the forests. Various types of indigenous fruits were collected and most of these fruits are eaten as raw. The study found that there were few cases of hunting from both forests under CBFM and JFM. This could be attributed to the fact that people were prohibited to set bush fires which help in awakening the animals and or burning the trees. This was one of the regulations set by the communities in conjunction with the district officials. The other reason could be that people are more involved in livestock and poultry keeping. Chicken and beef were easily sold for immediate cash incomes.

4.2.2.4 Honey
Table 6 shows that 16.7% of households interviewed were involved in beekeeping and honey collection and earned cash income from this activity. Mean income from this product was TZS 302,200 and was higher than income from other forest products making it a lucrative investment opportunity.

4.2.2.5 Timber
Sawing of timber from the forest was strictly prohibited by the village officials and when one violated this law the punishment was imprisonment or fine apart from the confiscation of whatever has been harvested. As such people were afraid to reveal whether they harvested timber from the forest reserve. Only 4% reported engaging in this activity after probing and persuasion. Further discussions with the Forest Assistants revealed that there were several cases of illegal harvesting of timber. It was reported that people involved went to the middle of the forest reserve at night, cut big poles for timber and returned home in the early hours of the morning unnoticed. Timber selling was a lucrative business as the demand for timber was high. Also, there were allegations that some of forest guards employed people to do the timber business and shared the proceeds. The forest assistants
also revealed that pit sawyers become ruthless to the extent of threatening to chop the assistants with *pangas* (big knives) when they stopped them for inspection/interrogation, although no such cases were reported by interviewees. The lives of forest guards were perceived to be at risk with pit sawyers operating at night.

### 4.3 Contribution of Forest to Households’ Income

Attempts to estimate the contribution of forest to household income in developing countries vary across case studies and forest resource types. Cavendish (1998), estimates a 35% contribution of forest income to total income in rural Zimbabwe, Levang *et al.* (2003), 30.4% in Indonesia and Adhukari (2003), estimate forests to contribute 20-14% of total income of mountain dwellers in rural Nepal. The differences in resource values targeted, local market conditions, transaction costs, and availability of alternative household income generating activities for households are some of the factors that influence what forest activities forest dwellers undertake and how much forest income they can possibly earn.

Knowledge of forest contribution to household income is critical to the analyses of cooperative action and incentives for successful local forest management. Figures in Table 7 are the estimated gross incomes derived from different household income generating activities, including forest products, agriculture and livestock and income from business and wages.
Table 7: The analysis of household income by income generating activities

<table>
<thead>
<tr>
<th>Source of income</th>
<th>Proportion of the sample</th>
<th>Mean Income (in TZS)</th>
<th>Percentage contribution to Total income</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crops</td>
<td>119 (99)</td>
<td>1043858.3</td>
<td>70.1</td>
<td>1</td>
</tr>
<tr>
<td>Forest</td>
<td>117 (97.5)</td>
<td>184195.8</td>
<td>12.4</td>
<td>2</td>
</tr>
<tr>
<td>Livestock</td>
<td>67 (55.8)</td>
<td>129833.3</td>
<td>8.7</td>
<td>3</td>
</tr>
<tr>
<td>Business</td>
<td>19 (16)</td>
<td>100783.3</td>
<td>6.8</td>
<td>4</td>
</tr>
<tr>
<td>Wages</td>
<td>33 (28)</td>
<td>29491.7</td>
<td>2.0</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>1488162.5</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

NB: Figure presented here was generated from a multiple response.

Figures presented in brackets represent percentages

The percentage contribution was calculated as total income in each category divided by total income from all five income sources as recorded in column (b). It is clear from the column (b) that agriculture is the main source of income, accounting for 70.1% of total household cash income followed by income from forest contributing 12.4% and income from livestock, business and wages that account for 8.7%, 6.8% and 2.0%; respectively. Notice that although the proportion of respondents involved in farming is almost equal to that of forest activities, the latter had lower mean income because most the forest products (e.g. firewood) is used for home use.

Fig. 2 below show household income by study site and income generating activity. Results show that people in the four villages derive a larger proportion of their income from crops followed by forest products. However a two way analysis of variance (ANOVA) shows that people at Itagutwa received less income from the forest resources, although this test shows no significant differences in income received by household between the four villages (Table 8). This suggests that irrespective of the proximity and type of forest...
management regime any initiative to improve people’s welfare through forest management, including REDD under discussion is likely to benefit all villages.

In contrast, people in Mfyome village derived more income (12% of the total) from forest products, although there were only 9% of the local population who earned income from forests. Contribution of forest income to total household income in Kiwele and Itagutwa was 13% and 14%; respectively. About 10% of people in Kiwele and 15% in Itagutwa earned some money from the forests. Most of this income was realized from sales of poles, timber, charcoal and baskets. These products once harvested and processed were sold in Iringa town about 30km from Kalenga division.

Table 8: Two Way ANOVA to compare income from forests

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>23640000000</td>
<td>3</td>
<td>787900000</td>
<td>1.215</td>
<td>.308</td>
</tr>
<tr>
<td>Within Groups</td>
<td>75250000000</td>
<td>116</td>
<td>648700000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>776200000000</td>
<td>119</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.4 Distribution of Forest Income by Gender and Households’ wealth

The relationship between wealth accumulation and forest income is one of the most debated topics in literature. It is often urged that the pattern of forest utilization and forest values depend on household ability to harvest, add value and market forest products (Kantai, 2002). What this means is that those households with larger endowments of wealth are more likely to acquire materials and tools for harvesting and processing timber and non-timber products than poor households. Whereas the latter depend on forests and woodlands as a source of commercial income, poor households exhibit a different type of dependency—they look at forests as important sources of safety-nets in hard times; subsistent foods, medicine and materials (construction poles and fuel wood) and other environmental services such as protection of soil erosion and watershed protection. These differences in perceptions and forest use implies that the type of forest livelihood activities undertaken by different income groups will tend to vary and so will be the impacts of their harvesting decision on forest conditions. In this study households were classified in three income groups, namely; low income group as “Poor” (51.7%), middle income group “Medium” (33.3%), and high income “rich” (15%). Those in the low income category have assets and or earn an annual income less than TZS 600 000; the middle income group earns between TZS 600 000 and 2 000 000; and high income group over TZS 2 000 000 (Appendix 1). Despite the significant seasonal variations of household income by sources, income from forest sources were aggregated on an annual to facilitate comparisons. Household income was earned from agriculture, sale of forest products and livestock as well as businesses and casual employment.

One of questions in forest income accounting related to whether poorer households derive significant income from forest products to be more reliant on the forests than richer households. Another question is whether the dependency is highest among women and
children. Of the 120 households who reported earning income from the sale of agricultural produce, 56 were male and 64 females and except for rich households, there was no significant difference in their incomes from these sources (Table 9).

Table 9: Pair wise Comparison of income from Crops between Wealth class and Gender

<table>
<thead>
<tr>
<th>Category of respondent</th>
<th>Sex of respondent (i)</th>
<th>Sex of respondent (j)</th>
<th>Mean diff</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Female</td>
<td>Male</td>
<td>-37688.59</td>
<td>0.952</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>37688.59</td>
<td>0.952</td>
</tr>
<tr>
<td>Middle</td>
<td>Female</td>
<td>Male</td>
<td>94 869.67</td>
<td>0.902</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>-94 869.67</td>
<td>0.902</td>
</tr>
<tr>
<td>Rich</td>
<td>Female</td>
<td>Male</td>
<td>35791.78</td>
<td>0.010</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>-35791.78</td>
<td>0.010</td>
</tr>
</tbody>
</table>

However, a comparison of households’ income derived from sale of forest products by sex and income groups, revealed that there were more women (58%) earning less than women’s average income from forest products of TZS 168 000 per year and the remaining 42% earning more than the average. In comparison, only 41% of male respondents earn less than the men’s average income from forest products across the three income groups. These differences are however expected because a larger portion of forest income came from charcoal and timber production and these activities were largely undertaken by men (Table 10 and 11).

Another source of forest income was wild honey mainly collection by men. Women collect wild fruits, tubers and mushroom, but these non-wood forest products are of low value, highly perishable and yet labour intensive for women along with their children who are involved in such collections. In contrast, timber and charcoal are non-perishable and
relatively high prices. It is thus not surprising that men derived more income from forests and woodlands than women.

Table 10: Pair wise Comparison of income from Forest between Wealth class and Gender

<table>
<thead>
<tr>
<th>Category of respondent</th>
<th>Sex of respondent (i)</th>
<th>Sex of respondent (j)</th>
<th>Mean diff (i-j)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Female</td>
<td>Male</td>
<td>-126 870.00</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>-358 510.00</td>
<td>0.000</td>
</tr>
<tr>
<td>Middle</td>
<td>Female</td>
<td>Male</td>
<td>126 870.97</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>-231 640.00</td>
<td>0.001</td>
</tr>
<tr>
<td>Rich</td>
<td>Female</td>
<td>Male</td>
<td>358 509.86</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>231 638.89</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Although women and poorer households are more reliant on forest products for subsistence, they get the lowest income from forest products. Most forest based income generating activities seem to be pro-male and most women are discouraged from engaging in high value male dominated forest income generating activities. This analysis suggests that harvesting of forest products and the amount of cash earned from the forest products depend on nearness to urban markets and on type of forest products being harvested and traded. Forest livelihoods are also differentiated by gender, with women collecting non-wood products (except honey, which is mostly collected men) mainly for subsistence and men harvesting timber, wood for charcoal, wild honey and other non-wood forest products for sale. Forest products and charcoal production in particular are the important sources of forest income for households living near urban centers.

This study and existing literature provide ample evidence that rural households are more dependants on forests than urban households, and that wealth endowment influence economic choices and income generating activities people engage in as well as the amount
of income they can possibly derive from forests (Bwalya, 2004). Although the sale of forest products contributed less than 30% to household income, forest contribution to local livelihood was substantial for many rural dwellers therefore, with the expected payments that REDD will offer, and if the compensation will match the opportunity cost, then many of the people in the study area is likely to support its implementation.

Table 11: Distribution of forest income by sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>Mean Income in TZS</th>
<th>Proportion of those who receive up to mean Income</th>
<th>Proportion of other categories of income earners</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>221,852</td>
<td>22 (40.7)</td>
<td>17 (31.5)</td>
<td>56 (100)</td>
</tr>
<tr>
<td>Female</td>
<td>168,036</td>
<td>37 (57.8)</td>
<td>17 (26.6)</td>
<td>64 (100)</td>
</tr>
</tbody>
</table>

NB: Figures presented in brackets represent percentages

4.5 Comparing Forest Income between CBFM and JFM

A comparison of income from forests under CBFM and JFM revealed that the mean annual income from these forests were TZS 329 600 and TZS 255 800, respectively. This finding shows that there were more than 40% of households living around forest under CBFM approach who derived more than the mean annual income from the forest. The analysis also shows that about 54% of villagers living around Mfyome and Kiwele earned more than TZS 100 000 per year.

Over 32% of those involved in the sale of forest products living around forests under JFM approach derive more than mean annual forest income with 68% of Itagutwa and Kitapilimwa villagers earning more than TZS 100 000. This is supported by the findings of Vyamana (2008b), who found that open access regimes of community forest
management like JFM give poor people access to all the products they need while CBFM inadvertently increase income inequality as they favour cash income generation by the rich while restricting the poor.

4.6 Trend and Reliability of Income from Forest Products

4.6.1 Trend of income from forest products

PFM in Iringa was established in 1999 and when this study was conducted a total of 131,253.7 ha of forest land were either under JFM or CBFM approach. Following this awareness-raising and sharing of information about PFM at all levels; income from the sale of forest product has been decreasing as shown in table 12 below. Over 80% of households involved in the study said that income from the forest was decreasing over time and this reduced the number of those involved in this type of activity. Unlike many forest dependent communities, the four villages in Kalenga division represented 36% of the villagers involved in the sale of these products. This is probably a result of limitations imposed on free utilization of forest products under CBFM.

The remaining 20% of respondents said that increased protection and conservation measures of PFM did not affect their access to and use of the forest resources hence not affecting their forest income and livelihood. Few respondents indicated that their income remained the same as some of the households were engaged in forestry activity for reasons other than income generation.

Table 12: Trend of income from sale of Forest products

<table>
<thead>
<tr>
<th>Trend of income</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced income</td>
<td>97</td>
<td>80.8</td>
</tr>
<tr>
<td>Remained the same</td>
<td>23</td>
<td>19.2</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>100</td>
</tr>
</tbody>
</table>
4.7 Effects of Forest Products on Income Distribution

Different income sources have different effects on Gini coefficient; in particular forestry income has slight positive effects on income distribution. The Gini coefficient of household income calculated including income from the forest was 0.748. The World Bank (2014) has estimated Gini Coefficient for Tanzania to be 0.476, 57 percent lower than the estimate here. One possible source of discrepancy is measurement error in the household survey data. The Gini Coefficient of forest alone was 0.849 indicating disequalizing income distributions. The diagonal line denotes perfect inequality and from the Lorenz curve below, 82% of the population owned 40% of the total income while the remaining 18% of the population owned about 60% of total income.

![Lorenz Curves for Total and Individual Sources of Income](image)

Figure 3: Lorenz Curves for Total and Individual Sources of Income

4.8 Concentration Coefficients

High participation rates in forestry occupations and the importance of forest-collected firewood to household budgets indicate that access to forests as a source of income reduces inequality (Fisher, 2004). To assess effects of different sources of income on income distribution the Gini(\(g_i\)) coefficients were decomposed according to the source of
income. The result of decomposition of Gini coefficient is shown in Table 13 where the effect of each source of income on inequality is given by the value of the relative concentration coefficient where for each income source with a concentration value lower than 0.748 help reduce income inequality. This indicates that diversification of income reduces income inequality across the sample. According to this result income from crops had inequality increasing effects while income from forestry, livestock, business and wages had inequality decreasing effects. This means that ceteris peribus any additional increase in income from crops will increase the level of inequality while additional income from forestry, livestock keeping, business and wages will decrease the level of inequality.

This is no surprise with forestry source, since collected firewood from adjacent forests represents an important income input for all sample households. In addition, participation in forestry occupations is common at the study sites. The finding that forest income lowers income inequality is consistent with other studies. Cavendish (1999) finds that environmental income reduced measured inequality by 20 to 30 percent for his sample of Zimbabwean smallholders. Reddy and Chakravarty (1999) found that forest income was associated with a small reduction in income inequality for a sample of northern Indian farmers. Sharma (2010) suggest that income from forestry and animal husbandry have an equalizing effect while crops income has disequalizing effect. Alain and Sadoulet (2001) in Mexico indicate that income has an inequality decreasing source of income. Also, Adams (1994) in Egypt indicates that non farm incomes reduce inequality. This could be explained by the fact that most of the forests under PFM in Tanzania were being rejuvenated and communities did not do substantial business in forest products.

As explained earlier that lack of enough capital to harvest, add value and market forest products has made the richer easily engaged in the sale of high value forest products than the poor. Also the diverse nature of forest products and services and the difficulty of
quantifying non market forest values cause low estimation of forest values to different communities.

Also the support given to those engaged in sale of forest products in Tanzania is minimal leading to most of the poor who engaged in forest activities either to quit from business, operate on a small scale or doing it illegally hence not entering into the computation of total GDP.

With regards to crops, the average landholding by wealth category across the four surveyed villages surveyed showed a large and significant difference between the areas of land owned by households in different wealth categories, with the wealthiest households owning more than four times as much land as the poorest. The inequality was exacerbated because wealthier households were able to buy all necessary farm inputs, whilst poorer households could not, leading low crop yield.

<table>
<thead>
<tr>
<th>Source</th>
<th>Relative concentration coefficient (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>0.0058</td>
</tr>
<tr>
<td>Crops</td>
<td>1.3858</td>
</tr>
<tr>
<td>Livestock</td>
<td>0.0065</td>
</tr>
<tr>
<td>Business</td>
<td>0.0065</td>
</tr>
<tr>
<td>Wages</td>
<td>-0.0011</td>
</tr>
</tbody>
</table>

Engaging on livestock keeping, especially in urban areas, requires one to have land either by owning or hiring it. In rural areas like Iringa, where land was adequate most of the people kept poultry or maintained piggery as sources of income. This might have contributed to the observed income equalizing effect.
Getting employment has been often a function of many things, including having education which tends to be inaccessible to poorer people. In the four studied villages, about 70% of those earning income from casual employment were poor. The remaining 30% were those classified under medium wealth class. In the informal sectors like in the surveyed villages, wage payment involves cash flow from potential employers under rich and medium wealth classes to the poor people (employees) hence decreased the level of inequality.

With respect to business, most poor people were engaging in because it had low entry cost and opportunities (technical advice and credit) were also available. The involvement by the majority might have contributed to the observed inequality decreasing effects of this income.

4.9 Other Social Benefits

4.9.1 Capacity building

When forestry management is practiced at the local level with community engagement there are benefits derived by individuals, and the community as a whole. At the individual level, benefits may include self-esteem and self-confidence, personal identity, sense of belonging, ownership, empowerment, well-being, and quality of life. Benefits to the community may include social connectedness, cohesion, integration, stability, and resilience (Edwards et al., 2008).

Arguably the most important benefit is the building of ‘community capacity’, a process which has been defined as activities, resources and support that strengthen the skills, abilities and confidence of people and community groups to take effective action and leading roles in the development of communities (Skinner, 2006). A high level of community capacity building was reported, for example, in the four villages; the
community worked in partnership with MEMA project to bring changes in environmental and forest management at large.

4.9.2 Research and education

The concern here is primarily on the number and types of visits and visitors to forests in the study area, and the economic value of those visits. The number of visits is a measure of accessibility of forests for education and learning. However, accessibility needs to be seen as more than just physical access, and includes the full range of economic, social, cultural and psychological factors (or barriers) that influence decisions to visit such forests (Weldon et al., 2007). It is estimated that the annual number of visitors from several places for research in the study area ranged from 5 to 12 a year. At least 95% of these visits were made to forests under PFM and the remaining to private woodlots. A specific fee is paid to the VNRC or village government for one to carry out research where the money collected helps the village to do several things. The total income from several sources in forests that was received by Kiwele village government is estimated to be around TZS 600,000 in the calendar year 2006 which was then used to buy pupils’ desks for village primary schools. In the year 2008 Mfyome received a total of TZS 825 000 which was used to rehabilitate water scheme in the village where they now easily fetch water. Money obtained from the sale of water is now an account village’ good source of income. The villages have set forest by laws where upon their breach one pays fines and or harvesting tools confiscated- this has been a good source of income for the respective villages and district council at large.

In the year 2007 Kiwele village received a total of TZS. 350 000 from the forest and the money was used to repair and service village tractor that is used by the community during farming season after paying a small amount of money as fee to operate the machine. All
these social factors in a way enhance community awareness on issues regarding environment consequences and the need for improving their level of understanding and decision making. This awareness can allow object assessment whether to accept or deny projects and/or initiatives such as REDD.
CHAPTER FIVE
CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study has found that different forest products are available and accessed by the adjacent communities under certain conditions or at a price. Some of them were abundantly available like firewood which is consumed by all respondents, implying that everyone benefit from the forest sector. On the other hand, availability of some of the forest products like timber and honey have been seen scarce because not every person could easily access, harvest and sell. The ability to access and harvest depends on restrictions to harvest put in place, the availability of alternative product, demand of the product, nearness to urban or market centers and ability to harvest and add value to the product. These factors generally have caused inadequacy of tangible local benefits as well as differences in receipts from forest resource among those involved.

Forestry activity has been the second most income generating activity realized mainly from the sale of timber, honey, building poles and charcoal. The data indicate high levels of dependence on forests for income. Like agriculture, forestry has been found to be practiced by many but, has a lower mean income because most of the products are used for subsistent food and household energy like firewood. The amount of income obtained from forest products depends on demand and availability of valuable forest products and proximity to urban markets. The study also found out that, forest average income was different between sex and forest type.

Regarding the effect of forestry income on overall income distribution, it has been found that forestry has income inequality decreasing effect. Despite its lower average income compared to agriculture, its income is distributed more equally.
The study has also found out that, forest incomes are largely unrecorded and consequently unrecognized. Poor and or inadequate markets have been observed for highly valued forest products. Many transactions related to forest products and services seemed to be undertaken illegally hence, not recorded because respondents were not ready to speak about them. Following discussion with key informants it was realized that even these study results might not reflect the "true" economic importance of the forest sector to the respective villages.

5.3 General Recommendations

Following this study findings, several recommendations have been raised;

i. More awareness, empowerment and education about REDD implementation and its expected benefits must be given to the residents in the four villages as it was done for PFM to make them purposefully engaged in the program. REDD needs to become more responsive to local situations (as the respondents recommended) the respective community must be assured of a range of poverty-reducing benefits (from safeguarding subsistence use of forest products to increasing income-generating opportunities).

ii. Because, forestry has income equalizing effect, access to the resource may reduce inequality across households. From the study, results showed that the communities derived some highly valued products from the reserved forests at a price. The rich could easily access the permits than non rich. Therefore, the government should put in place Policy measures to minimize the gap between those who have and those who do not have, so that many of the forest dependents get an opportunity of accessing, harvesting, processing and selling of forest products and services. These policies should focus on transferring income from rich to the poor, which can be
done by employing proper taxes and income transfer policies while also raising revenues.

iii. In order to raise forest income and promote sustainable local management, two major forest products must be involved; bee-keeping (honey and bee-wax) and managed charcoal production. The two have characteristically low value timber species, therefore will further underscore illegal timber harvesting. It has been obvious in the study that even those few that sold honey received some substantial amount of money, hence if well supported this will also reduce income inequality. No much value addition is needed on honey to be easily sold, therefore if well set even the poor will do it. Again, if the price of NTFPs is risen forest protection will benefit the poor.
REFERENCES


<table>
<thead>
<tr>
<th>Annual amount earned in TZS</th>
<th>Category</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 600 000.00</td>
<td>Poor</td>
<td>62</td>
<td>51.7</td>
</tr>
<tr>
<td>600 000 – 2 000 000.00</td>
<td>Medium</td>
<td>40</td>
<td>33.3</td>
</tr>
<tr>
<td>2 000 001 +</td>
<td>Rich</td>
<td>18</td>
<td>15</td>
</tr>
</tbody>
</table>
Appendix 2: Household Survey Questionnaire

Village ______________ Ward ______________ Division ______________

Name of enumerator: ____________________________________________

Name of respondent: ____________________________________________
Date: __________ Questionnaire No. __________________________

SECTION A: HOUSEHOLD CHARACTERISTICS AND COMPOSITION

<table>
<thead>
<tr>
<th>ID</th>
<th>Position in HH</th>
<th>Sex</th>
<th>Marital status</th>
<th>Age (yrs.)</th>
<th>Education</th>
<th>How long have you lived here (no of yrs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Head of HH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Spouse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Codes: 1=male; 2=female 2) Codes: 1= single; 2=married; 3=divorced; 4=separated; 5=widowed; 3) Codes: 1= no formal education; 2=primary; 3=secondary; 4=higher education (college, university or similar)

To determine general understanding among community members about maintaining forest conditions that help in improving livelihoods;

A1. Do you know and participate in PFM activities? 1. Yes 2. No
A2. If Yes, what motivates you to participate? (Tick 1)
   i. Distribution of benefits
   ii. Member of VNRC
   iii. Increase long-term access to forest resource
   iv. Other .................................................................

A3. Are you well represented and your voices heard? (E.g. in forest / environmental committees)? 1. Well 2. Not Well
A4. If not well, why do you feel so? (Most important reason)..........................
A5. Is there enough transparency; is there a good overview of incomes and expenditure?
1. Yes 2. NO

A6. If No, why? (Tick 1)
   i. No regular meeting
   ii. Irresponsible/uncommitted leaders
   iii. Poor participation of members
   iv. Other

A7. Do the forest products for daily household consumption like fuel wood, charcoal etc come from these forests? 1. Yes 2. No

A8. If Not, why?
   i. Prohibited
   ii. Hard to obtain a permit
   iii. Other sources (own woodlots)
   iv. Other reason
       (specify)

To assess availability of different forest products to the community

A9. What forest product do you harvest often in a year?
A10. How available to you are the forest products? Please tick once for each product that you use- leave the ones you do not use

<table>
<thead>
<tr>
<th>Item</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Abundant</td>
</tr>
<tr>
<td>Firewood</td>
<td></td>
</tr>
<tr>
<td>Wild fruits</td>
<td></td>
</tr>
<tr>
<td>Charcoal</td>
<td></td>
</tr>
<tr>
<td>Poles</td>
<td></td>
</tr>
<tr>
<td>Medicinal plants</td>
<td></td>
</tr>
<tr>
<td>Mushroom</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
</tr>
<tr>
<td>Bush meat</td>
<td></td>
</tr>
<tr>
<td>Honey</td>
<td></td>
</tr>
<tr>
<td>Weaving materials</td>
<td></td>
</tr>
<tr>
<td>Thatch grass</td>
<td></td>
</tr>
</tbody>
</table>

To examine the contribution of forest resource on total household income and income distribution

B1. Do increased protection and conservation measures of PFM affect your access to and use of forest resources hence affecting your forest incomes and livelihood?

<table>
<thead>
<tr>
<th>1. Affected income</th>
<th>2. The same</th>
<th>3. Not affected</th>
</tr>
</thead>
</table>

B2. If 'have affected and reduced your income, what do you consider to be the most important factor(s) limiting your access to and use of these forest products today? (Please rank up in the order of importance)

i. .................................................................

ii. .................................................................

iii. .................................................................

iv. .................................................................

B3. How far are you from the forests? 1. Near (below 2km), 2. Distant (more than 2km)

B4. Does the distance from household home to the forest affect the distribution of benefits from the forest resource? 1. Yes 2. No

B5. If Yes, how?

i. .................................................................

ii. .................................................................
B6. Do your household solely depend on forest resource for day to day life?
   1. Yes  2. No

B7. If Yes in B6 above, what activity gives you more returns?
   1. Beekeeping  2. Logging and timber making
   5. Weaving (for example mats, hats and baskets making)
   6. Harvesting poles and building materials

B8. For each activity mentioned above, how much do you earn per year?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Total amount harvested</th>
<th>Amount retained for home use</th>
<th>Amount sold</th>
<th>Price</th>
<th>Total Income earned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Beekeeping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Logging and timber making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Fuel-wood cutting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Charcoal making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Weaving (for example mats, hats and baskets making)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Harvesting poles and building materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C1. Apart from forest related activities, what other main income generating activity do you depend on? (Select only one)
   1. Farming:  2. Livestock keeping:  3. Business:
   4. Wage labourer:  5. Other.........................
C2. How much do you earn per year from identified activities above?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Total amount</th>
<th>Amount retained for home use</th>
<th>Amount sold</th>
<th>Price</th>
<th>Total Income earned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Farming:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Livestock Keeping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cattle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goats</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Business:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Wage labourer:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Other (specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To assess how different categories community members participate on and influence the use and management of forest resources and; (Wealth class will be obtained from key informants’ interview)

D1. Are you a member of any of the following groups?
   1. VNRC    2. VDC    3. WDC

D2. What assets do you own? Do they give any returns (Tick 1)

<table>
<thead>
<tr>
<th>Asset owned</th>
<th>Amount (size)</th>
<th>Returns (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D3. Did you plant trees or own woodlots on private land over the past 5 years that compliment your forest products requirements?
   i. 1 acre and below
   ii. 2-4 acres
   iii. Above 5 acres

To identify constraints facing proper forest management and draw lessons for improving REDD implementation in the study area.

E1. Do you know anything about REDD?  1. Yes  2. No

E2. If Yes, do you consider it to be a rewarding initiative in your local area?
   i. Cash (carbon market)
   ii. Proper land use
   iii. Tourism attraction
   iv. Research
E3. Do you think the current forest resource is used for business or commercial that prepares you to enter into carbon transaction? 1. Yes 2. No

E4. Are there any forests in your community that are protected by the state/public authorities?
Codes: 1=Yes 2=No

E5. If ‘yes’, how do you feel about this protection and their influence on livelihood incomes?
1. Increased incomes 2. Normal 3. No addition of incomes

E6. Are there any non tangible benefits?
   i. ..................................................
   ii. ..................................................
   iii. ..................................................

E6. If ‘No addition of incomes’ in E4 do you agree or disagree with the following reasons?
1. It restricts access to forests
2. It has neither compensation for losses nor return for work well done
3. It has no access to benefits from tourists
4. Other.................................................................

E7. Do you think PFM was very successful that REDD needs no research for it to take off? Yes NO

E8. If No in above what problems did you observe following PFM initiative to forest conservation?
   i. .................................................................
   ii. .................................................................
   iii. .................................................................
   iv. .................................................................

E10. Do you think similar problems can hinder REDD implementation? 1. Yes 2. No

E11. Any advice for REDD readiness?
   i. .................................................................
   ii. .................................................................
   iii. .................................................................
   iv. .................................................................
Appendix 3: Checklist for Key Informants (Wealth Index)

Dear key informants, you have been selected basing on your knowledge so as to provide necessary information that could be used to quantify and document the distributional effects of PFM socio-economic gains to local communities and their influence on REDD implementation and management in your area. All the information you will provide will be for academic purposes and be treated confidentially.

Therefore you are kindly requested to respond trustfully and faithfully to the following questions. I thank you in advance.

WEALTH RANKING

I. What types of wealth classes do exist in the village?

II. How are these levels categorized in your village? (e.g. possession of certain number of livestock, size of land, type of house owned, number of trees, etc)

III. With the assistance of key informants, let each household be categorized (each name of household head obtained from the village register is written on each card and categorized by key informants into various social classes.

IV. What are the characteristics of each social / wealth class?

V. What are the factors contributing to an individual or household to shift from one social class to another?

VI. Is there any explanation as to how PFM/REDD regime can improve your well being?