

**INCENTIVES FOR PARTICIPATORY FOREST MANAGEMENT AROUND
GISHWATI NATURAL FOREST, RWANDA**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
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ABSTRACT

Incentives in Participatory Forest Management (PFM) play a crucial role in conservation and poverty reduction at all levels of society. In Gishwati Natural Forest (GNF), human activities heavily affected the forest and incentive structure needs to be established in order to motivate people for its conservation. This study aimed to assess the nature of incentives for PFM in GNF and specifically questioned whether there were principle incentives given to local communities in and around GNF; what are community member's interests to participate in conservation of the forest; the contribution of PFM incentives to the conservation and livelihood of local communities and how communities perceived and practiced different PFM activities. Data were collected from four cells adjacent to GNF namely Karambo, Nkomane, Rusongati and Yungwe. Socio-economic data were collected through Participatory Rural Appraisal techniques, checklists and structured questionnaires. Questionnaire survey was administered to a total of 150 households representing the target population. Qualitative data were analyzed through content and structural-functional analyses. Quantitative socio-economic data were analyzed by descriptive and inferential statistics. The logistic regression results revealed that social economic factors influenced perceptions of communities on incentives for PFM activities; education level increased peoples' willingness to participate in forest management activities and had significant influence on their perceptions on that at 0.05 significant level; age showed that the older the villagers the more they have accumulated experience and knowledge on different forest management activities and incentives given. PFM had positive impacts on people's livelihood by income generating activities where 39% comes from employment. The forest created around 3000 employments and employees were earning an average of Frw 27 000 (about 50 USD) per month. The study concluded that incentives showed positive

impacts on conservation and livelihood of local communities where existing incentives such as employment, wood fuel, fodder, honey, wild fruits and vegetables have the potential to improve livelihood of the people even if they are still limited in nature and sources. The study recommended that relevant activities such as fruit processing, honey processing should be undertaken to increase household income and catalyze their incentive to effectively engage in Participatory Forest Management.

DECLARATION

I, Vestine Mukamparirwa, hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor been concurrently submitted in any other institution.



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DEDICATION

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LIST OF ABBREVIATIONS AND ACRONYMS

ANR	Amani Nature Reserve
CBD	Convention of Biological Diversity
CBFM	Community Based Forest Management
CGIS	Centre for Geographical Information System and Remote sensing/Rwanda
CIFOR	Centre For International Forestry Research
DeLPHE	Development Partners in High Education
EAC	East African Community
EDPRS	Economic Development and Poverty Reduction Strategy/Rwanda
EMPAFORM	Empowering Civil Society for Participatory Forest Management
ENR	Environment and Natural Resources
EUM	East Usambara Mountains
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
Frw	Rwandan Franc (French acronym)
GDP	Gross Domestic Product
GNF	Gishwati Natural Forest
GoR	Government of Rwanda
GWLM	Gishwati Water and Land Management
IDA	International Development Agency
IGAs	Income Generating Activities
IPCC	Intergovernmental Panel on Climate Change
ISAR	Institute of Agronomic Sciences of Rwanda (French acronym)
JFM	Joint Forest Management
MINAGRI	Ministry of Agriculture and Animal Resources/Rwanda

MINECOFIN	Ministry of Finance and Economic Planning/Rwanda
MINIRENA	Ministry of Natural Resources (French acronym)/Rwanda
MINITERE	Ministry of Lands, Environment, Forestry, Water and Mines
MNRT	Ministry of Natural Resources and Tourism/Tanzania
NAFA	National Forestry Authority/Rwanda
NEP	National Environment Policy/Rwanda
NEPAD	New Partnership on Africa's Development
NFP	National Forestry Policy/Rwanda
NGOs	Non Governmental Organisations
NISR	National Institute of Statistics of Rwanda
NUR	National University of Rwanda
PAREF	Projet d'Appui à la Reforestation/Rwanda (French acronym)
PFM	Participatory Forest Management
PRA	Participatory Rural Appraisal
REMA	Rwanda Environment Management Authority
RNRA	Rwanda Natural Resources Agency
SPSS	Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture
TFAP	Tropical Forestry Action Plan
UNEP	United Nations Environment Programme
URT	United Republic of Tanzania

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Rwanda, one of the East African Community (EAC) countries, is a small, landlocked and one of the world's most densely populated countries. The country has an area of about 26 338 km² and a population estimated at 10 412 826 (NISR, 2011), implying a population density of about 395 inhabitants per square km. Economically, Rwanda is among the world poorest countries, despite the significant progress made in the end of the last decade and the beginning of this decade (World Bank/ IDA, 2009). On average, the poverty in Rwanda has fallen by 3% where about 60% of population living under the poverty line in 2000/01 to 57% in 2005/06 (MINECOFIN/NISR, 2008).

From an annual growth rate of 10.5% attained over 1996-2002, the average real Gross Domestic Product (GDP) growth rates reached 5.6% in the period from 2003 to 2007 before picking up once again. In 2007, Rwanda's economy grew by 7.9% and it was expected to grow by 8.5 % in 2008; the main driving force for this increase is the strong agricultural progress (World Bank/IDA, 2009). In fact, according to this source, increased productivity in the agricultural and service sectors, accompanied by strong public and private sector investment activities are key to economic growth, employment and poverty reduction in the short to medium term.

Forest and tree resources, both planted and natural, constitute the main sources of energy for domestic (over 97% of households), commercial and institutional users, and this situation is unlikely to substantially change in the foreseeable future (MINIRENA, 2009).

According to FAO (1999a), 17.6% (about 435 000 ha) of Rwanda surface is forested, and 85.7% of this (373 000 ha) is classified as primary forest, the most biodiverse and carbon-dense form of forest. Change in forest cover has been observed where, between 1990 and 2010, Rwanda lost an average of 5 850 ha or 1.84% per year. Since then, forest sector had made considerable efforts at conservation and reforestation whereby, during those two decades, the country gained 36.8% of its forest cover (around 117 000 ha).

Forests play a crucial role in the lives of communities and nations. Apart from being reservoirs of other forms of biodiversity, forests are important as water catchments, soil erosion barriers, source of timber and non-timber materials. Forests also provide a very important service in the new and growing leisure industry, which involves the non consumptive use of biological diversity through eco-tourism. Forests also provide very important ecosystem services including nutrient cycling, soil formation, oxygen production, carbon sequestration and climate regulation (Arnell, 2004).

In Rwanda, the major threats to forests are mainly due to the rapid increase of population which is leading to forest encroachment and deforestation, mainly in search for settlements, agriculture and overgrazing land. Other threats include tree cutting, charcoal making, livestock overgrazing, farming activities, bushfires, stem debarking, mining and beekeeping (MINITERE and ISAR, 2007). At the national level, the institutional framework for nature conservation includes the Ministry of Natural Resources (MINIRENA), the Rwanda Environment Management Authority (REMA) and the Rwanda Natural Resources Agency (RNRA) which support different programs in relation to environment conservation.

Additionally, non- government organizations (NGOs) have entered into a Memorandum of Understanding (MoU) with the government to oversee management of forests whose biodiversity is threatened, Gishwati Natural Forest is one of such example. GNF was deforested in the 1980s by agricultural development and in the 1990s during the resettlement of people following the civil war and genocide (REMA, 2007). According to REMA (2007), deforestation of GNF is still causing persistent problems of floods and landslides which affect the livelihoods of population in the area. As forests resources were utilized exclusively by governments, the value of forests to the community was lost. It became more advantageous for them to convert forest land into farmland, whereby they regain use rights over the land.

This study provides the needed information about the role of incentives for the successful participatory forest management, there has been a growing recognition that local economy plays a central role in natural resource management, and providing incentives presents a valuable tool for both nature conservation and sustainable livelihood development. The challenge of participation in community forest management is to offer the local people a proper mix of incentives and this is increasingly becoming important in the case of GNF whose future existence has become a matter of concern.

1.2 Problem Statement

GNF has been heavily affected by human activities including encroachment for settlements, livestock grazing and farming. These activities have resulted in extensive soil erosion, flooding, landslides and reduced water quality threatening the neighbouring communities. Restoring the forest is important and this problem had long been recognized and labelled as "beyond hope" by many NGOs pursuing conservation initiatives in Rwanda. Presently, under the Government of Rwanda, *Projet d'Appui à la Reforestation*

(PAREF project) is working on reforestation in order to restore the GNF. Its main objective is to restore Gishwati degraded forest and its biodiversity and to improve livelihood of the people living in adjacent areas. GNF being among protected areas is not sufficient for the forest protection; the necessary incentive structure needs to be established for the initiative to serve its purpose. Unfortunately, such a structure is not yet in place.

1.3 Study Justification

The basic aim of incentives for biodiversity conservation is, to influence people's behaviour towards conservation, rather than degrade or deplete biodiversity in the course of their activities (Emerton, 1998). Little has been done at national and local levels in Rwanda focusing on incentives as a crucial component in nature conservation. This is of particular importance because natural resource use is so closely linked with livelihood issues of communities around forests.

There is expectation that PFM can bring substantial benefits in terms of livelihood security and poverty reduction, as well as providing important benefits to the poor in terms of improved local governance and empowerment (Bromley *et al.*, 2008). PFM may bring benefits by arresting forest degradation and supporting the development and empowerment of rural communities (MNRT, 1998). However, in Rwanda the persistence of resource degradation problems clearly indicates that, for most programs and projects having nature conservation as their primary goal, there is a need, to set in place the conditions under which local communities will be economically willing, and able, to conserve nature. Much still remains to be done to clarify on incentives and secure access right with regards to GNF. The study aimed to assess how the local communities perceive

the management program for GNF in terms of meeting the goal of utilizing and conserving forest biodiversity. The information is important for future planning of PFM interventions in GNF.

1.4 Objectives of the Study

1.4.1 The overall objective

The overall objective of the study is to assess the structure, nature and adequacy of incentives for Participatory Forest Management in the Gishwati Natural Forest.

1.4.2 Specific objectives

- i. To study the incentives offered to local people adjacent to GNF and their sources.
- ii. To examine the perception of the local communities on the conservation's incentive structure.
- iii. To study the potential impact of incentives to conservation and livelihood of the surrounding communities
- iv. To identify factors that influence local community's perception towards PMF activities.

1.4.3 Research questions

- i. What are the principle benefits given to local communities in and around the GNF?
- ii. What are community's interests to participate in conservation of the forest?
- iii. Is there any contribution of PFM incentives to the livelihood of the surrounding communities?
- iv. How do local communities perceive and practice different PFM activities?

1.4.4 Conceptual framework

The GoR in collaboration with PAREF and GWLM have designed a forest management program aimed at solving the problem of deforestation. This reality provides the starting point for the conceptual framework of the study which is summarized in Fig. 1. The need to involve local communities in conservation has been long recognized in modern conservation theories. Incentives to the forest adjacent communities will motivate them to conserve the forest and this strategy follows the argument that, if local communities have to control over the use of resources and can derive direct benefits from this use they will have an incentive to use resources wisely (Jones, 1995). The success of PFM will be realized when GoR, NGOs and other stakeholders are actively engaged in forest management.

It is hypothesized that through provision of both tangible and intangible incentives, the improvement of forest adjacent community's life can be achieved. This can be measured in terms of variables such as perception; livelihood; participation and such improvement will lead to a sustainable forest management in terms of forest quality and quality of life. The study therefore examined the existing incentives structure around GNF focusing on both economic and non economic incentives. The study further probed on the perception, livelihood and participation of community in relation to PFM. All these have a bearing on the success and hence the forest quality.

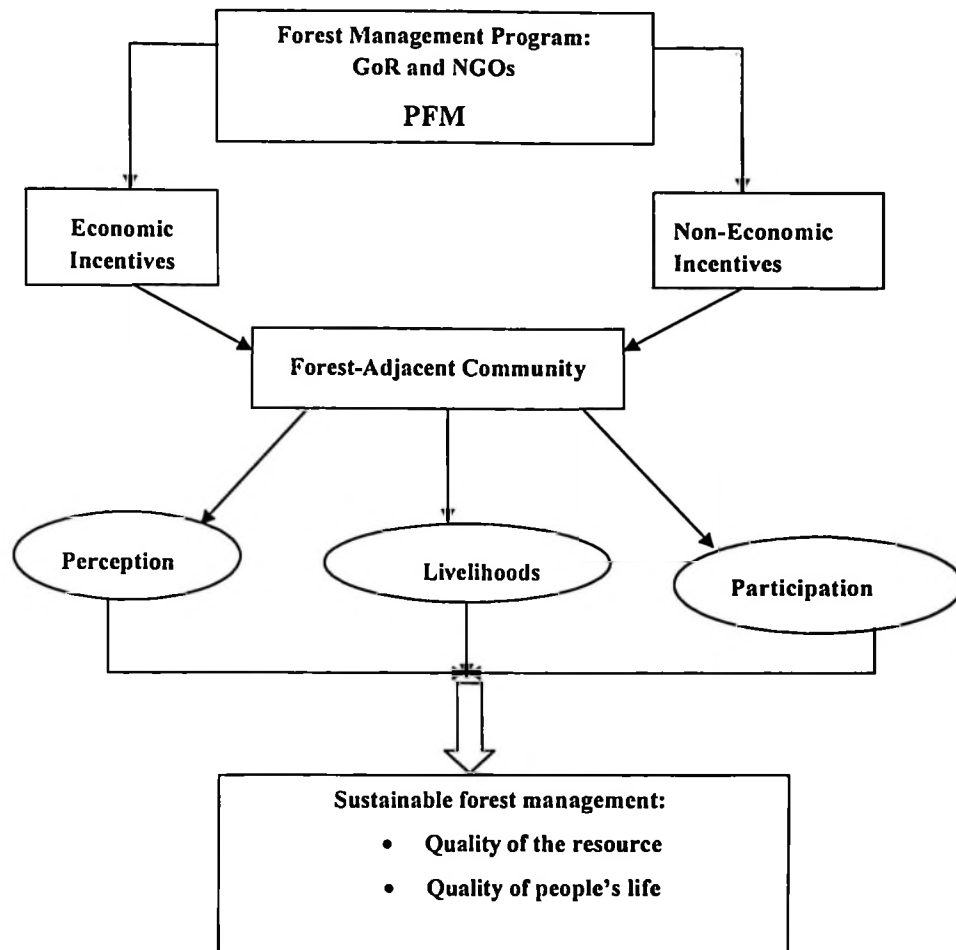


Figure 1: Conceptual framework for the study

1.5 Limitations of the Study

1.5.1 Lack of cooperation from respondents

Some respondents were not willing to give information because they thought this study would not change the situation and they would not benefit from answering the researchers questions. However, this problem was resolved through triangulation supplementing the information through discussion with key informants. Respondents were also given the right explanations on the benefit of the study to the country.

1.5.2 Poor memory of respondents

Some respondents had problems with memory since most of them did not keep written records of their activities. Some could not estimate some of the research variables like farm size; amount of crop productivity within the whole year, etc. However, consultation of crop assessment reports done by the ministry of agriculture was done to complete such information.

1.5.3 Limited time and resources

Due to limited time and resources it was not possible to visit and interview all stakeholders of GNF. Only stakeholders at local and district levels were interviewed and the majority were the local community adjacent to the forest, forest workers and the project staff members. Stakeholders at national level were not interviewed. However, this challenge was addressed by consulting reports and policies stating the role of stakeholders in relation to forest management.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Concept of Incentives

FAO (1999a) defined in very broad terms, incentive as to be anything that motives or stimulates people to act. Enters *et al.* (2001) stated other definitions referring to the "incitement and inducement of action". Incentives can be defined as specific inducements designed and implemented to influence or motivate people to act in a certain way. In the context of nature conservation, economic incentives are concerned with making it more worthwhile in financial and livelihood terms for communities to maintain, rather than to degrade, natural resources in the course of their economic activity (Williams, 2001).

In the forestry sector, incentives are not a new thing, they have been widely used in afforestation and rural development projects to encourage acceptance and participation of local communities (FAO, 2001a). The aim to put in place economic inducements for nature conservation is to limit biodiversity degradation and to discourage nature degradation through the use of penalties and disincentives. Economic incentives present a valuable tool for both nature conservation and sustainable livelihood development.

They play a crucial role in nature conservation at all levels of society. At the community level, though, it is particularly important to have appropriate incentive measures for nature conservation as natural resource use is so closely linked with livelihood issues (UNEP, 1993). Economic incentives act firstly as direct incentives; mechanisms that are targeted to specific objectives and encourage people to conserve biodiversity by providing specific rewards for changed behaviour. Secondly, they acts as indirect incentives; mechanisms

which encourage people to conserve biodiversity by setting in place general enabling conditions. Thirdly economic incentives act as disincentives which are mechanisms that discourage people from degrading natural resources. This brings a clear need to experiment and document both new and existing cases and identifies some ways forward for their development and use (UNEP, 1996).

Each year, about 13 million ha of forests are destroyed; 5.6 to 8.6 Gigatonnes of carbon are emitted and 14 000 to 40 000 species disappear from tropical forests (Reeder, 2007). Greenhouse gas emissions are likely to increase Earth's temperature by 1°C to 4°C in the next century, leading to the possibility of increasingly severe droughts and floods, enhanced rates of species invasion and extinction (Parry *et al.*, 2007), and thus significant economic harm. Tropical deforestation alone is responsible for 20 to 30% of carbon emissions and most species extinction worldwide hence conserving tropical forests could therefore reduce both global warming and biodiversity loss (FAO, 2001a).

An economic encouragement measure from a crosscutting argument in the Convention of Biological Diversity (CBD) calls for contracting parties to adapt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biodiversity (Dudley, 2004). Economic incentives are needed when nature is being degraded. Mugabe and Masika (1996) have indicated that people over-exploit resources, convert ecosystems, damage and pollute natural systems when it is economically desirable to do so because they can gain from doing so. In Rwanda, change in forest cover has been observed where, between 1990 and 2010 lost an average of 5 850 ha or 1.84% per year. Since then, forest sector had made considerable efforts at conservation and reforestation whereby, during those two decades, the country gained

36.8% of its forest cover (REMA, 2009). Little has been done at national and local levels focusing on incentives as a crucial component in nature conservation and incentives are required to influence stakeholders to be actively and willingly involved in managing forests sustainably by counterbalancing the opportunity costs incurred in the process.

2.2 Policies Governing Management of Natural Resources

Rwanda is a mountainous and over populated country with an essentially agricultural production insufficient for the needs of the population. The overexploitation of natural resources leads to an excessive degradation of environment (REMA, 2007).

On policy aspects, Rwanda has developed Vision 2020 which is one of the pillars of sustainable development including, environmental protection and management, poverty alleviation and investments promotion. From there, the government wants to build a nation where pressure on natural resources such as lands, water, forestry, biodiversity, is highly reduced and the process of environmental pollution and degradation are reversed.

On the other hand, sector policies have been prepared and implemented including environmental policy 2003, land policy 2003, energy policy 2004, agricultural policy 2004 and agricultural transformation strategy 2005/2008, national population policy 2003, decentralisation and good governance policy 2001.

On legal aspect, the Rwandan Constitution of 4 June 2003 stipulates in its article 49 that every citizen has a right to a safe and clean environment, that every individual has the duty to protect, safeguard and promote environment and that the State has the duty to the environmental protection. Similarly, organic law on environmental protection,

conservation and management aims at improving the living conditions of the population and viable environment (UNDP/UNR, 2003).

The Kyoto Protocol to the Framework Convention on Climate change 1998; Vienna Convention for the Protection of the Ozone Layer and Montreal Protocol on substances that deplete the Ozone Layer 2001; Recalling the Washington Agreement on International Trade in endangered species of Wild Fauna and Flora and other many conventions have been signed and ratified. Rwanda also participates to regional initiatives in environmental protection and management such as Nile Basin Initiatives, Lake Victoria Biodiversity Programme, and the New Partnership for Africa's Development (NEPAD) (MINIRENA, 2009).

At institutional level, the Ministry of Lands, Environment, Forests, Water and Mines (MINITERE) is responsible for the formulation of laws and policies aimed at rational utilisation and environmental protection. Some key policy established, include National Environment Policy (NEP), National Forest Policy (NFP) and the National Strategy and Action Plan for Biodiversity Conservation.

The NEP proposes measures to be taken and strategic actions which have direct impact on climate change in water resources, forestry and protected areas, biodiversity, agriculture, animal husbandry and fishing, transport and communication, commerce, industry and tourism, energy and mines, atmosphere and natural catastrophes (MINITERE, 2003).

The overall mission of National Forestry Policy (NFP) in Rwanda is to develop forest resources so as to meet the timber and non- timber forest products needs of the population

at domestic and industrial levels; manage forests to optimize their ecological functions notably soil erosion control, climate regulation and biodiversity conservation and to establish strong institutional framework for technical support and supervision of forest activities in order to improve and sustain the quality of products and services offered (MINITERE, 2004).

Some orientations of the NFP, such as promotion of agro-forestry, conservation and rehabilitation of forests and reforestation of lands unsuited to agriculture, are good to support adaptation to climate change (MINITERE, 2004a).

In the National Strategy and Action Plan of 2007 for biodiversity conservation, major actions planned include aspects of climate change are those related to restoration of damaged environment in protected areas, measures for conservation and sustainable use of biodiversity (REMA, 2008). The strategy also proposes promoting the use of environment friendly technologies for mining, trees cutting, fishing, agriculture, etc.

These policies recognises that in order for Rwanda's natural resources and environment to be sustainably managed, there is a need to adopt economic approach that provide incentives for sustainability, raise revenue, increase employment and in forestry management specifically, PFM may be one way of providing such incentives (MINITERE, 2003).

2.3 Forests and Livelihoods

2.3.1 Global perspectives

FAO (2001b) estimated that about 350 million people live in forested regions. Many are poor and depend on forests for incomes. Forest-based activities in developing countries

provide an equivalent of 17 million full-time jobs to many people in rural parts of the world and this make extensive use of forests as part of their livelihood systems. These include direct consumption of forest products and services (food, timber for construction, wood fuel, fodder for livestock, water, forest farming), collection of forest products for sale (hunting, non- timber forest products collection etc) and use of forest products for food security in times of seasonal shortages, drought and economic stress (CIFOR, 2005).

Pamela *et al.* (2000) argued that northern Ethiopia has very limited tree cover and establishment of trees or other types of leafy ground cover that provide biomass fuel, environmental services including watershed management, soil nutrient and water retention, fodder for livestock, construction materials for rural smallholders and a source of cash income may increase the likelihood of Ethiopian smallholders achieving sustainable livelihoods.

2.3.2 National level consideration

In Rwanda, the area occupied by forests all over the country was estimated at 240 746 hectare in 2007, approximately 10% of the surface of the national dry lands estimated to be 23 835 km² (MINITERE and CGIS-NUR, 2007).

Statistics from the Forest Department show that forests were estimated to cover about 659 000 ha in 1960 (MINITERE, 2007). This reflects a loss of approximately 64% of forests in Rwanda from 1960 to 2007, which is more than 1.3% per year. Forests through fuel wood and charcoal making are respectively estimated to account for about 78.3% and 4.9% of the total energy consumed in the country (MINITERE and ISAR, 2007).

Increasing numbers of initiatives link forest management with local, social and economic development, usually by providing incentives for forest neighbours to support conservation and sustainable use. These initiatives include multiple-use areas, buffer zone management and community-based conservation. In Tanzania, forests through fuel wood and charcoal are estimated to account for 95% of total energy consumed in the country (MNRT, 2001a).

2.4 Sustainable Forest Management

Sustainable Forest Management is a subset of sustainable development. Higmans *et al.* (1999) defined sustainable development as development that is economically viable, environmentally harmless and socially beneficial and which balances present and future needs. According to FAO (1999b), sustainable forest management is defined as the stewardship and use of forests and forestlands in a way, and at a rate, that maintains their biodiversity, productivity, and regeneration capacity, vitality and their potential to fulfill current and future relevant ecological, economic and social functions, at local, national, regional and global levels, and that does not cause damage to other ecosystems.

At regional level, Government's capacity to protect forests has been progressively deteriorating because of declining budgets and human resources. The creation of forest reserves for protection like catchments has been often blamed to alienate local communities from access rights (Misana, 1999).

Hence, it is not of surprise that, despite regular patrols by forest officers, catchment forests have continued to experience depletion and degradation. Kajembe and Kessy (2000) define PFM as a strategy to achieve sustainable forest management through encouraging

co-management of forests and woodlands. PFM which is sometimes referred to as collaborative forest management entails involvement of many stakeholders in forest management.

Bromley *et al.* (2008) argued that PFM can bring substantial benefits in terms of livelihood security and poverty reduction, as well as providing important benefits to the poor such as incentives as a crucial component in nature conservation in terms of improved local governance and empowerment.

In Rwanda, PFM programme activities have not reached a much greater degree of progress compared to other regional countries like Tanzania. The extent of PFM in Rwanda is shown by tourist- related benefit sharing from Nyungwe Forest Reserve (96 000 ha). In Tanzania, since 1995, more than 550 village forest reserves (VFRs) have been declared by communities out of communal lands and several thousand households, clans or groups have demarcated private forests. Together these developments have brought more than 0.5 million ha into protected status (Willy, 2000c).

CHAPTER THREE

3.0 MATERIAL AND METHODS

3.1 Study Area

3.1.1 Location

Gishwati Natural Forest is an Albertine Rift Afro-mountain forest and for decades constituted an important area for biodiversity conservation. It is situated in the western province of Rwanda and touches to Ngororero, Nyabihu, Rubavu and Rutsiro districts. In 1970s, Gishwati Natural Forest constituted approximately 28 000 ha in size and covered large areas of the highland range of the Congo-Nile Divide in the North-west of Rwanda before the deforestation started in the middle of the 1990s.

Since then, it was partly converted to pine plantation and pasture, more natural forest and degraded areas were converted to agriculture land and farmers settled in the extreme south and north (Gatera, 2001).

The study was conducted in villages surrounding Gishwati Natural Forest, specifically Karambo, Nkomane, Rusongati and Yungwe both from Kanama sector, Rubavu District (Fig.2).

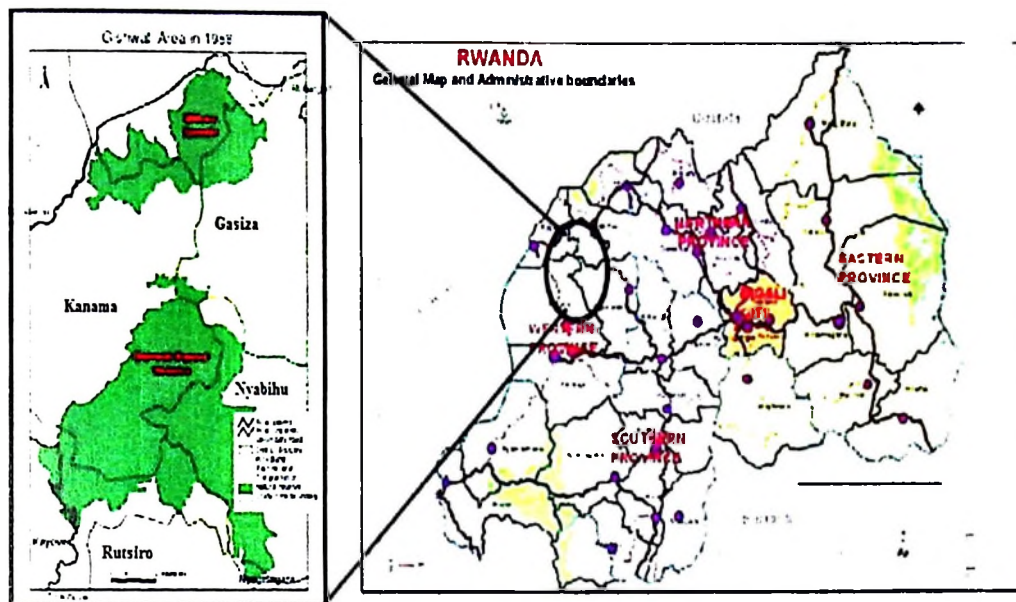


Figure 2: Location of the study area

In 2006, a land cover map revealed the actual status of land cover of GNF. In southern and northern part of the forest, changes occurred with biodiversity loss, drastic change of the natural vegetation cover and only single indigenous trees remained over twenty years as shown in Fig.3 and Fig.4 (MINIRENA, 2007).

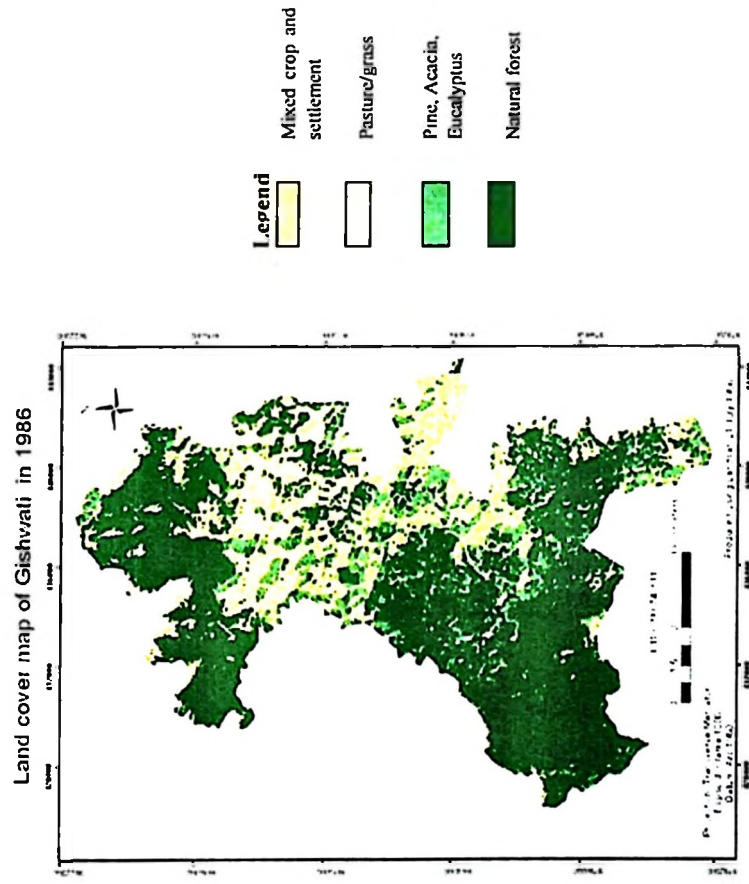


Figure 3: Land cover types and extend in 1986 in the study area

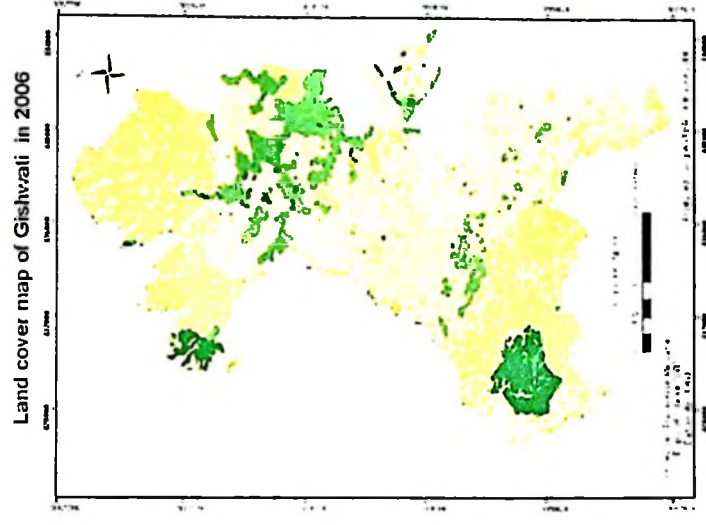


Figure 4: Land cover types and extend in 2006 in the study area

3.1.2 Climate and soils

The mean slope is 35% with an elevation ranging between 2000 and 3000 m. Temperatures are generally cool with an average of 10⁰C. The mean annual rainfall of 1800 mm is typical for an African forest. The very fertile Andisols, Mollisols, Entisols and Inceptisols are major soils of Gishwati watershed and could support suitable production of wide range of economic crops. Unlike soils of Rwanda in many areas, the soils in Gishwati are not acidic and exhibit high total organic carbon (TOC) content (MINITERE, 2007).

3.1.3 Population

Rubavu district extends to the area of 388.3 km² and the total population was 303 549 according to National Institute of Statistics of Rwanda (NISR, 2011). Out of this, 171 046 (56.3%) were women and 132 503 (43.7%) were men. Within the 12 sectors of Rubavu district, Kanama is the least densely populated (575 inhabitants per square kilometer). The average household size for the district was 6.4. Literate people comprised 56% of the population.

3.1.4 Farming systems

The farming system in the four study cells is a peasantry small scale with irish potatoes as a major food crop. Other crops grown include maize, beans, and some leguminous crops. The crops serve as cash crops as well. The farming method commonly practised is permanent plots with both monoculture and mixed cropping (inter-cropping) system. Ploughing is a common tillage method. Agroforestry is also practised by planting trees for fruits like avocado trees. Livestock keeping is common.

3.2 Data Collection Methods

The study was conducted in two phases. Phase one involved reconnaissance survey in order to get a general picture of the study area and pre-test the questionnaire. Participatory

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3.2 Data Collection Methods

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Rural Appraisal (PRA) exercises (Appendix 3) were used, based on interactive learning, shared knowledge with local people allowing them to apply their experience and capacity to share knowledge. Phase two comprised mainly of questionnaire surveys. During this phase, recruitment of research assistants and training them on data collection was also done. Focus Group Discussion (FGD) was also carried out during this phase.

3.2.1 Primary data collection

Primary data collection involved socio-economic survey in the communities living adjacent to the forest plantations. The research design used in this study was field study using administered questionnaires. It is chiefly used in studies that have household as units of analysis and advocated as one of the best methods available in collecting original data for describing a population (Babbie, 1995).

Sampling

Random sampling was used to select people from villages surrounding the GNF.

The sample size determination for the present study was done according to the following

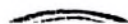
formulae:
$$n_0 = \frac{z^2 * (p) * (1-p)}{c^2} \dots\dots\dots (1)$$

Where

n_0 = sample size for the targeted precision level

Z = value of the standard variate at a given confidence level and to be worked out from table showing area under normal curve, here set at 1.96 (in simple at 2.0) corresponding to 95% confidence level;

P = proportion in the target population estimate to have a particular characteristic (eg.



involvement in forest management), if not known use 50%, $q = 1-p$;

C = accuracy desired, set at 0.05.

Therefore, the corrected sample size (n) for a finite population (N) that used for the

present study was calculated as follow: $n = \frac{n_0}{1 + \left[\frac{(n_0 + 1)}{N} \right]}$ (2)

Where

N = population size (= 1200 households in the study area)

Substituting these recommended values, equation (1) gives

$$n_0 = \frac{2^2 * 0.5 * 0.5}{0.05^2} = 400$$

Hence equation (2) gives

$$n = \frac{400}{1 + \left[\frac{400 + 1}{1200} \right]} = 299.8 \sim 300$$

Taking into account the competing needs, so that costs and efforts to minimize sampling error are optimally balanced, half of the precedent sample size was drawn in the same region; therefore, the total sample size considered for the study was 150 households randomly picked from each of the four cells surrounding the forest reserve.

Questionnaire Survey

A structured questionnaire was administered to the sample size to elicit information from respondents based on the specific objectives. Questions were either open ended, multiple choices, dichotomous or tabular. The questionnaire (Appendix 1) was pre-tested before the onset of the survey in order to see if the questions were understood and addressed issues under investigation.

The response to questionnaire pre-testing resulted in revision of questions. A household is defined as the number of people who dwell or live under the same roof and share the same bowl. The focus of the survey was to identify incentives given to local communities surrounding the forest; examine the perception of the local communities on the conservation incentive structure; value the potential impact of incentives to conservation and local community livelihood; and identify factors influencing local people's perception and practice in relation to PFM activities. The structured questionnaires were administered to 150 heads of households and were randomly selected from four cells adjacent to GNF.

Focus Group Discussion

Focused group discussions is a technique guided by a checklist (Appendix 2). Checklists were used to guide collection of data from key informants who were knowledgeable about the forest plantation's management and the society.

It is needed due to the limitations of human memory. Key informants are individuals who are accessible, willing to talk and have wide knowledge about issues in question. Key informants are not only members of the clientele, but are most often informed outsiders (Mettrick, 1993). They can be people who occupy leadership positions in various community sectors and are excellent sources of information about how community makes decisions, who have power and influence and what the community's major issues and needs are. Discussions with key informants focussed on: the contribution of GNF to the livelihoods of the adjacent local communities; socio-economic factors influencing perceptions of the local communities on the management of GNF; respondents' knowledge and awareness on forest management aspects and identification of stakeholders participating in management of GNF. The key informants in this study included: the

PAREF coordinator at district level; PAREF's technicians; local authorities at cells level and village leaders of the study villages.

Participant observation

This is one of the techniques used by researchers on arriving at a new community in order to overcome problems of alienation. The researcher tries to be part of the community being studied. In so doing the researcher gains the confidence of the persons being studied, so that the presence of the researcher does not interfere with the natural course of events and hence respondents tend to provide the researcher with honest answers to questions asked (Kajembe and Luoga, 1996). Much of information was obtained by observing what was going on, what villagers said and what they did. Observing operations in the forest allowed the researcher to discuss with the villagers on the way things were done. The process of participant observations enabled the researcher to observe the livelihood of the society and to tie together the more discrete elements of data gathered by other methods.

3.2.2 Secondary data collection

Secondary data were obtained through literature search from publications and reports from REMA offices, from libraries (NUR library and SUA national library).

3.3 Data Analysis

Both qualitative and quantitative methods were used to analyse the data. The methods used for data collection and analysis are summarised in Table 1.

3.3.1 Qualitative data analysis

Qualitative data were analyzed by using the Content and Structural functional analyses. Content analysis is a set of methods for analysing the symbolic content of any communication. The basic idea is to reduce the total content of communication to some set of categories that represent some characteristics of research interest (Singleton *et al.*, 1993). Through this method, the data collected through verbal discussions with key informants were analysed in details whereby the recorded dialogue was broken down into smallest meaningful units of information or themes and tendencies. According to Kajembe and Luoga (1996), the technique helps the researcher in ascertaining values and attitudes of the respondents thereby generating themes and tendencies. Structural-functional analysis helped the researcher to distinguish between visible and hidden functions. Visible functions are those consequences, which are “intended and recognized by the actors in the systems” while the hidden functions are those consequences, which are neither intended nor recognized by the actors.

3.3.2 Quantitative data analysis

The Statistical Package for Social Sciences (SPSS) computer program was used in the analysis of questionnaire data. The preparation of variables through coding was done to suit the research questions and method of analysis to be used. Both descriptive and inferential statistical analyses were employed to analyse the data.

Quantitative socio-economic data were analysed using descriptive statistical methods. Frequency distribution tables, charts, and numerical descriptive values were used to summarise the data.

This was carried out for the purpose of understanding the distribution of replies of respondents and to explain the socio economic characteristics of the communities adjacent to the forest plantations. Inferential statistical analysis was also carried out to establish how the socio-economic factors influenced perceptions of the local communities on the incentives structure for PFM activities.

According to Sanders and Smidt (2000), the process of statistical inference involves the use of a known sample statistic to arrive at judgment about an unknown population parameter from which the sample was taken. As one of inferential statistical analysis techniques, logistic regression was carried out. The dependent binary variable used was perception that the incentives for PFM activities were good perceived with the value of one if the response was “positively perceived” and zero if “otherwise”.

In this study, gender, age, education level, residence duration and main economic activity of respondents were the independent variables considered to influence the perceptions of local people on whether incentives on PFM activities were good perceived or not. To establish the likelihood of the socio-economic factors influencing the perceptions of the incentives on PFM activities, factors were entered sequentially in the logistic model checked and the insignificant factors removed from the prediction model. Using the logistic regression coefficient (β), prediction equations were then developed.

The following logistic regression model adopted from Pampel (2000) was used:

Logistic Regression Model

$$Y_i = \frac{1}{1 + e^{-x_i}} \dots\dots\dots(3)$$

Where:

- Y_i = The i^{th} probability of event to occur for dependent variable (perception on the incentives for PFM activities) and hence a binary variable with values '1' if the response of having positive perception on incentives for PFM is yes and '0' if otherwise.
- Z = $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \dots + \beta_n x_n + e_i$
- β_0 = Constant term of model without the independent variables
- β_1, β_n = Independent variable coefficients
- E_i = random error term
- I = 1, 2, ..., n; where n is the total number of respondents
- E = Natural logarithm base (approximately 2.718)
- $x_1 - x_n$ = Independent variables (education level, age, gender, duration of residence in years and main economic activity).

The independent variables included in the logistic model and a-priori assumptions were:

X_1 = Education level of the respondent (years of schooling). It was hypothesized that the respondents with high education level would be able to judge whether incentives for participation in forest management is enough motivating or not. The expected sign of the logistic regression coefficient β was positive (+).

X_2 = Age of respondent in years. It is assumed that the older the respondent the more chances the respondent has to see forest management practices over a long period of time and as such able to compare and judge whether the incentives which were given to people influence them to participate in forest management. Age of respondent is thus assumed to have a positive (+) expected sign of the parameter β .

X_3 = Gender of the household head. Gender as a social relation has a profound influence in the role men and women play in the management and conservation of natural resources. Forest work is considered men's chore. It is hypothesized that men frequent the forest more than women while searching for opportunities and this is an opportunities to receive incentives for participating in forest management. This was a variable with sign of 1 if the respondent was a man and 0 if a woman.

X_4 = Duration of residence (years). The more time a people have been staying in the areas surround that forest, the more they depend on the available resource and get involved in activities touching the resource. People who stayed around the forest for many years are more involving in forest management than those who stayed for a short time to the area and therefore could easily engage in activities willing them to receive incentives. This will have a positive expected sign on the parameter estimate β .

X_5 = Economic activities of the respondents. The economic activities of respondents were assumed to influence their perceptions on incentives for PFM activities. Interaction of respondents with the forest plantations depends on the economic activities of respondents. It is hypothesized that respondents whose economic activity is forest management oriented were more eligible to get incentives by participating in forest management than those who do other economic activities. This was a variable with code 1 for respondents who had main economic activity in forest management and 0 if otherwise.

The hypotheses tested were:

(H_0): $\beta=0$ implying that the regression coefficients are equal to zero and thus there is no correlation between dependent (perception on the incentives for PFM activities) and independent variables (socio economic factors); against

(Ha): $\beta \neq 0$ implying that the regression coefficients are not equal to zero and thus there is either a positive or negative correlation between dependent and independent variables.

To test whether the regression coefficients are significantly different from zero, the Wald statistic that asymptotically (i.e. in large samples) follows a Chi-Square distribution was used. The Wald statistic is distributed as Chi-square with degree of freedom (df) equal to the number of constrained parameters (r). With a single parameter, the Wald statistic is simply the square of the t-ratio. The odds ratios represented by $\text{Exp}(\beta)$ from logistic regression analysis were used in explaining the likelihood that the incentives for PFM activities are positively perceived or not.

To assess the goodness of fit of the regressions model to the data, three methods were used namely the model chi-square, the log likelihood ratio test denoted by $-2LL$ and the classification tables. Using the model chi-square test, the significance level of the model was tested at 0.05 probability level.

The magnitude of the $-2LL$ value also determined the goodness of fit of the model to the given data set. The smaller the value of $-2LL$, the better the goodness of fit is the model. For proper interpretation of logistic regression model results the researcher needed a careful look at:

- (i) the Wald statistic to see whether the effect of a particular variable is statistically significant or not; the sign of effect (β),
- (ii) to see whether the increase in the independent variable increased or decreased the probability of success (i.e occurrence of positive or negative perception on incentives for PFM activities);

- (iii) the magnitudes of the similarly measured variables, to determine which of the independent variables seemed to have a greater impact on occurrence of positive perceptions on incentives for PFM in the study area;
- (iv) the $\exp(\beta)$, to see how much a 1-unit increase in X_p changed the odds of success (this is because the odds of success is not the same as probability of success); and
- (v) The results of different values of independent variables (X) and made mathematical calculations to see how changes in the value of a particular independent variable affects the probability of success.

This is because the interpretation of the parameters in logistic regression is not a straightforward and easy as other cases of ordinary least square (OLS) methods (Norusis, 1990; Pampel, 2000) cited by Mlowe, (2007).

Table 1: Methods used for data collection and analysis

Objective	Methods of data collection	Methods for analysis
Incentives offered and the sources	- Questionnaire - FGD	- Descriptive analysis (frequencies and cross tabulations)
Perception on the existing incentive structure	-Questionnaire -Documents on existing incentives (Secondary data) -FGD -Key informant interview)	- Frequencies and cross tabulations - Inferential analysis (Logistic model) - Chi-square test
Potential impact of incentives to forest conservation	- Questionnaire - FGD - Participant observation - Key informant interview	- Frequencies and cross tabulations
Factors that influence local community's perception towards PMF activities.	- Questionnaire - FGD	- Descriptive analysis

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

This chapter covers the presentation of survey data results and their discussion with respect to the objectives. The study identified the existing incentives structure around GNF focusing on both economic and non economic incentives. The study further probed on the perception, livelihood and participation of community in relation to PFM.

4.1 Socio-economic Characteristics of the Studied Area

Table 2: Economic factors influencing the perceptions of local community on incentives for PFM activities

Variable	B	S.E.	Wald	Df	Sig.	Exp(β)
Education level	-0.904	0.505	3.211	1	0.030**	0.405
Age of respondents	0.554	0.720	0.592	1	0.442ns	0.575
Gender of respondents	0.009	0.254	0.001	1	0.972ns	1.009
Duration of residence	0.272	0.525	0.268	1	0.605ns	1.312
Main economic activities	-0.081	0.115	0.494	1	0.482ns	0.922
Constant	3.244	1.514	4.589	1	0.032	25.628

Note: (1) $p=0.05$; $-2LL = 131.300$; Overall percentage = 83.3

(2) β = Regression coefficient; SE= Standard error of the estimate; Sig= significance level; Wald= $\beta/(SE)^2$; df= degree of freedom; Exp (β)= odds ratio. ns= not significant.

**=significant at 0.05 level

The results of logistic regression analysis revealed that “education level” had significant effect on incentives perception for PFM activities ($p<0.05$) (Table 2). The logistic

regression model fitted to the data by 83.3%, which is shown by a significant value of 0.032 for a constant (Table 2). Chi-square value of 3.868 which was not significant at 5% probability level ($P = 0.569$) implied that the independent variables did not affect much the outcome or the dependent variables. However, -2LL did not fit well the data to the model since it was large with value of 131.3. This is because statistically -2LL is a badness of fit indicator, that is, large numbers means poor fit of the model to the data. Table 2 shows that Wald statistics are non-zero values, which implies that there is interaction between the dependent and independent variables. According to Mlowe (2007), the non-zero Wald statistic values indicate the presence of relationships between the explanatory variables.

From the results in Table 2 it is clear that all the independent variables included in the logistic regression model have non-zero regression coefficients which explains the existence of relationship between dependent (perceptions of local community on incentives for PFM activities) variable and independent (socio-economic factors) variables.

Table 2 indicates that education level of respondents has a negative coefficient of -0.904 and odds ratio of 0.405. This means that for every increase in education level the perception on odds ratio of an event to occur i.e. perception that the incentives for participatory forest management activities are enough motivating will significantly ($p=0.030$) decrease by a factor of 0.405. A plausible explanation is that increase in education level tends to increase peoples' willingness to participate in forest management activities and as such they are able to tell if the incentives are enough motivating or not. Increase in education level also decreases the negative perceptions of respondents towards PFM because educated people are well informed about forest management. The low level

of education in the study areas around the forest plantation has a negative bearing to the management of the forest, suggesting that extra efforts are needed to reach less educated people.

The results in Table 3 shows that from the total of 150 respondents, only 7% have been at secondary level of education, 27% went to primary and didn't complete, 45% had primary education and 21% had no level of education. From these results, it indicates that most people in GNF surrounding cells completed the primary education and few benefited shortly from secondary education. However, education is an important ingredient for sustainable natural resources management and development.

Education is regarded as “key” to better opportunities for employment, accessibility to information, services, independent and correct actions with regard to survival and development and tends to stimulate self-confidence and self-reliance; therefore there may not be development without education. Given everything else, educated rural households are more productive in agriculture and are likely to have more off-farm income earning opportunities than the non-educated. Therefore, education promotes better management of household resources and reduces pressure on the easily accessible natural resources (Luhasi, 1998). Mbwanbo (2000) reported that people who are better educated tend to plant more trees for their own uses around their homesteads as opposed to less educated ones. Planting trees around homesteads reduces dependency on the state owned forest plantations. In order to have sustainable management of GNF, there is a need to educate the surrounding local community.

Table 3: Education level in the study area

Education status	Cells				Total
	Karambo	Nkomane	Rusongati	Yungwe	
None	4(7)	16(28)	4(40)	7(30)	31(21)
no completed Primary	22(37)	14(24)	0(0)	5(22)	41(27)
Primary	33(56)	23(40)	6(60)	6(26)	68(45)
no completed secondary	0(0)	5(9)	0(0)	5(22)	10(7)
Total	59(100)	58(100)	10(100)	23(100)	150(100)

Note: Values outside parenthesis denote number of respondents and those inside denote percentage

Table 2 also indicates that age of respondent has a logistic regression coefficient (β) of 0.554 and odds ratio of 0.442. This implies that increase in age increases the odds ratio of perceptions on incentives effectiveness by a factor of 0.442. A plausible explanation is that the older the respondent the more chances the respondent has to see forest management practices over a long period of time and as such able to compare and judge whether the incentives which were given to people influence them to participate in forest management. The older the villagers the more they have accumulated experience and knowledge on different aspects including incentives on forest management.

These results concur with the study by Kajembe and Mwihomeke (2001) who reported that elders were able to judge appropriately the need to conserve natural resources unlike the youth whose major interest was to gain economic benefits out of forest at the expense of overexploitation of the resource. However, this factor did not have significant impact on the management effectiveness of the forest plantation ($p=0.442$).

Furthermore, sex of respondents has a positive logistic regression coefficient (β) of 0.009 and odds ratio ($\text{Exp}\beta$) of 0.972 (Table 2). This means that for every increase in one male the perception on odds ratio of an event to occur i.e. perception that the incentives for participatory forest management activities increases by a factor of 0.972. This is because gender as a social relation has a profound influence in the role men frequent the forest more than women while searching for job opportunities and in so doing receive incentives that motivate them to participate in forest management activities than women.

However, in four considered cells, males and females were both represented during the interviews (Fig. 6). This is because gender as a social relation has a profound influence in the role men and women play in the management and conservation of natural resources. The results indicate that more males were available as heads of households and forest works are considered men's chore and they are the ones influence the acceptance or rejection of most new programmes in the area including PFM.

These findings are more or less similar to those reported by Edward (2007). In the study done to assess the current knowledge of stakeholders with regards to the concession process in forest management arrangement, (Edwar, 2007) revealed that throughout the assessment, women appeared to be less informed than men, and less confident in their knowledge, suggesting that extra efforts are needed to reach women.

Also Mendoza (2005) reported similar observations in the East Usambara Mountains (EUM) in Tanzania that problems of gender representation have arisen in the participatory planning of Amani Nature Reserve (ANR) management, especially women's needs have not been taken into account adequately in all aspects and locations. These results indicate that still there are difficulties in implementation of the PFM unless local level factors, such

as gender relations, that shape the outcomes of conservation efforts will be highly taken into consideration.

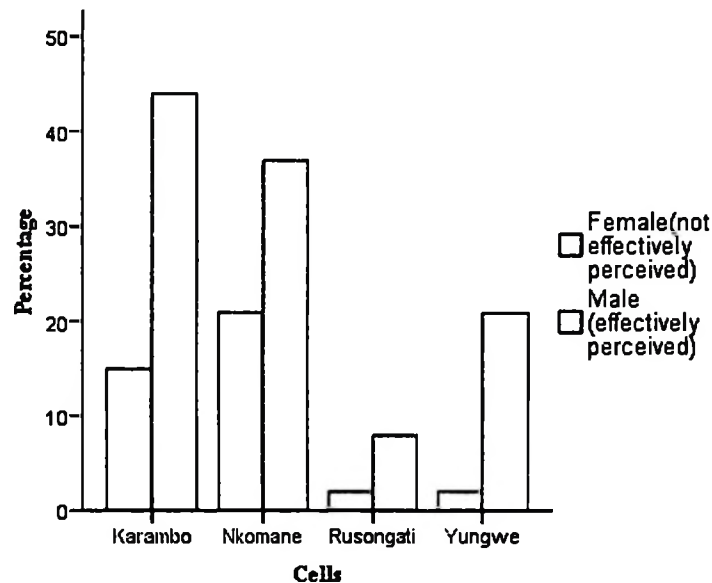


Figure 5: Perceptions by villagers by sex on whether the received incentives for PFM are effectively or not perceived

Table 2 further indicates that duration of residence had a logistic regression coefficient of 0.272 and odds ratio of 1.312. The more time a person stays in a particular area the more one becomes concerned with the surrounding environment. It was assumed that the more time a people have been staying in the areas surround that forest, the more they depend on the available resource and get involved in activities touching the resource. People who stayed around the forest for many years are more involving in forest management than those who stayed for a short time to the area and therefore could easily engage in activities willing them to receive incentives. However, the effect of duration of residence in the area on the odds of perception on the management of the forest was not statistically significant ($P=0.605$).

The results in Table 2 indicate also that the “main economic activities” have a negative logistic regression coefficient (β) of -0.081 and the odds ratio ($\text{Exp}\beta$) of 0.922. This means that for every increase in main economic activity the perception on odds ratio of an event to occur i.e. perception that the respondents whose economic activity is forest management oriented were more eligible to get incentives by participating in forest management than those who do other economic activities will significantly ($p=0.482$) decrease by a factor of 0.922. A possible explanation is that increase in economic activities of local communities increases land scarcity and therefore conflict between the forest authorities and communities making the communities to have negative attitude towards the forest. The main economic activities such as agriculture, livestock keeping and tree planting depend on land availability and this means that more economic activities demand more land. When land is scarce, community interaction with the forest increases through encroachment, search for employment and other forest based livelihood activities. The main economic activities of the people in the study areas, which were also considered as the main sources of livelihood in the households included farming and livestock keeping.

The most of respondents (43%) stated farming as their main occupation as reported in Table 4, followed by 36% doing both farming and livestock keeping, then 11% conducting both farming and beekeeping and 10% conducting farming, livestock keeping and beekeeping.

Usually more economic activities depend on land, which is found mostly in the forest plantation, and the communities adjacent to the forest plantation are facing shortage of land. They are thus forced to look for alternative means of sustaining their lives. Similar

results reported by Mlowe (2007) argued that when land is scarce, community interaction with the forest increases through encroachment, search for employment and other forest based livelihood activities.

Table 4: Economic activities in the study area

		Cells				
Social economic attributes		Karambo	Nkomanc	Rusongati	Yungwe	Overall
	Economic Activities					
	Farming	8(14)	34(59)	4(40)	18(78)	64(43)
	Farming and Livestock	27(46)	17(29)	6(60)	5(22)	55(36)
	Farming and Beekeeping	11(18)	5(9)	0(0)	0(0)	16(11)
	Both farming, livestock and beekeeping	13(22)	2(3)	0(0)	0(0)	15(10)
Total		59(100)	58(100)	10(100)	23(100)	150(100)

Note: Values outside parenthesis denote number of respondents and those inside denote percentage

According to Mafupa (2006), cases of land competition between communities around the forest cause some disturbance in the forest.

4.1.1 Other socio-economic characteristics influencing perception of people on the conservation incentive structure

4.1.1.1 Farm size and household distribution in the study area

Besides the land scarcity in Rwanda, NSIR (2011) reported the high density population of 395 people per square kilometer and this is a big problem where a sustained conversion of land and biodiversity habitat has been and is still threatening biodiversity in Rwanda (GoR, 2004). Table 5 shows the farm size and household distribution in the study area.

Table 5: Household and farm sizes in the study area

Socio-economic attribute		Cells				Overall
		Karambo	Nkomane	Rusongati	Yungwe	
Farm Size	0.5-1.5	43(73)	47(81)	9(90)	19(83)	118(79)
	2-3	13(22)	9(16)	1(10)	3(13)	26(17)
	3.5-4.5	3(5)	2(3)	0(0)	1(4)	6(4)
Total		59(100)	58(100)	10(100)	23(100)	150(100)
Household Size	2 – 4	7(12)	27(47)	4(40)	3(13)	41(27)
	5 – 7	39(66)	21(36)	3(30)	14	77(51)
	8 – 9	13(22)	10(17)	3(30)	6(26)	32(22)
Total		59(100)	58(100)	10(100)	23(100)	150(100)

(Percentages are in Parenthesis)

These results indicate that the majority (79%) of respondents have farm sizes ranging between 0.5 – 1.5 ha. The minimum land size was 0.5 ha and the maximum land size being 4.5 ha. This has implications on availability of land to local people for different uses because the smaller the farm size the more people would depend on the forest plantation to meet their varied needs. When people have large farmland it means that they have enough land for their undertakings and probably acquire some important forest products like firewood from their own lands and are therefore not tempted to encroach the forests.

In the study area 97% of respondents reported that their land holdings were inadequate (Table 6). Williams *et al.* (1999) reported that small farm size of household forces household members to participate in participatory forest management initiatives so as they learn to diversify income sources and is a driving factor towards participation in agroforestry practice.

The results from the Table 5 indicate that few people (4%) possess a farm size ranging between 3.5 to 4.5 ha. This shows how land is so scarce in Rwanda and there is a crop decline all over the country and in the study area specifically as a result of shortage of land, fertility decline and growing population.

These results show that inadequate farm land size around homesteads increases disturbances in the forest and motivate people around to encroach in the reserve for higher yields. Furthermore the results in Table 5 revealed that household size in the study area was between 2 – 9 people, most of the families 51% ranging from 5 to 7 people and 22% from 8 - 9 people. These results show that there is high population in villages surrounding GNF. According to NISR (2011), the mean household size is 4.3 in Rwanda.

The big problem of high density population zones in Rwanda are currently characterised by overexploitation of lands and a vegetal cover severely altered. This situation explains the migratory dynamic of people from most densely populated provinces in the north west (former provinces of Ruhengeri and Gisenyi) where the study area is located towards the least populated provinces especially in the east (former provinces of Umutara and Kibungo) and south east (former Kigali Ngali province) in search of a new land for agriculture and livestock keeping (MINITERE, 2006). High population is one of factors influencing deforestation. Mafupa (2006) argued that the more the families grow up in size the more they adopt farm and livestock oriented activities and therefore more land is required to meet their needs. These results could be that increase in household size implies more mouths to feed but on the other hand it implies high availability of labour and hence motive people in participating in PFM activities for satisfaction of their needs.

4.1.1.2 Land ownership and adequacy

Table 6: Land ownership and adequacy in the study area

Socio-economic attribute		Karambo	Nkomane	Cells Rusongati	Yungwe	Overall
Land ownership	Yes	59(39)	57(38)	6(4)	22(15)	144(96)
	No	0(0)	1(1)	4(4)	1(1)	6(4)
Total		59(39)	58(39)	10(7)	23(15)	150(100)
Adequate land	Yes	1(1)	3(2)	0(0)	0(0)	4(4)
	No	58(39)	55(37)	10(7)	23(15)	146(97)
Total		59(39)	58(39)	10(7)	23(15)	150(100)

(Percentages are in Parenthesis)

The results of the study reported in Table 6 revealed that 96% of respondents owned land and only 4% did not own land. Most of them 97% claimed the land to be inadequate and this concur with results in Table 5 where most of of respondents 79% reported that their land size ranged between 0.5 to 1.5 ha.

Current statistics in Rwanda showed that half of the population own a portion of land that is less than 0.5 ha and more than a quarter of the total population have only less than 0.2 ha to grow both food and export crops (MINAGRI, 2009a). Land use planning is essential in areas of land scarcity. Insecure land tenure from poor land use planning has had negative effects on forest development especially in areas of high population pressure and undefined land use security of tenure for forestlands (MNRT, 2001).

The respondents reported that it is difficult for them to maximize the production from little they possess because of soil erosion and land fertility problems. For people living around

the forest an important source of livelihood is the supply of wild goods. Deforestation of GNF obviously reduces the supply of such goods. The results in Table 6 imply that although land for most of people is not enough in the study area, but land possession is important for farmer to decide to adopt different interventions for natural resources conservation by motivating people in participating in PFM activities for satisfaction of their needs.

4.1.1.3 Types of crops grown

People surrounding the GNF grow variety of crops for their household economy as indicated in Table 7 of results. Crops grown include crops for subsistence such as irish potatoes, maize, beans and horticulture crops and cash crop including mainly irish potatoes and some of horticulture crops like cabbages. 51 % ; 18% and 15 % reported respectively irish potatoe, maize and beans the most cultivated crops in the area as shown in Table 7. The results showed that there is low agricultural productivity in the study area which is one of challenges to poverty reduction. Only 11 % of all respondents could produce more than 1200 kg of both irish potatoes and maize; 14% of them could produce 901 to 1200 kg of beans, maize and irish potatoes. This imply that the agriculture in the study area is not market oriented and this problem of low productivity is attributed to differents constraints all over the country and specifically in the study area. These constraints include small range of available fertilizers, quality and excessive costs of fertilizer while the purchasing power of most of farmers in Rwanda is very weak, low rate of use of improved seeds, poor soil conservation measurements and other factors(MINAGRI, 2009; World, 2009).

Table 7: Crops and yield in the study area

Crops grown	Last year-yield (in Kg)						Total
	under 100	100- 300	301-600	601- 900	901- 1200	over 1200	
Onions	3(60)	2(40)	0(0)	0(0)	0(0)	0(0)	5(3)
Beans	9(41)	2(9)	4(18)	5(23)	2(9)	0(0)	22(15)
Cabbages	12(92)	1(8)	0(0)	0(0)	0(0)	0(0)	13(9)
Maize	9(33)	3(11)	5(19)	5(19)	4(15)	1(4)	27(18)
Irish potatoes	24(34)	7(10)	6((8)	8(11)	16(23)	15(21)	76(51)
Pepper	3(100)	0(0)	0(0)	0(0)	0(0)	0(0)	3(2)
Tomato	3(75)	1(25)	0(0)	0(0)	0(0)	0(0)	4(3)
Total	63(42)	16(11)	15(10)	18(12)	22(14)	16(11)	150(100)

(Percentages are in Parenthesis)

As an incentives to people, PFM have to concentrate on economic growth of the local people. The contribution to the household income from activities established under PFM as shown in Table 10 revealed that environmental benefits provided to local communities including water supply, rainfall availability, amelioration of climate, erosion reduction both play a role in improving agricultural production.

4.1.1.4 Livestock keeping

Table 8: Livestock in the study area

Socio-economic attributes		Cells				Total
		Karambo	Nkomane	Rusongati	Yungwe	
Livestock keeping	Yes	48(32)	41(27)	6(4)	23(15)	118(78)
	No	11(7)	17(11)	4(3)	0(0)	32(22)
	Total	59(39)	58(39)	10(7)	23(15)	150(100)
Type of Livestock Kept	Cow	14(9)	3(2)	0(0)	13(9)	30(20)
	Goat	17(11)	18(12)	0(0)	10(7)	45(30)
	Sheep	1(1)	1(1)	3(2)	0(0)	5(3)
	Rabbit	2(1)	0(0)	0(0)	0(0)	2(1)
	different	14(9)	19(13)	3(2)	0(0)	36(24)
	livestock					
Total		48(41)	41(35)	6(5)	23(19)	118(100)

Note: Values outside parenthesis denote number of respondents and those inside denote percentage

Results indicate that 78% of the respondents own livestock and the rest 22% did not have livestock (Table 8). Among those who owned livestock, about 51% feed their animals indoor, 17% graze their animals with different grazing systems, 9% graze their animals in private owned pasture and only 1% grazed animals inside GNF. These results indicated that the majority of those who own livestock probably have improved breed, which in most cases are zero grazed. A key informant in Karambo cell had an opinion that many people grazed their animals in the forest plantation but declined to tell the truth. Such responses could be due to the fact that grazing in the forest reserve was known to be illegal, therefore respondents decided to hide the truth regarding where they graze their animals.



These results imply that livestock is an economic activity for income generation that, PFM is struggling to harmonize people to conduct as an incentive for successful sustainable forest management.

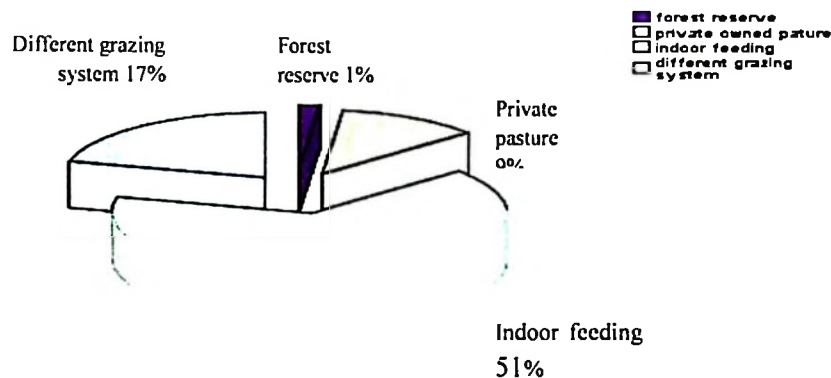


Figure 6: Livestock grazing system around Gishwati Natural Forest

Respondents reported that there is minimal destruction of the forest reserves from the cattle keeping activity as most of them (51%) use zero grazing (Fig. 6). This mode of feeding cattle has been promoted by GoR in order to promote sustainable conservation of the environment, particularly in this study area where GNF has been affected by excessive deforestation (MINAGRI, 2009).

4.2 Factors Influencing Perceptions

4.2.1 Perception of local communities on access of forest products

PFM policy can be classed as anticipatory in nature because it attempts to put in place mechanisms such as participatory forums to deal with issues and conflicts, and to develop management plans through participatory processes that provide a strategy for sustainable management and utilisation of the forest (Horn, 2002).

Results from the study as shown in Fig.7, local communities can access to some of the forest products by different ways. 46% of respondents reported that the accessibility in forest is done by permission, 8% claimed that the harvesting of forest product is done illegally, 38% of them reported that there is agreement between local people and the current stakeholder involved in management of the forest. The PRA results show that the illegal harvesting of wood fuel has considerably reduced due to the protection measures adopted by state through local authorities but still there is illegal accessibility to wild fruits and vegetables even if the forest is protected. These results imply that with PFM programme, people can utilize the forest products sustainably and thus reach to a sustainable management.

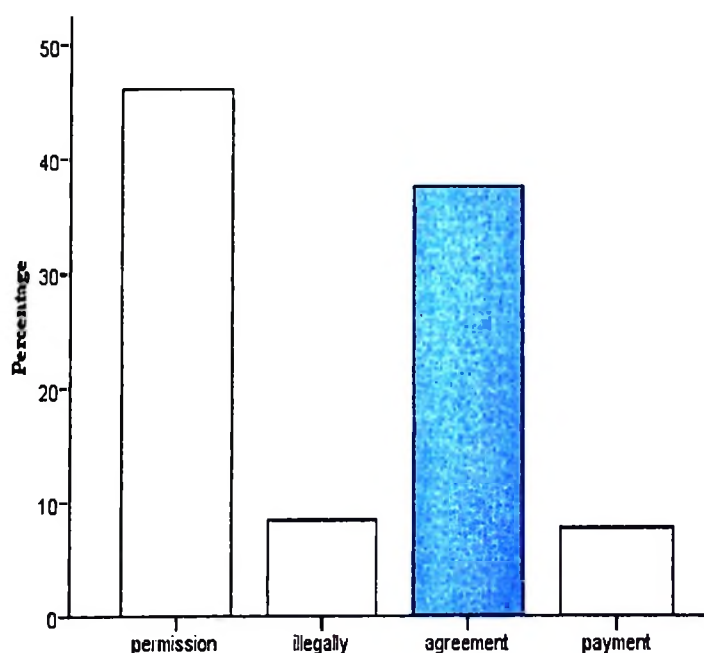


Figure 7: Perception on how local people get forest products

4.2.2 Capacity building as incentive for participatory management

Capacity building is the strategy used in PFM as incentive to successful conservation. In Rwanda, the ENR sector is among the youngest in terms of public institution framework,

and it faces enormous institutional and human resources capacity constraints. A sub-component of institutional capacity building support is embedded in each of programmes for the sector (MINIRENA, 2009). Through capacity building rural people will enhance different new technologies for easy implementation of new established projects.

Table 9 indicated the level of local people's power to decide over the use of the forest; the level of the local people involvement in implementation of various activities, in evaluation of forest reserve and in benefit sharing as main points of capacity building in the current forest management in the study area.

Table 9: Capacity building components in the area

	Cells				
Issues	Karambo	Nkomane	Rusongati	Yungwe	Total
The level of local people having power to decide over the use of the forest					
Very satisfactory	11(7)	3(2)	0(0)	2(1)	16(11)
Satisfactory	26(17)	21(14)	2(1)	12(8)	61(41)
Unsatisfactory	20(13)	31(21)	7(5)	6(4)	64(43)
No opinion	2(1)	3(2)	1(1)	3(2)	9(6)
Total	59(39)	58(38)	10(7)	23(15)	150(100)
The level of local people in implementation of various activities					
Very satisfactory	8(5)	6(4)	0(0)	2(1)	16(11)
Satisfactory	22(15)	22(15)	4(3)	13(9)	61(41)
Unsatisfactory	25(17)	25(17)	5(3)	7(5)	62(41)
No opinion	4(3)	5(3)	1(1)	1(1)	11(7)
Total	59(39)	58(38)	10(7)	23(15)	150(100)
The level of local people's involvement in the evaluation of forest reserve					
Very satisfactory	0(0)	0(0)	0(0)	0(0)	0(0)
Satisfactory	6(4)	11(7)	3(2)	9(6)	29(19)
Unsatisfactory	33(22)	30(20)	1(1)	9(6)	73(49)
No opinion	20(13)	17(11)	6(4)	5(3)	48(32)
Total	59(39)	58(38)	10(7)	23(15)	150(100)
The level of local people's involvement in benefit sharing					
Very satisfactory	0(0)	0(0)	0(0)	0(0)	0(0)
Satisfactory	11(7)	14(9)	1(1)	4(3)	30(20)
Unsatisfactory	26(17)	23(15)	5(3)	10(7)	64(43)
No opinion	22(15)	21(14)	4(3)	9(6)	56(37)
Total	59(39)	58(38)	10(7)	23(15)	150(100)

Note: Values outside parenthesis denote number of respondents and those inside denote %

Results indicated that 43% of the responded claimed the power to decide over the use of the forest to be unsatisfactory. During the participant observations, most of respondents agreed that local authorities played a big role in terms of decision making. 41% reported that the power to decide over the use of the forest is satisfactory.

The results also showed that local people are considered to be core category in decision making with only 11% of the total cases. According to these results (Table 9), the implication of local communities in decision making about the use of the forest is limited in GNF areas. This may impact positively or negatively on forest products and forest conservation in general. Usually the decision in policy process is based on scientific knowledge (Ramboll, 2003); if it is the case for the tree species to be planted the output should be better.

However, the implementation may be constrained by local communities who usually resist to changes for different reasons (Bucyerimanza, 2001). Among these reasons the lack of participation in decision seems to be the main. From the results, 41% of respondents reported to be satisfactory of their involvement in the implementation of various activities but 41% of them claimed to be unsatisfactory.

These results imply that the decision power over the use of forest influence on people involvement in various activities and thus success of targeted objective. The local people participation increases the success of different programmes introduced in their respective areas.

Furthermore, Table 9 indicates that the issue of forest reserves evaluation is not known, as 49% of respondents stated the level of involvement in forest reserves evaluation to be unsatisfactory, 32% had no opinion and only 19% of the total cases said to be satisfactory. None reported to be very satisfactory of their level of involvement in forest reserves evaluation. The implication of these results is that local people in the area covered by the study are not involved in forest evaluation; they don't know the quality and quantity of

their forest. As a result, disloyal people will continue with illegal harvesting taking advantages of not knowing what is inside the forest by surrounding community. For the successful management of a resource, people have to be aware of what they are managing in quantity and quality and thus everyone will be responsible for protecting values of the resource in the area.

Government recognised that local communities have the right to benefit from natural forests. The sustainable harvesting of resources for local benefit and for the enhancement of commercial opportunities was stated as a means of protecting both forest and woodland resources, and the application of incentives to encourage sustainable management of forests was endorsed (Fiona, 2009). The level of people involvement in benefit sharing is low in GNF by 43% of respondents claimed to be unsatisfactory and 37% had no opinion. Only 20% said to be satisfactory and no one was very satisfactory of the way they share benefits from the forest (Table 9). These results imply that, with limited local roles in overall decision-making as to the use and control of the resource; local revenue sharing still tends to define PFM in the area. Mlowe (2007) argued that in JFM people adjacent the ARN are still in worry of being totally involved in the forest management due to some difficulties, the forest is not theirs and thus they are sharing management and benefits with the government. It is recommendable that benefits that are useful to people, state and forest conservation may be seen in the concept that poor local people around the forest move from positions of subordinate beneficiaries (receiving a share of access, products or other benefits) into positions where they may themselves regulate this source of livelihood, with long-term perspectives (Wily, 2002).

4.3 Provided Incentives to Local People

4.3.1 Quantitative benefits to the local communities around the forest

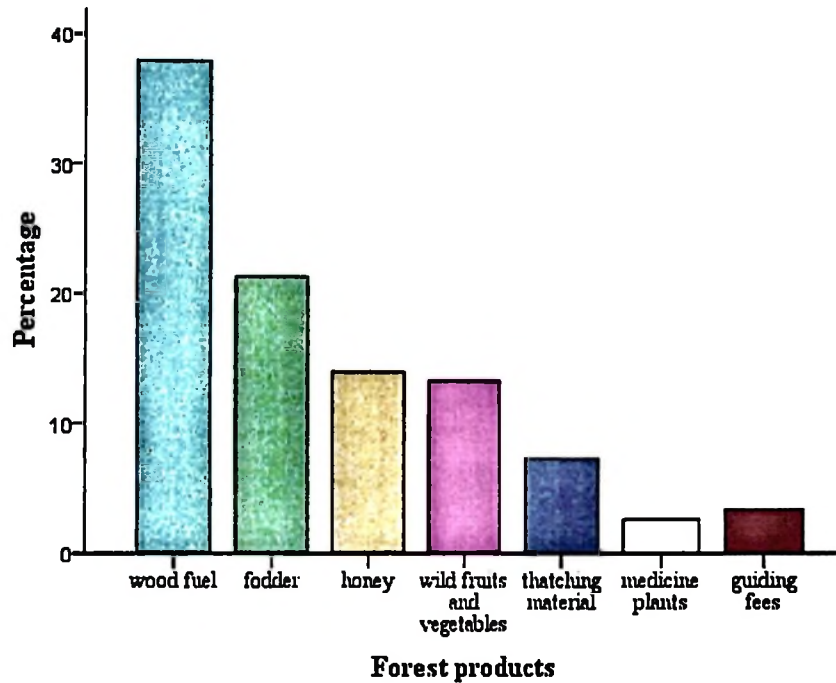


Figure 8: Accessible forest products in the study

From the current study, it was revealed that household major benefits taken from the forest in all four cells were wood fuel reported by 38%, fodder reported by 21%, honey reported by 14%, wild fruits and vegetables reported by 13%, medicine plants reported by 3% and guiding fees reported by 4% (Fig. 8). These results indicated that local people still depend on the forests products in many ways, most importantly as a source of fuel wood.

Therefore, some products are not permitted like weaving material as 7% of respondents reported to take them illegally. These results imply that people's needs are not fulfilled as still there is illegal taking of some forest products which brings back the move forward to sustainable conservation.

Similar observations were found by Mlowe (2007) who reported that some of potential forest products were illegally taken from ANR while it was not permitted in Memorandum of Understanding (MoU) prepared by Tanzanian government and all participating villages when agreed to manage the ANR through village resources management plans. Forests continue to be central to livelihood systems; local people should be the main stakeholders thus meeting their needs and aspirations on a sustainable basis which is the key factor in the sustainable development of participatory forestry. Salam *et al.* (2005) stated that attempts to manage participatory forests on a long term basis without accommodating the multiple interests of the participants in the decision making and implementation process have failed.

In many parts of India, small village groups have started to protect and reclaim degraded forestlands through collective action. PFM programme seeks to develop partnerships between local community institutions and state forest departments for sustainable management and participatory benefit sharing of public forestlands. The primary objective of PFM is to ensure sustainable use of forests to meet local needs equitably while ensuring environment sustainability. The central premise is that local people who are depending on forests have greatest stake in sustainable forest management (Pandey, 1999).

Furthermore the results in Fig. 8 revealed that the taking of some products for the four cells from the forest is evident. Almost all households rely on wood fuel collected from nearby forest, and for villagers living near to GNF these are key sources of forest products. It is rare for villagers living near forests to purchase firewood; hence the loss of access to the forest for firewood would affect all households in the villages.

In addition, some people collect other products from the forest, both for home consumption and for sale. About 14 % of respondents reported honey as their benefit from the forest. There are associations of beekeepers and they are getting honey as incentives from the forest.

About 7% of respondents reported to collect weaving material and this imply that illegal collection is done in GNF which uncertain sustainable conservation of the forest. GNF partnership between local people and actor in forest sector is still required to be strengthened and for this to be successful participants must have the security of receiving the benefits and sustainable livelihood of the people surrounding the resource is the most important objective of PFM.

4.3.2 Benefits from environment services

Like in other tropical forests, GNF before its deforestation helped maintain soil quality, limit erosion, and stabilised hillsides and modulated seasonal flooding. The loss of the forest in many areas has resulted in tremendous environment consequences such as accelerated soil erosion, landslides and flooding towards the valleys. In 1998, flooding caused by deforestation of GNF has forced displacement of many families in the area (REMA, 2007).



Plate 1: (a) Flooding around a farmer's house (b) Flooding in a farmer's plot GNF

Thereafter, efforts have been put with the GoR to restore GNF, conserve it as well as other natural resources. In last decade, there has been an urgency of sustainable use of nature resources in Rwanda which is important for future growth and poverty reduction of the country.

Table 10: Access to environmental services from the study area

Environmental services	Cells				Total
	Karambo	Nkomane	Rusongati	Yungwe	
Rainfall available	19(13)	13(9)	2(1)	7(5)	41(28)
Erosion reduced	7(5)	11(7)	1(1)	3(2)	22(15)
Good climate	7(5)	7(5)	2(1)	6(4)	22(15)
Water	10(7)	11(7)	3(2)	1(1)	25(17)
Soil fertility	16(11)	16(11)	2(1)	6(4)	40(26)
Maintained					

Note: Values outside parenthesis denote number of respondents; those inside denote percentage

From Table 10 of the study results, it was revealed that local communities reported to have benefited from environment services including reliable rainfall reported by 28%. erosion reduction 15%, amelioration of climate 15%, water catchment 17% and soil fertility maintained 26%. These results imply that for the local communities, the forest has been

and is still the important source of their directly as well as indirect daily needs. To increase forest and tree cover is to ensure adequate and sustainable supply of forest and biomass resources to meet the growing multiple demands for food, fibre, fodder, fuel as well as environmental services (MINIRENA, 2009). According to Mlowe (2007) a healthy forest maintain or enhance agricultural production by restoring soil fertility.

4.3.3 PFM related income generating activities (IGAs)

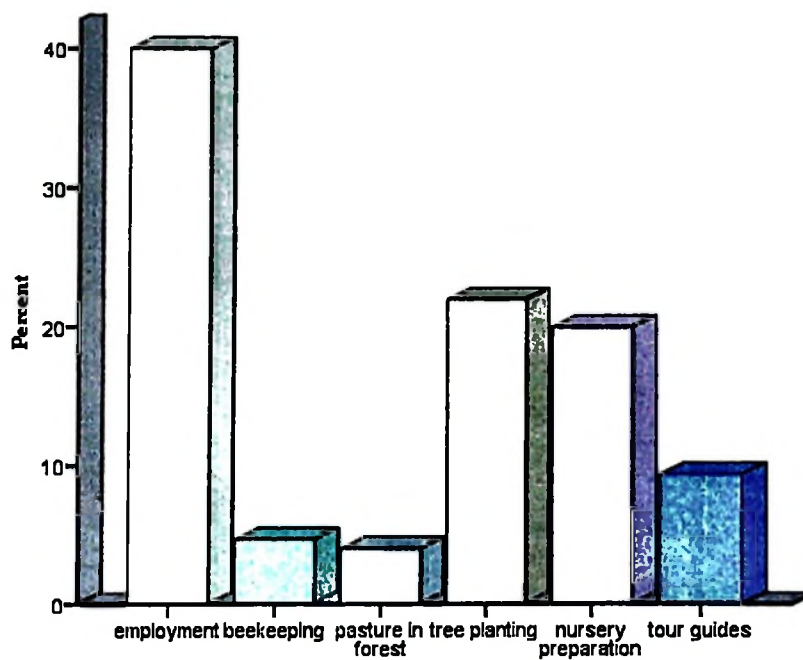


Figure 9: Income generating activities serving as incentives in the study area

The introduction of IGA within forest catchments and PFM programs aims at supporting communities to access to alternative livelihood activities and gain income (EMPAFORM, 2009). PFM initiates IGAs for the purpose of increasing rural economy, rising up household's income, hence alleviating poverty and assuring food security. This reduces the dependence of the people to the forest for their daily needs. One of the challenges in forest management is to ensure that local people are provided with sufficient economic

incentives to become involved in sustainable forest management. The IGAs established in the study area (Fig. 9) are not enough and need to be conducted effectively.

The income generations to the households from these IGAs are too low and are not serving the purpose. The observations from the study revealed that people are still poor although the IGAs are trying to reduce their poverty. Incentives are not only providing direct products from the forest to people but also other incentives like job facilities; income from tour guiding services and provision of alternative source of income generating activities. Forest Departments, in most of the countries have some policy of benefit sharing, whereby a proportion of government revenues are used to finance community development activities in forest-adjacent areas.

One of the PFM strategy is to motivate people establish IGAs for the purpose of increasing their income and hence improving their livelihoods. Fig. 9 explains different income generating activities which are conducted by local people in Gishwati Natural Forest. The results revealed that people living in forest adjacent areas depend on the GNF employment which is important for their income generation. Most of them are employed by NGOs. About 39% of respondents indicated to be employed in the ongoing activities and they confirmed that this is a strong incentive that contributes to the improvement of their livelihoods. The most plausible explanation is that benefit to these people means tangible economic benefits. According to Dubois (1999), to function as incentives, access and use rights must provide more tangible economic benefits to the people.

The rate of employment opportunities is still low compared to the efforts needed to restore and protect the forest, therefore greater effort from PFM is recommendable to reduce the

risk of people being self employed in illegal harvesting of forest products. Tree planting is another income generating activity. Currently in GNF there are different actors dealing with the restoration of the degraded forest. PAREF project one of the projects present in the area has objective of restore the degraded forest and its biodiversity as well as improving livelihood of the people living in the region. The participatory management has been considered and local people are benefiting from the project activities. 23% of respondents reported to be involved in tree planting activities and found it as a good source of income. The project compensate every worker Frw. 900 (Rwandan Franc) per day and team leaders get Frw. 1 000 per day, the payment is done monthly.

Nursery preparation for tree species to be planted also was another income generation activity conducted by communities as reported by 20% of the respondents, tour guides reported by 9%, beekeeping by 5% and livestock keeping on forest pastures reported by 4% (Fig. 9). Most of teenagers indicated tour guides to be an activity of income generation in the study area. They protect the young trees so that the cattle don't damage them before they grown up, and they get another income by transporting milk cow from forest pastures to the market.

Beekeeping for honey is an activity also that generates income in some parts of the GNF areas. There are cooperatives of beekeepers having hives in the forests and the activity is generating income but they reported that the production is still low; they need to get modern hives so that they ameliorate their production. The cooperative development, which is a major strategy for rural development largely revolves around agro-produce and agri-business, and thus constitutes an important entry point to integrate sustainable environmental natural resource management principles (MINECOFIN/NISR, 2008). From

observations the findings suggest that loans have to be provided to the local people for reinforce the project.

According to Mogoka *et al.* (2001) there is economic rationale to these benefit sharing arrangements that improvements in local welfare, and the provision of visible local benefits from forest, will engender community support for protected areas and reduce unsustainable or illegal forest activities. A strategy in community-based approaches to forest management is the promotion of alternatives to forest damaging activities such as market development activities and widespread use of enterprise. One example of this approach was set in place under the Kenya Indigenous Forest Conservation Project where involved the promotion of alternative enterprises and livelihood activities such as zero-grazing, new sources of income and employment, energy-efficient stoves and the provision of credit facilities to allow their development. Here, the economic rationale is that if local pressure is to be taken off forests and if communities are forego unsustainable forest-based livelihoods activities, then they must be provided with alternative sources of income and subsistence products that can replace those.

As stated above, incentives are not only providing direct products from forest to the local people, from PRA results it was found that, there are different services which are provided by government and NGOs. From NGOs (currently PAREF project in the study area) it was found that villages get services other than forest products like employment and a bank account is opened for free to any local people participating in forest activities specifically in tree planting, tree nursery preparation and tour guidance in GNF restoration activities.

Respondents confirmed that considering offered incentives in GNF, the financial benefit to households remains low, although the relatively small amounts they receive have an impact on household's improvement, particularly if timed well, because cash incomes in most communities are extremely low.

Such income helps them to satisfy basic needs like paying health assurance, school materials for their children, fertilizers, etc. PFM is still having the task to initiate such tree planting activities around homes and in farms in the study area and thus reducing pressure in forest reserve.

4.4 The Impact of Incentives to Conservation and Livelihood of Local People

4.4.1 The potential impact of incentives to conservation

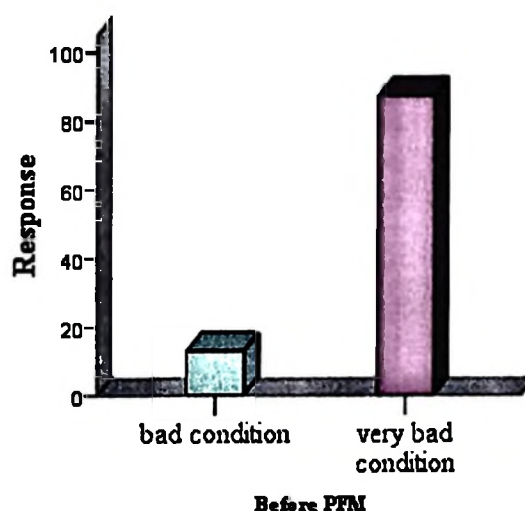


Figure 10: The condition of GNF before PFM

These results indicate the condition of the GNF before PFM's initiation. Before the GoR took initiatives for restoring and protecting the GNF, it was much degraded. In the 1970s, GNF constituted approximately 28 000 ha in size. Since 1980s, forest clearing for large

scale cattle ranching projects, particularly cattle grazing within the forest, pine plantation, cropland and settlement resulted in the loss of about 61.7% of the forest (Gatera, 2001). In 1986, the east central part of Gishwati was converted to pine plantation and pasture; after 1988, the pasture land was extended to the south west; and military zone in the northern part of the forest covering 3 000 ha. In 1995, more natural forest and degraded areas mostly occupied by shrubs were converted to agriculture land and farmers were settled in the extreme south and north.

After instability happened in Rwanda, there was acute shortage of land to resettle people and the decision was to utilize rare public land and forest (Kanyamibwa, 1998). All these activities in GNF resulted in landslide, soil erosion and excessive rainfall threatening the existence of communities.

However, many efforts have been put in order to restore the natural forest and protect the remaining of its biodiversity. In 2000, through its long-term vision called Vision 2020, the GoR has prioritized environment and natural resources as one of the cross-cutting issues and set objective of ensuring that environment and natural resources are utilized and managed productively in sustainable national development (GoR, 2002). One of the main focuses in forest sector were the forest rehabilitation and strengthening its institutional capacity to increase production of timber and other wood products and to enhance forest services for catchment protection and change adaptation. A national inventory has been undertaken, and a tree planting programme implemented to increase forest and agro-forest cover to at least 30% of the land area (MINITERE, 2003).

From the study results reported in Fig. 10, about 87% reported that the forest was in very bad condition and 13% of respondents reported that the forest was in bad condition before the government and NGOs started the restoration of the forest. After the active participation of local people in forest management activities, 33% of respondents reported that the condition of the forest has been improved. 48% of them claimed that the forest needs other efforts and with PAREF project intervention, the establishment of PFM programme expect to achieve the intended goal of restoring the forest.

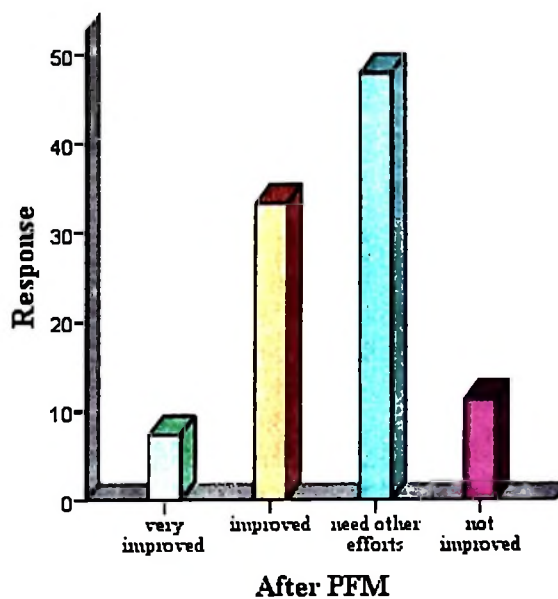


Figure 11: The condition of GNF after PFM

PFM's one strategy is giving to people incentives for the active participation in management of the forest and alleviating poverty by improving their livelihood. Salam (2005) argued that the link between assured benefits and sustainable development appears to be strong as sustainable rural development and poverty alleviation are the most important objectives of participatory forest management. The current study results imply that PFM has already shown its positive impacts to the forest conservation. Protection

practices adopted under PFM in the study area had a direct impact on the forest condition as the general trends shows that, by the use of respondent's views and observations different aspects of the forest have increased with example of tree density. As reported by 97% of the all respondents (Fig.12), tree density is one of the aspects that increased after PFM.

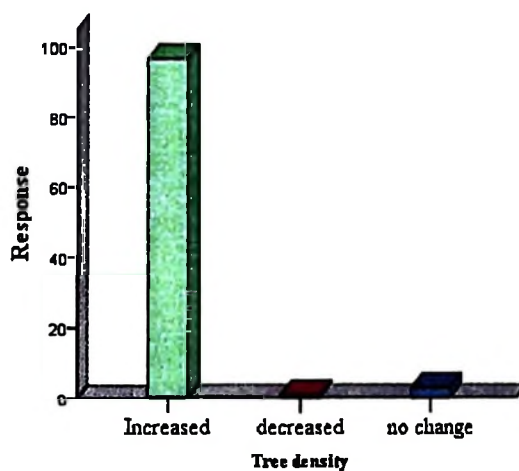


Figure 12: Protection practices adopted under PFM in the study area

These results imply that, since the establishment of the participatory forest management programme there was an improvement in forest cover for GNF. The current results concur with the results of Caroline (2008) who observed that the deforestation has been reduced in ANR and thus the PFM shows its positive impact on conservation of these efforts.

4.4.2 The potential impact of incentives to the livelihood of local communities

Table 11: Responses on IGAs before and after PFM

	Cell				
Activities	Karambo	Nkomane	Rusongati	Yungwe	Total
Employment					
Before PFM	0(0)	0(0)	0(0)	0(0)	0(0)
After PFM	14(9)	25(16)	4(3)	16(11)	59(39)
Total	14(9)	25(16)	4(3)	16(11)	59(39)
Beekeeping					
Before PFM	1(1)	0(0)	0(0)	0(0)	1(1)
After PFM	6(4)	0(0)	0(0)	0(0)	6(4)
Total	7(5)	0(0)	0(0)	0(0)	7(5)
Tree nursery					
Before PFM	0(0)	0(0)	0(0)	0(0)	0(0)
After PFM	13(9)	11(7)	3(2)	3(2)	30(20)
Total	13(9)	11(7)	3(2)	3(2)	30(20)

(Percentages are in parenthesis)

Income generating activities provide an important, indeed critical, component of PFM implementation strategy, especially where the direct and most other indirect benefits from forest management are limited. Ideally, IGAs should be able to reduce economic pressure on the protected forest resources. Experience suggests that the most successful IGAs are those that are based on an economic activity that is already being undertaken by the community.

According to the World Bank (2005), the participation of local users is encouraged by an annual flow of income from different IGAs, and also non timber products such as agricultural intercrops, fodder, and commercial valuable seeds fruits or leave. After the

active participation of local communities in Gishwati forest management, different IGAs have been created as reported by most of respondents in the area.

Employment is one of important IGA in the study area, 39% of all respondents have been employed after the PFM initiated during PAREF project activities. It was revealed that the money obtained from PFM activities are used for further household development. These results imply that PFM have impact on the changes of the income thus rising up the level of livelihood of people in the study area.

Beekeeping is another IGA carried out in the study area. 4% of respondents adopted beekeeping as their activity generating income after the PFM programme. Trees nursery is also an income generating activity and 20% of respondents who conduct it, said that it has been established when activities of restoring the forest started as Table 11 indicated. The impact of incentives to the livelihood of surrounding communities is shown by the income from those IGAs conducted under PFM. The household income from PFM initiatives was contributed by employment by average income per household per month of Frw. 27 000 as reported by local people. The contribution is given by PAREF project that offered around 3000 employments to local people in 2010 including different activities such as, tree planting, tree nursery, tour guides, etc.

Other income sources not from PFM initiatives in the study area were milk production, food crops like maize, beans, and cash crops like irish potatoes, cabbages, etc. The overall household income for the local people is estimated from the totality of farm income and off-farm income.

Table 7 showed that communities around GNF depend on maize, Irish potatoes, beans, cabbages, onions for food and cash crops, but still the crop production does not fulfil demand for household food security.

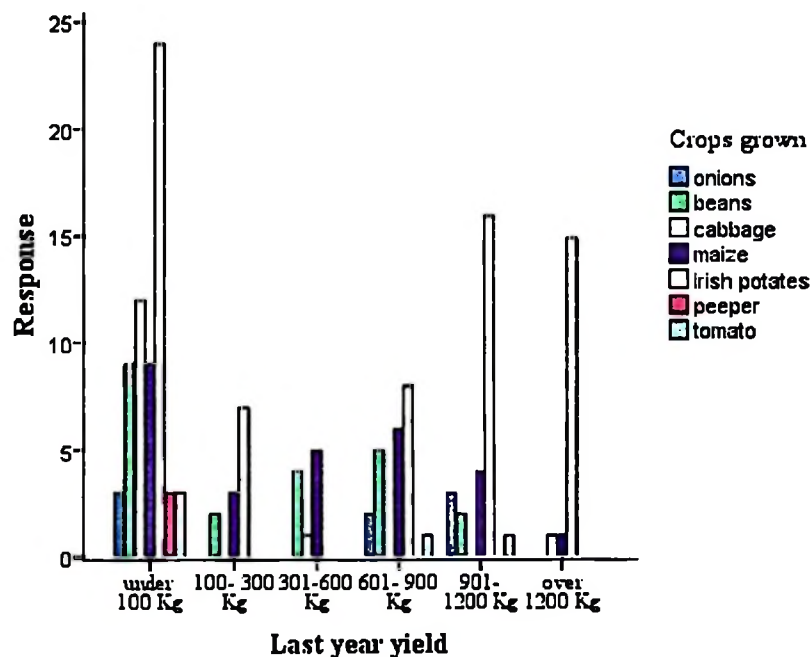


Figure 13: Reported frequencies for food security in the study area

The measured yields from crops like maize, beans, Irish potatoes are very low. The results of Fig.13 indicate last year's production of the most grown crops where about 9 respondents (about 7%), 24 respondents (about 16%) and 9 respondents (about 7%) got respectively maize, Irish potatoes and beans of less than 100 kg per year. This situation shows how households in the study area are suffering from food insecurity. Main reasons attributed to such situation are small land with big household size; low fertility of the soil; poor farming methods; and lack of inputs.

According to different studies, in natural forest and its surrounding areas; the soil was relatively fertile and initially gave reasonable crop yields but with time its productivity declined as nutrients reserves were depleted through harvesting, loss of organic matter, leaching and soil erosion (Georgia University, 2002). All these results imply that initiatives done by PFM still need more efforts, as income average contributing to the total monthly income is low.

Participation of local communities in activities related to PFM initiatives was investigated through a series of open-ended interviews questions. One of the PFM strategies is to create relationship between the forest staff agents and the communities around forest reserve. The increased interaction between the local people and the project is considered as one reason for those people's increased awareness to conservation. Table 12 of the results indicates some of factors that influence local community's perception and participation towards PFM activities. From the results, about 99% of all respondents said the forest to be important to them because it offers the potential for sustainable economic development and provides the essential global environmental services. About 83% of the respondents reported the forest to be managed effectively under PFM strategies although there are still some problems in the implementation of some activities and the power to decide over the use of the forest as reported previously.

4.5 Local Communities' Perception and Practice in relation to PFM Activities

Table 12: Communities' perception regards to PFM activities

Parameter	Cells				Overall
	Karambo	Nkomane	Rusongati	Yungwe	
Knowing the boundaries of the forest reserve					
I know	59(39)	58(39)	10(7)	23(15)	150(100)
I don't know	0(0)	0(0)	0(0)	0(0)	0(0)
Total	59(39)	58(39)	10(7)	23(15)	150(100)
Boundaries respecting					
It is respected	54(36)	52(35)	10(7)	21(14)	137(91)
Not respected	5(3)	6(4)	0(0)	2(1)	13(9)
I don't know	0(0)	0(0)	0(0)	0(0)	0(0)
Total	59(39)	58(39)	10(7)	23(15)	150(100)
The forest importance					
It is important	59(39)	57(38)	10(7)	22(15)	148(99)
Not important	0(0)	1(1)	0(0)	1(1)	2(1)
Total	59(39)	58(39)	10(7)	23(15)	150(100)
Current management (PFM) effectiveness					
It is effective	49(33)	49(33)	9(6)	18(12)	125(83)
Not effective	10(7)	9(6)	1(1)	5(3)	25(17)
Total	59(39)	58(39)	10(7)	23(15)	150(100)

(Percentages are in parentheses)

Furthermore Table 12 showed that 14% claimed the participatory management to be not effective with reasons that there is a poor benefit sharing mechanism. Involvement of community in forest management activities and awareness about forest protection has increased due to participatory management; the most perceived impact being their increase involvement in forestry related activities such as tree planting. From the PRA results communities reported that local authorities have put many efforts to update the surrounding people about the boundaries of the forest.

The results indicated that 100% of respondents know the boundaries of the forest which is a good indicator to their protection effects towards forest against damaging activities like illegal cattle grazing and encroachment.

The results also indicated that 91% of respondents said that boundaries are respected. The implication of these results is the positive participation in sustainable forest conservation. According to local people's perceptions, the most serious problem facing GNF is that there is the failure by the management to protect the young trees damaged by cows and illegal harvesting of some forest products (Table13).

Other problems include harvesting without replanting, fire in the forest, etc. However, when local people were asked what should consist a proper mix of solutions, most of them (Table 13) reported that disincentive and intervention of authorities are needed to fight for such problems.

Table 13: Reported responses for general problems and their proposed solutions in GNF

Response	Frequency	Percentage
General problems		
Fire in forest	21	14
Damaged young trees by cow	54	36
Illegal harvesting of forest products	52	34
Lack of tools	23	15
Proposed solutions		
Disincentives	73	49
Intervention of project authorities	23	15.3
Reinforce the protection through guards	54	36.0

The current GNF management is a concern for forest sector stakeholders including the central government, local government, private sector, local communities, NGOs and government institutions.

Their interests include providing employment to the local communities, collecting revenues from forest royalties, guiding the implementation of policy and legislation, forest protection, educating local communities on the importance of the forest, and delegating activities to other stakeholders in the management of the plantations. The effectiveness implementation, transparency and commitment in PFM can increase participation of local communities in forest management for utilization and conservation.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The general objective of the study was to assess the nature of incentives for participatory forest management in Gishwati Natural Forest. More specifically the study intended to address the following objectives (i) To identify the incentives offered to local people adjacent to GNF and the sources; (ii) To examine the perception of the local communities on the existing incentive structure; (iii) To study the potential impact of incentives to conservation and the livelihood of the surrounding communities and (iv) To identify factors that influence local community's perception towards PFM activities in the study area.

With regards to incentives, the study concluded that incentives have shown positive impacts on conservation and the livelihood of the local communities. This is based on findings which revealed that existing incentives such as wood fuel, fodder, honey, wild fruits and vegetables, medicine plants, etc have the potential to improve livelihood of the local people even if they are still limited in nature and sources.

The study further concludes that the income generating activities are still inadequate and too low to serve as incentives. The observations from the study revealed that people are still poor although the IGAs are trying to reduce their poverty.

Regarding factors influencing perception of the communities on incentives structure, the study concluded that local people's participation in various activities increases the success of different programmes introduced in their respective areas.

This is because findings indicated that lack of power to decide over the use and management of the forest and lack of community's involvement in benefit sharing are the factors that may decrease the willingness to participate and distort the implementation of participatory initiatives.

With regards to potential impact of incentives on conservation and livelihood of the communities, the study concluded that after the participation of people in forest management activities, the condition of the forest has been improved and thus improving their livelihoods. This is based on findings which revealed that incentives given to local people such as employment showed its positive impact on conservation. About 52% of respondents reported the forest to be in very bad condition before PFM but after many efforts that have been done about 33% of respondents reported that the condition of the forest has been improved as well as their livelihoods.

Furthermore, regarding factors influencing local community's perception towards PFM activities, the study concluded that communities have been influenced by the increased interaction between them and the project. This is based on study findings which revealed that such interaction was the major factor contributing to local people's increased awareness to conservation. The participatory management of the forest initiated by PAREF project had succeeded in meeting its main objectives of restoring Gishwati degraded forest and its biodiversity and improving livelihood of the people living in adjacent areas.

5.2 Recommendations

Basing on the aim of this study, the findings have gone through a range of incentives measures, many of these are being tried out though not always successfully; may others need to be introduced.

The study revealed that the level of people involvement in getting incentives is low in GNF. It is recommended that identification of relevant activities should be undertaken by communities to increase household income and catalyze their incentive to effectively engage in Participatory Forest Management. It is advised to start with activities which people already know and are already doing such as vegetable/fruit production and processing, honey processing, agro-forest conservation agriculture.

The study further revealed that income generating activities are still inadequate and too low to serve as incentives. People are still poor although the IGAs contribute to increase their income. It is recommended that introduction of new technology for income generating activities should be carefully designed to ensure that people have a better understanding of its comparative advantages and are assured of its sustainability beyond project timeframe.

Although the concept of incentives in PFM exist for a long time, its application remain new in Rwanda and few has been done on this practice. For this we faced a lack of scientific publications on the subject and for many communities the practice need to be explained in depth. In this case, future studies focus on how the approach should be strengthened are needed.

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APPENDICES

Appendix 1: Questionnaire for household survey

Section A. Household background Information

A.1 Questionnaire No..... Date of interview.....

A.2 Name of Interviewer.....

A.3 Basic Respondent's Information

Village/Cell/Sector	Gender	Age	Education level	Main occupation	Marital status	Household size (number of members)
	1 = Male		1 = None	1 = Farmer only	1 = Married	
	2 = Female		2= no completed primary	2 =Govt. employee	2 = Single	
			3 = primary	3 = Private employee	3 = Divorced	
			4 = post primary	4 = Self employee	4 = Widowed	
			5 = no completed secondary			
			6 = completed secondary			
			7 = university			

A.4 How long have you been in this area?

Section B. Farm Holdings

B.1 what is the main household economic activities?

1. Farming
2. Livestock keeping
3. Both farming and livestock keeping
4. Small business
5. Beekeeping
6. Others (Please specify).....

B.2 Do you own land in this village? 1. Yes 2. No

B.3 If yes in B.2, how did you acquire land you own?

1. Bought
2. Rented
3. Inherited
4. Given by the State

B.4 what is the agricultural land do you own (ha).....

B.5 is your land holdings adequate?

1. Yes ☐

2. No ☐

B.6 If no in B.5 give reasons

1.....

2.....

3.....

B.7 is it possible to get more land? 1. Yes 2. No

B.8 if yes how could you get it?

B.9 what type of crops grown, yield and cash generated last year (2010) in the area?

Crop	Type of crop grown	Last year's yield	Cash generated
1. Maize			
2. Potatoes			
3. Beans			
4. Peas			
5. Vegetables			
6. Other (specify)			

Section C: Livestock Production

C.1 Do you own livestock?

1. Yes ☐
2. No ☐

C.2 If Yes, which livestock do you own?

Type of animal	Number	Grazing/ Feeding system*	Cash generated last year
Cattle			
Goats			
Sheep			
Chicken			
Rabbit			
Other/ specify			

*Key:

- A. Communal lands
- B. Forest reserves
- C. Private owned pastures
- D. Indoor feeding
- E. Different grazing system

Section D. Perceived Incentives from the Forest Reserve

D.1 what type of benefits/incentives do the forest reserve provides to your household? and what amount would you be benefited, if converted in monetary terms?

No.	Household benefits	Quantity received	Community benefits

D.2 who is administrating the community/household benefits received?

D.3 how do these benefits influence household activities in relation to forest conservation?

D.4 what are the source of revenue in your forest reserve?

D.5 is there any member of your household employed by institutions? 1. Yes 2. No. If yes:

No.	Institutions name	Position	Location
1			
2			
3			

Section E. Local people's perception on the existing incentive structure

E.1 List the products and services you get from forest?

1.....

2.....

3.....

4.....

E.2 how do you get those products and services?

1. by permission

2. Illegally
3. Through laid down agreement
4. Others (please specify)

E.3 Are you involved in the management of the forest reserve? 1. Yes 2. No

E.4 If yes in E.3 what is your main role in managing and conserving the forest?

1. Tree planting both in the forest and outside the forest
2. Management of the planted trees
3. Forest protection
4. Tree nursery
5. Others (specify)

E.5 what is your opinion on the local people involvement in managing the forest reserve?

Level	Opinion			
	Very satisfactory	Satisfactory	Unsatisfactory	No opinion
Decision making				
Implementation of various activities				
Evaluation				
Benefit sharing				

Section F. The Potential Impact of Incentives to forest Conservation

F.1 what are the advantages of being involved in forest management?

F.2 what are the disadvantages of being involved in management of the forest?

F.3 how the forest looks like before and after this program (PFM)?

Section G. Local People's Perceptions and Awareness to Forest Reserve Management (through PFM activities)

G.1 who owns the forest reserve?

1. Central Government
2. Local government
3. Private institution
4. Individuals

G.2 In your view, is the current forest management effective? 1. Yes 2. No

G.3 If no in G.2 what are the reasons?

- 1.....
- 2.....
- 3.....
- 4.....

G.4 Do you know the boundaries of the forest reserve? 1. Yes 2. No

G.5 If yes in G.4, are they respected? 1. Yes 2. No

G.6 If No, give reasons

- 1.....
- 2.....
- 3.....
- 4.....

G.7 what are other institutions dealing with the management of this forest reserve?.....

G.8 Is the forest important to you? 1. Yes 2. No

G.9 If yes in G.8 what is the most important value of forest to you?

1. Provides products and services

2. Provides employment

3. Provides rainfall

3. Others (specify).....

G.10 Are there any conflicts with regards to management and use of the forest reserve? 1. Yes 2. No

G.11 if yes in G.10 please indicates any conflicts with the above stakeholders in:

1. Management and protection of the forest

2. Use of forest products and services

G.12 how are these conflicts resolved?

G.13 what are the general problems with the regards to forest management and use of its products?

G.14 What do you think can be a solution to those problems?

G.15 What are your perception regarding future intervention to improve condition of the forest?

1.

2.

3.

4.

5.

Appendix 2: Checklists for key informants

1. Local Leader

1. Name of local government/institution
2. Awareness on the importance of the forest reserve
3. Stakeholders and their interests in managing and use of the forest reserve
4. Effectiveness of forest reserve management activities by the forest manager
5. Perception of local leader regarding future interventions to improve conditions of the forest
6. Goods and services obtained from the forest reserve
7. Accessibility of goods and services obtained from the forest reserve
8. List major problems in management of the forest
9. Relationship of village leader with the above indicated stakeholder
10. Stakeholder platforms for meeting discussion and decision making
11. Any conflicts in management with the above stakeholder
12. Conflict resolution and management

2. Forest manager

1. Name of institution
2. Stakeholders and their interests in managing and use of the forest reserve
3. Stakeholder platforms for meeting discussion and decision making
4. Manager's role and mandate in the management of forest reserve
5. Manager's perceptions regarding future interventions to improve conditions of the forest
6. Goods and services obtained from the forest reserve
7. Accessibility of goods and services obtained from the forest reserve
8. Conflict management and resolution
9. Forest management relationship with other stakeholders
10. Functioning and, monitoring of participatory forest management and problems experienced on its implementation.

Appendix 3: Participatory Rural Appraisal (PRA)

1. Explanation of the village condition before and after independence, and before and after PAREF project intervention
2. The forest product obtained from the forest reserve
3. Forest product priorities
4. Institution dealing with the forest conservation
5. Incentives given to villagers before and after PFM
6. Economic activities of the local people