

**Analysis of the potential socio-economic impact of establishing  
plantation forestry on rural communities in Sanga District,  
Niassa province, Mozambique**

by

**Jennifer Landry**



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Supervisor: Prof Paxie W. Chirwa  
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## DECLARATION

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## **ABSTRACT**

This thesis assesses the livelihoods of rural households in a proposed green field forestry area, located in Sanga District of Niassa province, Mozambique. The livelihood analysis was used to analyze potential socio-economic impacts of introducing forest plantations to rural households located within the proposed afforestation area. The study made use of household interviews, key informant interviews and secondary data. The sustainable livelihoods framework was used in the research process to develop the household questionnaire and to identify livelihood strategies. Data was analyzed using 331 household questionnaires collected throughout the proposed afforestation area in various communities in the study area. Findings from the study indicated that there is minimal wealth gaps between rural households; but that the introduction of the forestry industry and the subsequent employment created thereof may result in larger wealth gaps between wage earning and non-wage earning households. The study further concludes by linking the potential socio-economic impacts with mitigation recommendations that could be harmonized with FSC Standard requirements for forestry companies interested in developing a forest industry in the study area.

## OPSOMMING

Hierdie tesis ontleed die lewensbestaan van landelike huishoudings in 'n voorgestelde nuwe bosbou area, gelee in die Sanga distrik van die Niassa provinsie, Mosambiek. Die lewensbestaan ontleding was gebruik om die potensiele sosio-ekonomiese impak van die vestiging van bosbou plantasies op landelike huishoudings in die voorgestelde bebossings area te analiseer. Hierdie studie het gebruik gemaak van huishoudelike onderhoude, sleutel informant onderhoude asook sekondere data. Die volhoubare lewensbestaan raamwerk was gebruik in die navorsings proses om die huishoudelike onderhoude te ontwikkel en om die huishoudelike strategie te identifiseer. Data was geanaliseer van 331 huishoudelike onderhoude afgeneem in verskeie gemeenskappe binne die studie areas. Bevindinge van die studie het aangetoon dat daar minimale inkomste gapings is tussen landelike huishoudings, maar met die vestiging van kommersiele bosbou en geassosieerde werskeppings moontlikhede, mag groter inkomste gapings ontwikkel tussen huishoudings wat inkostes uit bosbou verdien en huishoudings daarsonder. Verder het die studie aangetoon dat daar 'n potensiele sosiale impak is van mense wat na die area migreer en dat sulke impakte deur FSC sertifisering beheer kan word.

# TABLE OF CONTENTS

<b>DECLARATION.....</b>	<b>ii</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>iii</b>
<b>ABSTRACT.....</b>	<b>v</b>
<b>OPSOMMING.....</b>	<b>vi</b>
<b>LIST OF TABLES .....</b>	<b>xi</b>
<b>LIST OF FIGURES .....</b>	<b>xiii</b>
<b>ACRONYMS .....</b>	<b>xiv</b>
<b>CHAPTER 1: INTRODUCTION.....</b>	<b>1</b>
1.1    Background.....	1
1.2    Study rationale .....	3
1.3    Objectives and research questions .....	4
1.4    Thesis structure .....	5
<b>CHAPTER 2: LITERATURE REVIEW.....</b>	<b>6</b>
2.1    Natural resources and land use .....	6
2.1.1    Miombo woodlands.....	6
2.1.2    Household agricultural practices .....	7
2.2    Sustainable livelihood framework .....	8
2.2.1    Vulnerability context.....	9
2.2.2    Livelihood assets.....	10
2.2.3    Policies, institutions and processes .....	11
2.2.4    Livelihood strategies.....	11
2.2.5    Livelihood outcomes .....	12
2.3    Land tenure and land laws in Mozambique .....	12
2.4    Rural poverty .....	14
2.5    Socio-economic impact of forestry development .....	14
2.5.1    Socio-economic impacts of community forestry .....	15
2.5.2    Socio-economic impacts of commercial plantations.....	16

2.5.3	<i>Perceived socio-economic impacts of afforestation</i> .....	16
2.6	Chapter summary .....	17
<b>CHAPTER 3: METHODS</b> .....		<b>19</b>
3.1	Background .....	19
3.2	Description of case study area .....	19
3.3	Sample design and sampling methods .....	21
3.3.1	<i>Primary and secondary data</i> .....	21
3.3.2	<i>Household surveys</i> .....	22
3.3.3	<i>Household sampling strategy</i> .....	22
3.3.4	<i>Key informant interviews</i> .....	24
3.4	Data Analysis .....	25
3.4.1	<i>Wealth Categorization</i> .....	25
3.5	Statistical Analysis .....	29
3.6	Chapter summary .....	31
<b>CHAPTER 4: RESULTS</b> .....		<b>32</b>
4.1	General household information .....	32
4.2	Education .....	33
4.3	Health care and frequent illness .....	35
4.4	Household skills and income .....	36
4.5	Household Activities .....	36
4.6	Household <i>Machambas</i> .....	38
4.7	Housing type .....	39
4.8	Household assets .....	41
4.9	Agricultural Crops .....	42
4.10	Use of Natural Resources .....	43
4.10.1	<i>Indigenous trees</i> .....	43
4.10.2	<i>Land uses</i> .....	44
4.10.3	<i>Firewood</i> .....	45
4.10.4	<i>Use of traditional medicine</i> .....	45



4.10.5	<i>Water availability</i> .....	46
4.11	Household spending.....	46
4.12	Threats, coping mechanisms and food insecurity .....	47
4.13	Forestry awareness, participation willingness, and perceptions .....	51
4.13.1	<i>Perceived impacts and benefits of forestry on community</i> .....	52
4.13.2	<i>Perceived impacts and benefits of forestry on family</i> .....	53
4.13.3	<i>Perceived impacts of forestry on culture and tradition</i> .....	55
4.13.4	<i>Impacts on water and land availability</i> .....	56
4.14	Key informant interviews .....	56
4.14.1	<i>Potential impacts</i> .....	57
4.14.2	<i>Potential forestry development challenges</i> .....	57
4.15	Chapter summary .....	58
<b>CHAPTER 5: DISCUSSION .....</b>		<b>60</b>
5.1	Current socio-economic profile of households.....	60
5.1.1	<i>Factors contributing to household wealth</i> .....	61
5.2	Current livelihood strategies .....	63
5.2.1	<i>Livelihood portfolios</i> .....	65
5.2.2	<i>Coping mechanisms</i> .....	66
5.3	Natural resource use.....	67
5.4	Income sources and expenditures .....	69
5.5	Potential socio-economic impacts of introducing forestry industry .....	70
5.5.1	<i>Land use change and land availability</i> .....	71
5.5.2	<i>Water and natural resource availability</i> .....	72
5.5.3	<i>Reduction in household labor</i> .....	73
5.5.4	<i>Increase in traffic</i> .....	73
5.5.5	<i>Cultural and social impacts</i> .....	74
5.6	Chapter summary .....	75

<b>CHAPTER 6: CONCLUSION AND RECOMMENDATIONS</b> .....	<b>76</b>
6.1 Conclusion .....	76
6.1.1 <i>Current status of rural households prior to forestry</i> .....	76
6.1.2 <i>Socio-economic impacts of forest plantations</i> .....	76
6.2 Recommendations for mitigating adverse socio-economic impacts.....	80
6.3 Relevancy of FSC Standard in Addressing Socio-economic Impacts .....	85
6.4 Chapter summary .....	85
<b>APPENDIX I</b> .....	<b>95</b>
<b>APPENDIX II</b> .....	<b>110</b>

## LIST OF TABLES

Table 2.1: Commonly reported positive and negative perceptions of social and economic impacts from afforestation .....	17
Table 3.1: Wealth ranking values for housing characteristics .....	27
Table 3.2: Key assets for wealth categorization and their associated wealth indicator values .....	28
Table 3.3: Frequency table showing assets and the number of households that own them. ....	28
Table 4.1: Percentage and number of households receiving medical attention. ....	35
Table 4.2: Percentage and number of households experiencing frequent illness .....	35
Table 4.3: Percentage of households with assets, mean rank and standard deviation (SD), and average number assets owned per household.....	42
Table 4.4: Percentage and mean rank with standard deviation (SD) of household cultivating agricultural crops used for consumption and sale.....	43
Table 4.5: Most frequently (%) reported trees used by households (please note: not all of the trees reported by households are presented; only the top 5 are reported).....	44
Table 4.6: Results of ranking land classes of most importance.....	44
Table 4.7: Results of ranking land classes households would be willing to give up for forestry .....	45
Table 4.8: Frequency of households spending, mean rank and standard deviation (SD) of spending.....	47
Table 4.9: Frequencies of coping mechanisms used by households to deal with threats .	49
Table 4.10: Time of year households suffered from food insecurity.....	50
Table 4.11: Summary of household perceptions of benefits forestry will have on community .....	52
Table 4.12: Summary of household perceptions of impacts forestry will have on community .....	53
Table 4.13: Summary of household perceptions of benefits for family if they were employed by Forestry Company.....	53
Table 4.14 Summary of household perceptions of impacts on family if they were employed by Forestry Company.....	54
Table 4.15: Summary of household perceptions of benefits for family if they were not employed by Forestry Company.....	54
Table 4.16 Summary of household perceptions of impacts on family if they were not employed by Forestry Company.....	55

Table 4.17: Summary of households perceived impacts on local culture and tradition ...	55
Table 4.18: Households perceived impacts on water availability with introduction of plantation forestry .....	56
Table 4.19 Households perceived impacts on land availability with introduction of plantation forestry .....	56
Table 6.1: Summary of the potential socio-economic impacts of industrial forestry on rural households, and associated mitigation recommendations and FSC Standard Criterion .....	77

## LIST OF FIGURES

Figure 2.1: Sustainable livelihood framework.....	9
Figure 3.1: Diagram showing Mozambique and provinces, and a close-up of the Niassa province of Mozambique, and the Sanga district (study area).....	20
Figure 3.2: Map showing the communities within the Sanga District that were sampled, only communities within the proposed plantation area were sampled .....	23
Figure 3.3: Histogram plotting the total household <i>machamba</i> area.....	26
Figure 3.4: Histogram showing the wealth values of households.....	29
Figure 4.1: Age distribution of all household members .....	33
Figure 4.2 Education levels of heads of households.....	33
Figure 4.3: School attendance of children .....	34
Figure 4.4: Household skills and frequency of households that receive an income from the associated skill.....	36
Figure 4.5: Summary of regular household activities and by whom they are performed.....	37
Figure 4.6: Summary of when (time of year) activities are performed by households ....	38
Figure 4.7: Summary of the main housing material of the households .....	40
Figure 4.8: Summary of the window types of houses.....	40
Figure 4.9: Summary of the house sizes .....	41
Figure 4.10: Summary of the roofing materials used on houses.....	41
Figure 4.11: Frequency of threats experienced by households.....	48
Figure 4.12: Months of food insecurity experienced by households.....	49
Figure 4.13: Results of bootstrap analysis of head of household gender and number of months of food insecurity.....	50
Figure 4.14: Frequency of land available for planting by households that were willing to participate in planting program.....	51

## ACRONYMS

CBNRM	Community Based Natural Resource Management
DFID	Department of International Development
FSC	Forest Stewardship Council
GIS	Geographical Information System
NGO	Non-Governmental Organization
SIDA	Swedish International Development Cooperation Agency
SD	Standard Deviation
SLF	Sustainable Livelihoods Framework

# CHAPTER 1: INTRODUCTION

## 1.1 Background

Economic development in Mozambique has been hampered due to the civil war which lasted for 16 years (World Bank, 2008). Marking the end of the civil war in 1994, the government of Mozambique has been working at creating opportunities for economic development throughout the country (Cramer & Pontara, 1998). In developing countries<sup>1</sup> such as Mozambique, governments view forestry as a means of economic development in rural communities, as it aids economic development by generating revenue (Charnley, 2005) and foreign exchange from exports of forest products or through import substitution (Evans and Turnbull, 2000). In the Niassa province of Mozambique, government is actively promoting forestry development as a means of economic development and poverty alleviation<sup>2</sup> (Manhiça, 2007).

Niassa is located in the north western part of the country and is the poorest province in the country. The province has a great deal of potential for agriculture, forestry and eco-tourism development due to land availability and wildlife resources. The soils on the Lichinga plateau in Niassa are fertile, and there is high rainfall and ideal temperatures (Herbert, 2007) which are the key growing conditions necessary for plantation forestry and agriculture.

In order to facilitate economic development in Niassa, the government in partnership with Swedish International Development Cooperation Agency (SIDA) are funding a private sector support program called the Malonda foundation ([www.niassa.net/malonda](http://www.niassa.net/malonda)). The Malonda foundation offers assistance to interested investors, helping them get launched in Lichinga (Cuellar et al., 2006) and has been actively promoting plantation development in the Niassa Province by matching landowners with prospective Forestry Companies

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<sup>1</sup> Developing country refers to a country that is poor and whose citizens are mostly agricultural workers but that wants to become more advanced socially and economically. [www.wordwebonline.com](http://www.wordwebonline.com)

<sup>2</sup> Poverty Alleviation can be defined as a successful lessening of deprivation of well-being, or successful prevention of increase in deprivation (Sunderlin, 2006).

(Flynn & Neilson, 2007). Malonda's goal is to reduce poverty in Niassa by strengthening private sector institutions ([www.niassa.net/malonda](http://www.niassa.net/malonda)).

Since the initiation of the Malonda foundation there has been growing interest by Forestry Companies to initiate commercial forestry plantations (Flynn & Neilson, 2007) in the Lichinga region of Niassa. As part of the economic development plan for the province, the government of Mozambique has a concession area of approximately 400 000 hectares of state land available for private sector forestry development (Cuellar et al., 2006). These concession areas are delineated in open common lands and lands formerly used for agriculture. Portions of this available land will be leased to suitable private investors that can demonstrate sustainable forest management by reaching annual performance targets and complying with Forest Stewardship Council (FSC) certification standard. Some plantation development has already begun and there has been interest by additional forestry companies in establishing *eucalyptus* plantations for the production of pulpwood and solidwood. There are currently five forestry companies investing in plantation establishment in the Niassa province (Manhiça, 2007).

Much of the land available for forestry development is occupied by rural Mozambicans practicing shifting agriculture. According to the latest census done in 2007, Mozambique has a population of 20.5 million people (Instituto Nacional de Estatística, 2007), approximately 70% of which live in rural areas (Suca, 2001). According to Cramer and Pontara, (1998), two thirds of the rural population is deemed to be absolutely poor. The population density in Niassa according to the 2004 Census is 7.5 inhabitants per square kilometre (Instituto Nacional de Estatística, 2004), which is one of the lowest densities in the country. The proposed forestry development area will be surrounded by rural communities. The conversion of some 400 000 hectares of land into forestry plantations has raised concerns amongst various stakeholders regarding the social economic impacts that may be created (Cuellar et al., 2006). Hence, this issue will be addressed in this study.



## 1.2 Study rationale

The introduction of forestry plantations will result in significant land use changes that will impact the livelihoods of rural households. Before implementing such development in Niassa it is important for forestry companies to understand the livelihood strategies of rural residents and their reliance on the existing natural resources. The strength of evaluating livelihoods using the Sustainable livelihoods framework (SLF) is that it focuses on the people (SLF is discussed further in Chapter 2). Understanding the livelihood strategies of people will help to formulate a forestry establishment program to; mitigate any impacts on rural livelihoods, monitor livelihood criterion indicators over time, and identify conservation requirements in order to manage the land in a way to conserve livelihood aspects (ex. natural plant species, cultural lands, agricultural resources, water). Specifically, a household livelihood study of rural residents will provide insight and understanding of aspects such as; how natural resources are currently used, the skills and education levels of the residents, their coping mechanisms to shocks and stresses, and their views on plantation forestry. Putting people at the centre rather than material well being of the states will ensure sustainable human development in the communities in lieu of focusing solely on economic development opportunities. Sustainable human development includes the expansion of income and wealth, but it also includes many other valued and valuable things (Grima et al., 2003). Hence one would want to understand the importance of forestry for sustainable livelihoods beyond economic benefits.

There is a lack of information on the socio-economic conditions before and after establishment of forestry plantations (Charnley, 2005). This study will help to address this gap. The baseline data that will be collected in this study will allow the impacts of forestry to be monitored throughout the development of plantations to show the before and after scenarios of pre and post forestry plantations.

The findings of this study will help serve as useful guidelines for forestry companies looking to initiate new forestry developments in Niassa. The outcomes of this study will provide the necessary information and tools to; put in place a monitoring plan to evaluate poverty alleviation and socio-economic impacts of local economic development

initiatives such as forestry, agriculture and tourism. The study will further provide recommendations for mitigation programs that will need to be put in place by forestry companies to offset any potential negative impacts. Recommended mitigation measures will also be cross referenced with relevant Forest Stewardship Council (FSC) criterion indicators to show how recommended programs will also meet FSC requirements and to expose possible gaps in the certification standard. The FSC standard is the chosen standard since it is internationally recognized and is a requirement by Mozambique government in the concession area.

### **1.3 Objectives and research questions**

The main aim of this study is to identify and analyze the potential socio-economic impact of a green field forestry project on the livelihoods of rural residents in the rural district of Sanga located 60 km north of Lichinga, in the Niassa Province of Mozambique. Specifically the study will have the following objectives and associated research questions;

Specific Objective 1: To evaluate the current livelihoods of rural households prior to the introduction of proposed forest activities

#### *Research Questions*

1. What are the current socio economic profiles of the rural households?
2. What are the livelihood strategies of the rural households?
3. How are lands and natural resources used by the rural households?

Specific Objective 2: To identify the socio-economic impact of forest plantation establishment on the rural households of Sanga

#### *Research Questions*

1. How may the introduction of forestry impact the current socio economic profile of the rural households?
2. How may the introduction of forestry impact rural household livelihood strategies?

3. How may the introduction of forestry impact rural households use of land and natural resources?

Specific Objective 3: To formulate recommendations for forestry companies to mitigate possible adverse socio-economic impacts associated with a green field project in forestry

*Research Question*

1. How does the Forest Stewardship Council (FSC) standard address identified potential socio-economic impacts?

## **1.4 Thesis structure**

This thesis consists of six chapters. Chapter two consists of a literature review of current land use and agricultural practices in Mozambique, a description of the sustainable livelihoods framework, an overview of land tenure in Mozambique, a discussion on rural poverty, and a review of socio-economic case studies that have been conducted. Chapter 3 discusses the research strategy, a description of the case study area, sampling design and methods, and data analysis methods. Chapter 4 presents the results of the research, chapter 5 discusses the findings of the study, and chapter 6 will conclude the thesis and present recommendations.

## CHAPTER 2: LITERATURE REVIEW

This chapter reviews literature related to the Miombo woodlands and the use of natural resources in Mozambique and other Miombo woodland areas. The importance of agriculture to rural households and a description of their current practices is reviewed. The sustainable livelihoods framework is presented which describes the key components of the framework and the assessment of livelihoods and livelihood strategies. This chapter also provides a brief description of the land tenure and land laws in Mozambique. Finally, case studies that were found in the literature regarding socio-economic impacts as a result of forestry are highlighted.

### 2.1 Natural resources and land use

#### 2.1.1 Miombo woodlands

The existing forest lands surrounding the proposed forestry area are Miombo woodlands. Miombo is the most extensive tropical seasonal woodland and dry forest formation in Africa. It covers substantial portions of South and Central Africa; Angola, Zimbabwe, Zambia, Malawi, Mozambique, Tanzania, and the southern part of Democratic Republic of Congo (DRC) (Campbell et al., 2007). These woodlands have over 20 vegetation types with more than 190 species of trees and shrubs (Herbert, 2007). Miombo woodlands are characterized by three Caesalpinoide genera; *Brachystegia*, *Julbernardia*, and *Isoberlinia*. The species in this genus produce hard timber, and have many fibrous, tannin rich barks (Campbell et al., 2007). These species are not desirable species for plantation forestry or pulp production.

Deforestation of Miombo woodlands is of great concern, and in Miombo countries statistics of woodland cover continues to show a decline. The Miombo woodlands play a significant role in the livelihoods of neighboring communities (Campbell et al., 2007). Although Miombo woodlands will not be harvested to make way for forest plantations, the plantations established in arable areas may push nearby residents into opening new frontiers and harvest Miombo woodlands (Maung and Yamamoto, 2008). Miombo

woodland cover is declining mainly due to land clearing for agriculture and wood extraction for energy (Campbell et al., 2007). In order to protect Miombo woodlands, conservation initiatives in Mozambique include the Niassa reserve situated in the north of the province, which is the largest Miombo conservation area (42 000 km<sup>2</sup>) in the country (FAO, 2005); and the Wildlife and Forestry Laws promote conservation of natural resources through local community, associations and private sector participation (Salomão and Matose, 2007).

The forest resources are invaluable to rural and urban populations where poverty and dependence on forestry resources are high. Rural communities use fuel wood for cooking and in urban areas charcoal is widely used as a major source of energy for cooking. Many of the tree species found in the Miombo woodlands have multiple uses and are protected by the communities because of their importance and traditional beliefs. Some trees are left uncut in agricultural areas either because they are fruit trees, have medicinal purposes, or have spiritual values. Some trees are protected because they are believed to produce water, these trees grow along rivers and people believe that if you cut them the water source will go dry. Many of the products produced by the Miombo woodlands are sold in local and urban markets and provide an income to the rural people (Salomão & Matose, 2007).

The main economic activities in Miombo woodlands include; charcoal production, building material harvesting, honey production and sales, fuel wood collection, hand sawing for timber, wooden furniture production (Salomão & Matose, 2007), food gathering, animal husbandry, hunting, fishing, and traditional medicines (Makonda & Gillah, 2007).

### **2.1.2 Household agricultural practices**

Various authors (Cueller et al., 2006; Johnstone et al., 2004) have highlighted subsistence farming as the mainstay of the local people in the proposed forestry area. Miombo woodlands surrounding rural communities are harvested and cleared so that *machambas* can be established. *Machambas* are household agricultural plots where crops such as; maize, beans, cassava, and sweet potatoes are cultivated (Ministério da Administração

Estatal, 2005) for both sustenance and income (Salomão & Matose, 2007). The average size of a household *machamba* is 1.6 hectares in size (Cueller et al., 2006).

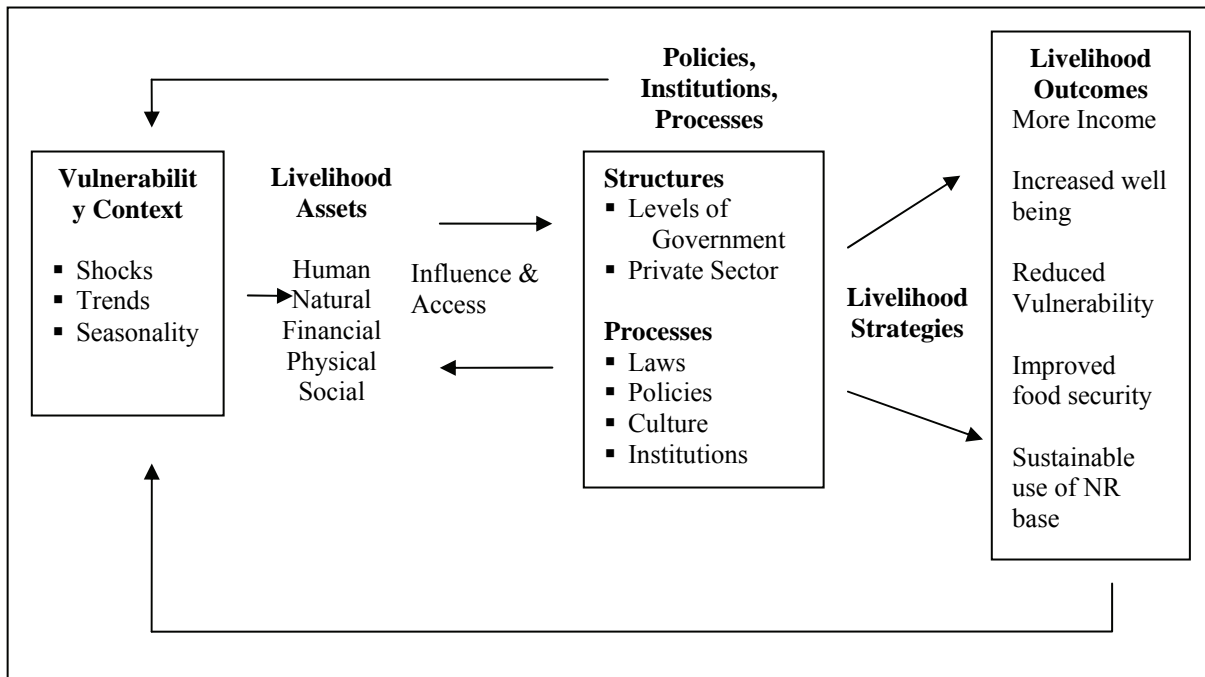
In Niassa, rural communities practice shifting agriculture. *Machambas* are used for 2-3 years, after which farmers move to a new site to cultivate their *machambas* on newly cleared land. If farmers had the means to buy or produce fertilizers these *machambas* could be used longer (Cueller et al., 2006). In lower wetter sites called *dambos* or wet *machambas* they cultivate green leafy vegetables, potatoes and tomatoes. *Machambas* in the wetter sites are used for a longer period, sometimes more than 10 years. These soils are much more fertile and are occasionally improved with organic fertilizers (Herbert, 2007).

## **2.2 Sustainable livelihood framework**

The sustainable livelihoods (SL) framework (Figure 2.1) is an established and increasingly used model by research and applied development organizations, including the Department of International Development (DFID) (Adato & Meinzen-Dick, 2002). The conceptual framework analyzes causes of poverty, people's access to resources, livelihood activities, and their relationships (Adato & Meinzen-Dick, 2002; Bond et al., 2007).

The livelihoods framework (Figure 2.1) can be applied to various scales of livelihood analysis, for example; researchers can look at individual livelihoods, households, community, a region or even a nation (Scoones, 1998). This framework puts the reality of households at the centre of analysis and investigates the economic, ecological, and social factors which determine their ability to construct sustainable livelihood strategies. This form of analysis looks at more than just incomes and/or consumptions, and provides a better understanding of poverty and how households make a living (Rakodi, 1999). A household is deemed sustainable when it can cope and recover from stresses and shocks, maintain and enhance its capabilities and assets, while not undermining the natural resource base (Scoones, 1998). Assets are very complex, highly diverse, sometimes sensitive, and quantitative in nature (Bond et al., 2007). To cover all of the details of people's livelihoods in a study would be daunting and when applying the framework you

can not include everything on the checklist, therefore researchers must prioritize what it is that they want to evaluate (Adato & Meinzen-Dick, 2002).



**Figure 2.1: Sustainable livelihood framework**

Source: Adapted from Adato and Meinzen-Dick 2002

### 2.2.1 Vulnerability context

The framework begins with the vulnerability context within which people operate. Vulnerability reflects the lack of safeguards against unforeseen events such as; social conventions (dowry, funerals, weddings), disasters, physical incapacity (sickness, child bearing, and accidents), unproductive expenditure, and exploitation. Such contingencies often force poverty ratchets, requiring the sale and loss of assets to cope, thus making people poorer and more vulnerable to becoming even more poor (Chambers, 1983). The vulnerability context encompasses;

- *trends* in population, resources, and economic indicators such as prices, governance, or even technology
- *shocks* such as changes in human or animal health, natural disasters, sudden economic changes, or conflict; and

- *seasonality* in prices, agricultural production, employment opportunities, resource availability, or health (Adato and Meinzen, 2002).

### **2.2.2 Livelihood assets**

The next part of the framework deals with the five core capitals/assets (livelihood platform or capital assets framework) that households access and utilise for their diverse livelihood strategies, and that provide sustainability to their livelihoods (Bond et al., 2007). A livelihood as defined by Chambers and Conway (1992) comprises the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living. This definition is a popular definition and has been used by several researchers adopting a rural livelihoods approach (Ellis, 2000).

The five assets that have been identified to be the key components to a livelihood platform include; natural capital, physical capital, human capital, social capital, and financial capital. All of which are closely linked together (Pandey, 2005) as follows:

- Natural Capital is essentially the resources that are available to the households including; land, water and other environmental or natural resources. Rural poor households are heavily dependent on natural resources for food, energy, water, and building materials (Radoki, 1999) which are resources useful for sustainable livelihoods. Another form of natural capital is the possession of livestock (Kragden et al., 2001).
- Physical Capital or produced capital is the basic infrastructure, the agricultural implements, household assets and the means that enable households to pursue their livelihoods (Radoki, 1999, Kragden et al., 2001). Improved access is a physical capital such as roads, or transportation. Another example is electricity supply which enables households to invest in equipment which may lead to a means of earning better incomes (Radoki, 1999).
- Human Capital is the quantity and quality of labour resources available to households. This could include the number of people available in the household capable of taking advantage of opportunities of economic activities. Such opportunities may be constrained by the age, sex, skills, education and health of



the people in the household. Secondly their time may be constrained by the demands of household maintenance which is influenced by the household dependency ratio (Radoki, 1999).

- Social Capital is defined as 'the rules, norms, obligations, reciprocity and trust embedded in social relations, social structures, and society's institutional arrangements, which enable its members to achieve their individual and community objectives'. It includes social relations at the household, community and societal levels, but in order to measure this relationship we must rely on indicators (Radoki, 1999). Linked with social capital and not separately identified is political capital which is based on access to decision-making (Radoki, 1999).
- Financial Capital is the financial resources such as; earnings, credit, savings, etc., that people use to achieve their livelihood objectives (Radoki, 1999). Financial capital allows people to adopt different livelihood strategies and can be converted into other types of capital. However, this asset is usually the least available to the poor (Kollmair & Gamper, 2002).

### **2.2.3 Policies, institutions and processes**

The policies, institutions and processes refers to the informal and formal organizations that shape livelihoods by influencing access to assets, livelihood strategies, vulnerability and terms of exchange. These can include different levels of government, laws, the private sector, non government organizations, culture, and institutions (Adato & Meinzen-Dick, 2002).

### **2.2.4 Livelihood strategies**

All of these components that make up the livelihoods framework influence people's livelihood strategies (Adato & Meinzen-Dick, 2002). Livelihood strategies are the ways that households try to improve or sustain their livelihood (Kragden et al., 2001). Three livelihood strategies have been identified within the livelihood framework which include; agricultural intensification/extensification, livelihood diversification, and migration (Scoones, 1998; Radoki, 1999). Agricultural intensification/extensification is when people gain more of their livelihood from agriculture either through intensification

(producing more output per unit area through capital input or increased labour) or extensification (increase the amount of cultivated land). Livelihood diversification is when people earn an income through other activities apart from agricultural land, or people migrate elsewhere to seek employment either temporarily or permanently (Scoones, 1998).

The reality of poor people is that in order to survive they must pursue diverse activities, by different family members taking advantage of different resources and opportunities at different times. Multiple livelihood strategies are used to make enough income or to provide more security. Sometimes this is seasonal where family members pursue different activities at different times of the year (Adato & Meinzen-Dick, 2002)

### **2.2.5 Livelihood outcomes**

The final part of the framework is the livelihood outcomes which are shaped by the vulnerability context and the assets. The livelihood outcomes are often the types of impact that researchers are interested in. But these outcomes are not the end since they will feedback into the future assets (Adato & Meinzen-Dick, 2002).

## **2.3 Land tenure and land laws in Mozambique**

Land tenure and clear titles to the land are major issues that play a crucial role in poverty alleviation, vulnerability, and the livelihoods of the rural poor. Land in terms of the sustainable livelihoods framework is a physical capital, and improved access to physical capital is an essential element of strategies to reduce household poverty (Radoki, 1999).

In Mozambique, the state is responsible for the ownership, management and administration of the land. The management and administration of the land has been delegated to a variety of stakeholders including agencies of the state, the private sector, and local communities under customary arrangements (Salomão & Matose, 2007). A study by Clement and Amezaga (2009) revealed that when land was under state control, the local communities did not have sense of custodianship and therefore destroyed the forest. However, once land rights are placed with the communities, there is increased awareness and the forest become a public good; and communities put in place rules and

regulations to protect them. In the Sanga District, local communities are under customary arrangements. Private sector activities such as forestry and land use changes are administered and approved by local government. (Manhiça, 2008).

In 1997, the government of Mozambique approved three main policies and strategies to guide the management of natural resources. The first policy is the National Land policy which recognizes traditional ownership. This policy also empowered local communities, by allowing them to participate in the delimitation and categorization of land uses in their communities and the recognition of the land uses by government (Nhantumbo et al., 2001). The second policy is the National Forestry and Wildlife Policy, which empowers the local communities with ownership and participation in the management of natural resources through community-based natural resource management (CBNRM) initiatives. The policy has shifted from large investments in forestry plantations by government to a participatory management approach, where the State intends to manage the natural resources as a joint venture with the private sector and the local communities (Nhantumbo et al., 2001). The third policy is the National Environmental Law. This policy does not involve the communities directly but serves to protect the environment by providing regulations that minimize negative environmental impacts resulting from development activities and/or irrational use of natural resources (Ntantumbo et al., 2001).

The challenge is the integration of the goals of the various stakeholders; the state, the communities, and the private sector. From these policies laws were passed. In 1997 the Land Law was adopted, which states that the right to use and occupy land can be acquired through customary tenure, continuous occupation or official authorisation (Herbert, 2007).

In 1999 the Forestry Law was adopted; consistent with the National Forestry and Wildlife Policy, it recommends integrated management of natural resources that ensures effective participation of local communities, associations, and the private sector. It furthermore establishes that the involvement of the private sector in natural resource management should aim at furthering local community development (Salomão & Matose, 2007). More specifically, under the Forestry and Wildlife Law of 1999, the main rights and

benefits for forest dependent communities are as follows; subsistence level use of resources; participation in co-management; community consultation and approval prior to allocation of exploitation rights to third parties; development benefits derived from exploitation under a concession regime, return of 20% of forestry tax revenue to the communities; and 50% of the value of fines received by the individual contributing to law enforcement (Johnstone et al., 2004).

## **2.4 Rural poverty**

In Mozambique the rural poor can be described as living in extremely isolated and self contained households (Cramer & Pontara, 1998). As a result of the isolation, they tend to be subsistence orientated and their survival strategy is focused on self sufficiency rather than trade related exploitation. In parts of Mozambique trade activities have increased over the last 10 years; in terms of numbers of kiosks, shops and visits by traders. However, most of the market interaction is local and small scale (Eriksen & Silva, 2009).

A number of studies of rural poverty in Mozambique have noted the importance of access of rural households to cultivable land and how it is considered the critical factor in their survival (Cramer & Pontara, 1998). Mozambique resembles poor rural areas in other countries, where local communities either inhabit or use resources on lands under the custodianship of the state according to customary rights of resource tenure (Charnley, 2005). Despite a slight differentiation regionally, in general, the poor in Mozambique can be described as peasants. Typically, the most disadvantaged in the communities are the women, especially those in female headed households. For this reason, special attention should be paid to female headed households and other relevant categories of people when looking at poverty in communities (Cramer & Pontara, 1998).

## **2.5 Socio-economic impact of forestry development**

Through a review of literature studies that have been done to evaluate socio economic impacts of forestry plantations two broad categories were identified, which include; socio-economic impacts of community forestry (natural forests and plantations) on rural livelihoods, and socio-economic impacts of farm forestry and land use changes (commercial plantations) on rural communities.

### **2.5.1 Socio-economic impacts of community forestry**

Community forestry in Nepal was not very successful in improving livelihoods due to inequitable distribution of the benefits accrued from natural resources where more elite members of the community were provided with more access (Thoms, 2008; Adhikari et al., 2003). Access to natural resources was also an issue identified in a study of impacts of teak plantations by Maung and Yamamoto (2008) in Myanmar. As a result of inadequate access, destruction of teak plantations, agricultural encroachment and illegal logging were problems that arose since locals did not have access to resources on which to survive, therefore in difficult economic times they would use the plantations (Maung & Yamamoto, 2008). Similarly in Africa, securing benefits from forests is expected to improve livelihoods of forest dependent communities at the household, village, and community levels. The benefits take the form of financial returns from the sale of forest products, lease of forest resources and collection of fines. The other benefits are secured rights over local resources; reduced vulnerability through a sustainable supply of forest goods and services and improved partnerships with external institutions such as local governments and other service providers (Blomley and Ramadhani, 2006). Involvement of various stakeholders, especially local communities, in natural resource management projects has generated successful and sustainable results in several West African countries, such as Benin, Burkina Faso, Cote d'Ivoire and Mali (World Bank, 1998). The involvement of communities in forest management is now a significant feature of national forestry policies and practices and of internationally supported programmes throughout the world (Fisher, 1999; Shackleton *et al.*, 2002).

The impacts found in community forestry are not directly applicable since community forests (either natural forests or plantations) are managed by the community members. Even though community forestry differs from the proposed Greenfield plans in terms of management, two important points were apparent from some of the community forestry studies; the need to ensure equity amongst community members when providing employment opportunities and the importance of ensuring people have access to sufficient natural resources to continue their livelihoods.

### **2.5.2 Socio-economic impacts of commercial plantations**

There are few studies that have evaluated socio-economic impacts which accompany plantations establishment and there is a need to study different modes of plantation industry development and their impacts (Schirmer, 2006). There are other countries that have commercial plantations established but only studies from Australia and New Zealand was found in the literature. Perhaps in the cases of commercial plantations owned privately companies have conducted their own socio-economic impact studies but have not published them. The situation in Australia and New Zealand are again different from the situation proposed in Mozambique. In Australia and New Zealand the primary difference is that commercial farm lands are purchased by private forestry companies and later converted into plantations (Schirmer, 2006; Aldwell & Whyte, 1984; Farnsworth, 1983). Therefore the land ownership differs and one would suspect that the socio-economic impacts to communities in Australia would be less than Mozambique given the number of families living around the proposed plantation areas and their low level of economic diversity (Tonts et al., 2001).

### **2.5.3 Perceived socio-economic impacts of afforestation**

In a literature review by Schirmer (2006) of conflicts over afforestation all over the world some common issues arose that can be applicable to Mozambique. Table 2.1 presents the most commonly reported positive and negative perceptions of social and economic impact as a result of afforestation.

**Table 2.1: Commonly reported positive and negative perceptions of social and economic impacts from afforestation**

	<b>Positive Perceptions</b>	<b>Negative Perceptions</b>
<b>Social</b>	Provides an exit from farming (more applicable to farm lands being purchased by afforestation companies)	Can lead to a decline in rural populations if there is not enough land for residents to continue their livelihoods
	Can improve local/regional markets by increasing spending	Decrease in population can result in a decrease in social services (i.e. schools, health services, markets).
	Can revitalize declining rural communities by creating new employment opportunities and new industry	Loss of culture and sense of identify with changes of land use, population, and/or landscape
	Increase quantity of jobs	Can provide less employment per hectare than other alternative land uses
	Increase quality of jobs	Decreased quality of jobs
	May be safer than other land use alternatives	Increased health and safety risks for locals (fire risks, road safety issues, chemicals, etc)
<b>Economic</b>	Can enhance the landscape and increase tourism	Affects visual aesthetics of the landscape, can adversely effect tourism
	Can increase land prices and property values	Increased land prices may make it difficult for people to buy land, or cam decrease land value since people will not want property bordering plantations
	Can provide benefits to farms and rural land management	Takes up land needed for other uses such as agriculture
	Help to improve soil stability, water quality and wildlife habitat	Adversely affect neighbours; run-off of chemicals, spread of weeds, erosion, changing water quality/quantity, and/or providing habitat for unwanted pests.

Source: Adapted from Schirmer, 2006

## 2.6 Chapter summary

The literature reviewed the importance of Miombo woodland and agriculture to the livelihoods of rural households. It also provided an overview to the sustainable livelihoods framework for conducting livelihood assessments of poor rural households. A review of the land tenure and land laws in Mozambique revealed that rural communities have traditional ownership. Communities have the right to use and occupy

lands, and are entitled to participate in land use planning but it appears that it is the government that ultimately has the final say. Finally, the literature reviewed the socio-economic impacts of introducing plantation forestry. The following chapter will present methodology that was used to evaluate the livelihoods of the rural households, and potential impacts of afforestation.



## **CHAPTER 3: METHODS**

This chapter provides a description of the study area as well as some background on the livelihoods framework and why it was used. The methodology also describes how primary and secondary data were collected to conduct and how the data was analyzed to interpret results.

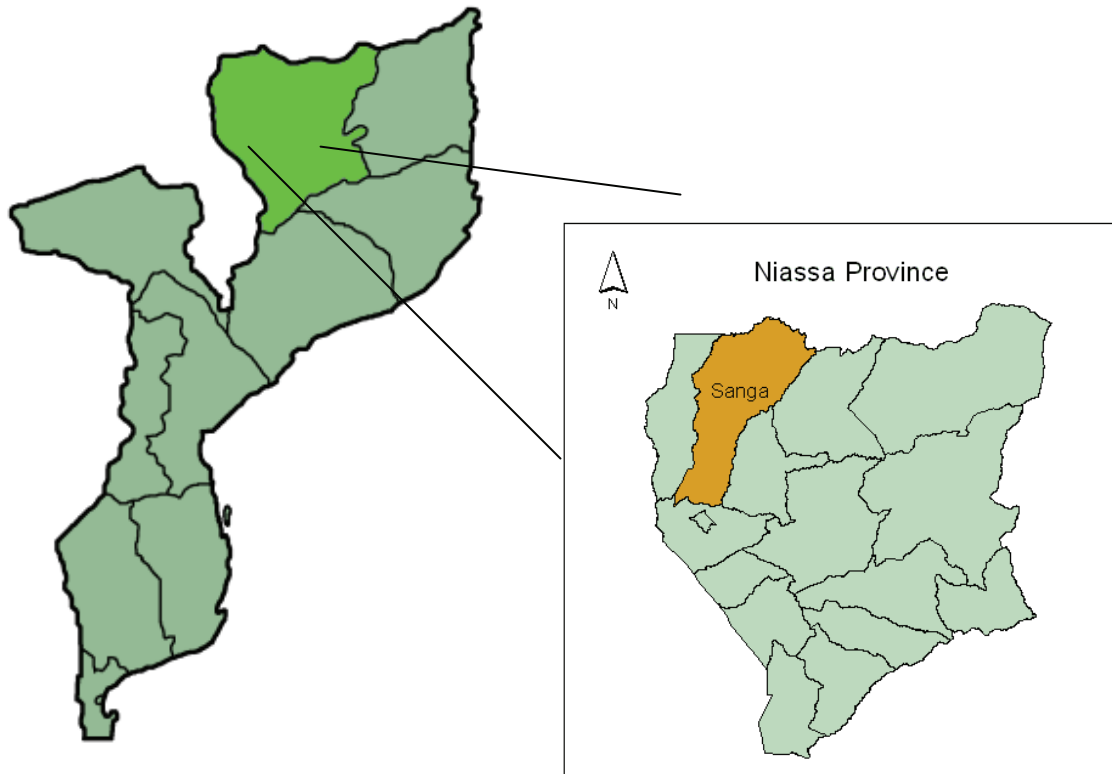
### **3.1 Background**

The research process that was used in this study is loosely based on the DFID sustainable livelihood framework (Bond et al., 2007). The sustainable livelihood framework has been found to be an effective method for assessing livelihoods of the poor (Adato & Meinzen-Dick, 2002). While social economic studies based solely on income and expenditure data have been used in developed countries (Addicott et al., 2003), these are not effective indicators of wealth in areas such as Mozambique. However, studies have been done where the livelihoods framework has been adapted and used in agricultural research to assess the impact of their interventions on poverty; and have been found successful (Adato & Meinzen-Dick, 2002). In forestry, Pandey (2005) successfully used the livelihoods framework to monitor the impact of joint forest management on livelihoods of rural people in India. Thus, the livelihoods conceptual approach was also used in this study to assess the livelihoods of the rural residents in the Sanga District of Niassa.

### **3.2 Description of case study area**

Mozambique is divided up into 10 provinces and 128 districts (administrative units). The study area is the Sanga district located within the Niassa province of Mozambique (Figure 3.1). The area was selected since the majority of the proposed plantation area falls within this district. Sanga district is located 60 km north of the provincial capital city of Lichinga, bordering on the northern boundary of the Sanga district is Tanzania. The area of Sanga is 13 469 km<sup>2</sup> (Ministério da Administração Estatal, 2005) and in 2007 had a population of 56 282 inhabitants, with 27 423 men and 28 859 women (Instituto

Nacional de Estatística, 2007). The average household size is 5 members. In a 1997 census, the population was 44 225 inhabitants with a density of 4.5 inhabitants per km<sup>2</sup> (Ministério da Administração Estatal, 2005).



**Figure 3.1: Diagram showing Mozambique and provinces, and a close-up of the Niassa province of Mozambique, and the Sanga district (study area).**

In Sanga, the rainy season is from December to March, with April being a transition month and the dry season is from May to October with November being another transition month. Average annual precipitation is between 1000 and 1200 mm in the plains and along rivers, but precipitation can reach up to 2000 in the higher altitude areas. Temperatures average between 20 to 23 degrees Celsius in forested areas and 23 to 26 degrees Celsius in the open plains and in the northern part of the district and along the Rovuma River (Ministério da Administração Estatal, 2005).

Agriculture is the main activity for the residents of the district and is practiced on small sized family plots of land. Subsistence farming is the main livelihood strategy, and there

are a diversity of fruits available such as; mangos, oranges, pears, lemons and papayas. The fruits are produced for local families and are not commercialized. The most important commercial products are sugar cane and tobacco. Forest products are primarily used for fuel (wood or charcoal) and for house construction. Some alternative activities to agriculture are carpentry, fishing, and wood carving (Ministério da Administração Estatal, 2005). There are some parts of the districts where there are soil erosion problems in deforested areas; with some communities travelling 10 km to access wood.

The main language in Sanga is Yao and there is also some Ngoni and Swahili which is an influence from Tanzania and Portuguese which is the official language of Mozambique. The dominant religion is Islam with about 90% of the population practicing, with a smaller Christian population (Ministério da Administração Estatal, 2005).

### **3.3 Sample design and sampling methods**

For this study, the livelihood framework was used in the research process and was used as a guide when designing the household survey. Emphasis of the framework was placed in the beginning of the framework in the vulnerability and livelihood assets sections. Questions were formulated to collect household data to assess their asset or capital status, these capitals include; natural, physical, human, financial, and social. Questions were also formulated to understand how households cope with shocks, trends, and seasonality.

#### **3.3.1 Primary and secondary data**

Livelihoods of rural residents living in Sanga district site were assessed at the household level. Household livelihoods in the rural communities were evaluated using the sustainable livelihoods framework which helped to identify the household survey questions (Place et al., 2003). Secondary data such as public records, census information, past studies were consulted to provide helpful information in preparation for focus group meetings, household survey questionnaires, and for key informant interviews (Adhikari et al., 2004).

### **3.3.2 Household surveys**

Household data were collected with the use of questionnaires and trained interviewers that could communicate in the local languages. The survey was translated into Portuguese and interviewers were asked to complete the survey in Portuguese.

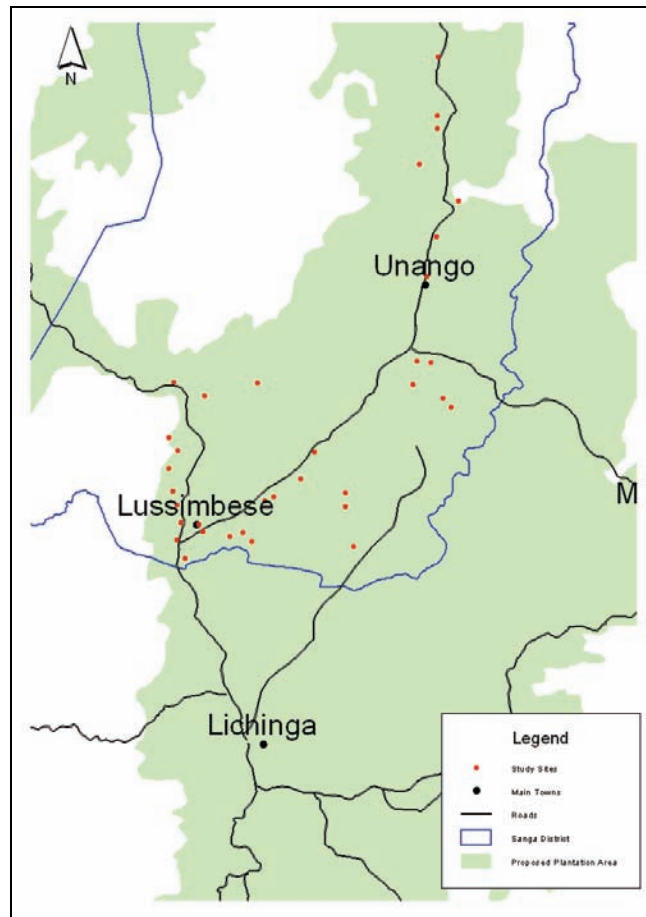
The household questionnaire collected general household information and was designed to assess household's socio-economic position within the community, their livelihood strategy, natural resource use, household vulnerability, and their perceptions of the impacts of introducing plantations in their communities (see the English version of the household survey is presented in Appendix I).

The survey was divided into seven sections. The first page of the survey was completed by the interviewer and included general information such as; date of survey, their name, and location. The first page also included the objectives of the study so that interviewers could inform the interviewees the purpose of the study. The first section of the survey collected human asset information such as education, sex, ages, skill assets, and household responsibilities. Section two collected physical asset information such as; agriculture land information, description of home, and assets and their importance. Section three dealt with land use and availability of resources and collected information on; agricultural crops, traditional tree use and importance, availability and use of wood, water, traditional medicines and different land types. Section four was related to financial assets; how they acquired and spend income. Section five collected information on social assets such as; political involvement, membership to association or organizations, and any outside assistance they may have received. Section six dealt with problems (stresses) they may have faced in the last year and how they coped. The final section asked questions relating to forestry activities, to understand their perceptions of forestry and how they may be impacted.

### **3.3.3 Household sampling strategy**

In the Sanga district there are approximately 33 villages or communities (Figure 3.2). A Geographical Information System (GIS) spatial coverage of the district and the location of the communities were available, which also included population data from 2007. In

order to sample households in the area, the total population data for each of the communities in the spatial database was divided by 5 which is the average number of household members. This provided an estimate of the number of households in each of the communities. After computing the estimated number of households in each of the communities, a 5% sampling target was set for each community within the Sanga District. In survey research a 5% sample size is considered sufficient (Bartlett, Kotrlik, and Higgins, 2001). To obtain a 5% sample of all the households in Sanga, a total of 338 household interviews were needed. Appendix II contains a list of the communities that were sampled and the sample target that was calculated using the above described method.



**Figure 3.2: Map showing the communities within the Sanga District that were sampled, only communities within the proposed plantation area were sampled**

To complete the 338 household interviews, four experienced interviewers were used to conduct interviews over a 4 week period in October 2008 (before the beginning of the rainy season when households begin work in the *Machambas*). A supervisor was also hired to assist in training and maintaining data quality by checking over completed surveys and sitting in during interviews to ensure consistency amongst interviewers and to ensure household survey targets were met. The use of supervisors and interviewers to collect the data was necessary since the researcher could not communicate in Portuguese or Yao.

During the design of the questionnaires, the questions were put into words that could be easily translated from English, to Portuguese and then to the local language, of Yao. Prior to the data collection, a one day training workshop was held with the survey technicians to; review the questionnaires, instruction on completing the forms, and household sampling selection. After the training, the technicians were asked to interview two households each and to complete the survey forms as instructed. Upon completion of the test interviews, the technicians were asked to make revision suggestions to ensure consistent and efficient data collection (Adhikari et al., 2004).

Before household sampling began, the approval of the study was needed by local government authorities as well as by the traditional leaders in each of the communities. Approval was first granted by the Minister of the Sanga district and upon arrival in each of communities approval was sought from the local traditional leaders. One of the surveyors sought approval on behalf of the group of surveyors prior to conducting their interviews.

### **3.3.4 Key informant interviews**

In addition to a household survey, key informant interviews were conducted with individuals with specialized knowledge, such as; government representatives, NGOs, private industries, and religious organizations (Adata & Meinzen-Dick, 2002). These semi-structured interviews were used to solicit local knowledge, opinions, and views of local livelihoods. Key informant interviewees were also asked how they thought forestry would impact local rural residents and what mitigations measures would be required.

Interviews were conducted by the researcher and information was captured using field notes.

### **3.4 Data Analysis**

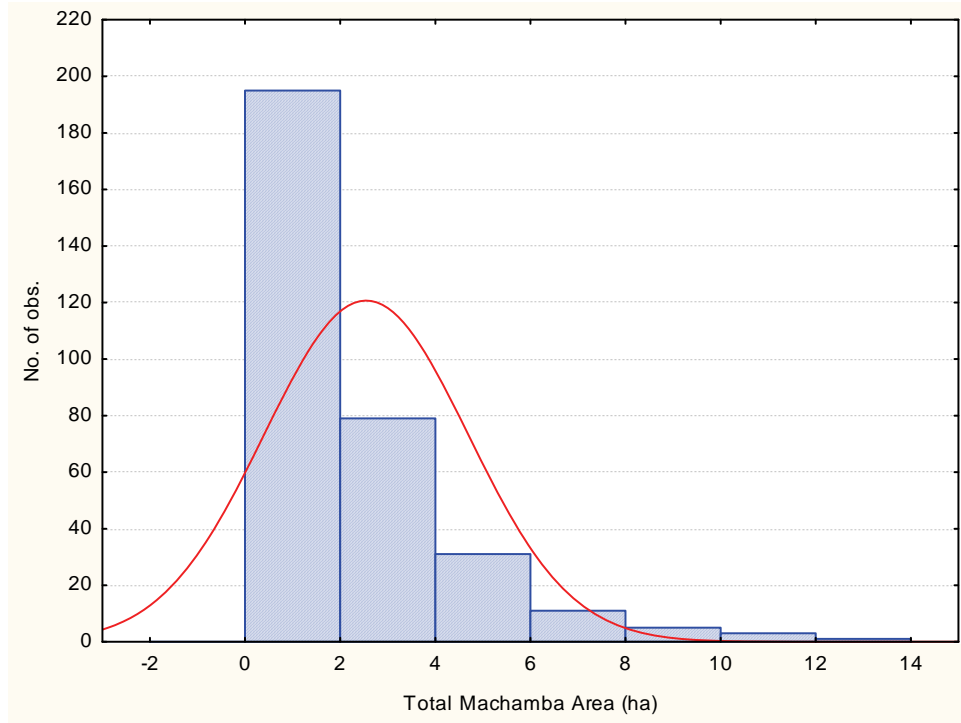
Household survey data were entered into a Microsoft Excel 2002 database and was statistically analyzed using Statistica 8 (StatSoft Inc., 1984-2008). Basic descriptive statistics and frequency tables were used to summarize the answers to each of the household survey questions. Using more applied statistical analysis, comparative relationships between different household variables and wealth categories were analyzed in order to understand different livelihood strategies and contributors to wealth.

#### **3.4.1 Wealth Categorization**

For comparison purposes, the households were classified into wealth categories using wealth indicators (Ellis, 2003). The wealth categories that were used include; low, medium, and high. The process that was used to categorize the households was as follows;

Wealth indicators were identified through information that was collected during key informant interviews. Key informants were asked how they would describe a wealthy household in a rural community and most commonly the following indicators of wealth were given; the amount of land a household possesses thus more land equals more wealth, the type of house they own (small, medium or large) and the materials they use to build their homes, and their assets. Using these indicators of wealth, ranking values were assigned to households.

The total amount of land owned by households was plotted in a histogram (Figure 3.3). Using the histogram four values of 0, 1, 2, or 3 were assigned to each household. If the household had 0 hectares of land they were given a value of zero, if the household had between 0 to 1.9 hectares they were given a value of 1. Households with 2 to 5.9 hectares of land were given a value of 2, and households with 6 or more hectares were given a value of 3.



**Figure 3.3: Histogram plotting the total household *machamba* area.**

The size of the household's home and the materials that were used to build the homes was another wealth indicator used to calculate the wealth category. The housing was described using four characteristics; material used for the main structure (mud, bricks dried by sun, bricks dried by fire, cement, and straw), type of window (no window, open, glass, or wood), roofing material (thatch or grass, and zinc), and by size (small, medium, or large). Values were assigned to each characteristic with values of 1, 2, or 3 and the higher values represented the wealthier housing characteristics. Table 3.1 presents the values that were assigned for the housing characteristics.



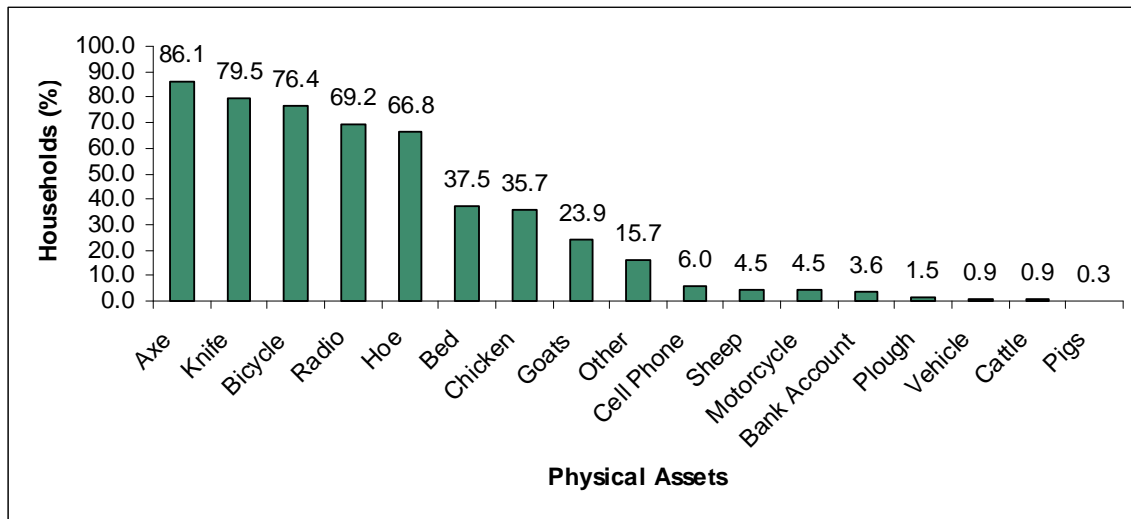
**Table 3.1: Wealth ranking values for housing characteristics**

<b>House characteristic</b>	<b>Description</b>	<b>Assigned Value</b>
<b><i>Main material</i></b>	Mud	1
	Bricks (dried by sun)	2
	Bricks (dried by fire)	3
<b><i>Window</i></b>	Cement	2
	Straw	1
	No window	1
	Open	1
	Glass	3
<b><i>Roofing material</i></b>	Wood	2
	Thatch	1
	Zinc	2
<b><i>Size</i></b>	Small	1
	Medium	2
	Large	3

The final wealth indicators were assets owned by the household. During the interview households were asked which physical assets they possessed. Wealth classes were computed by assigning wealth ranking values to six key wealth indicating assets. The key assets and assigned wealth values are presented in Table 3.2. The key wealth assets were identified by determining the most common assets owned by households. Figure 3.4 below shows the results of household asset frequency. The most commonly owned assets (assets owned by more than 69% of households) were selected as wealth indicators, and were as follows; radio, bicycle, axe, and knife. Each of these indicators if owned by the households was worth a wealth value of 2. Goats and sheep were ranked as the most important livestock and were therefore selected as wealth indicators, and were each valued at 3. The maximum total wealth value for household assets was 14. The wealth values were not assigned according to monetary value, but were assigned according to importance value.

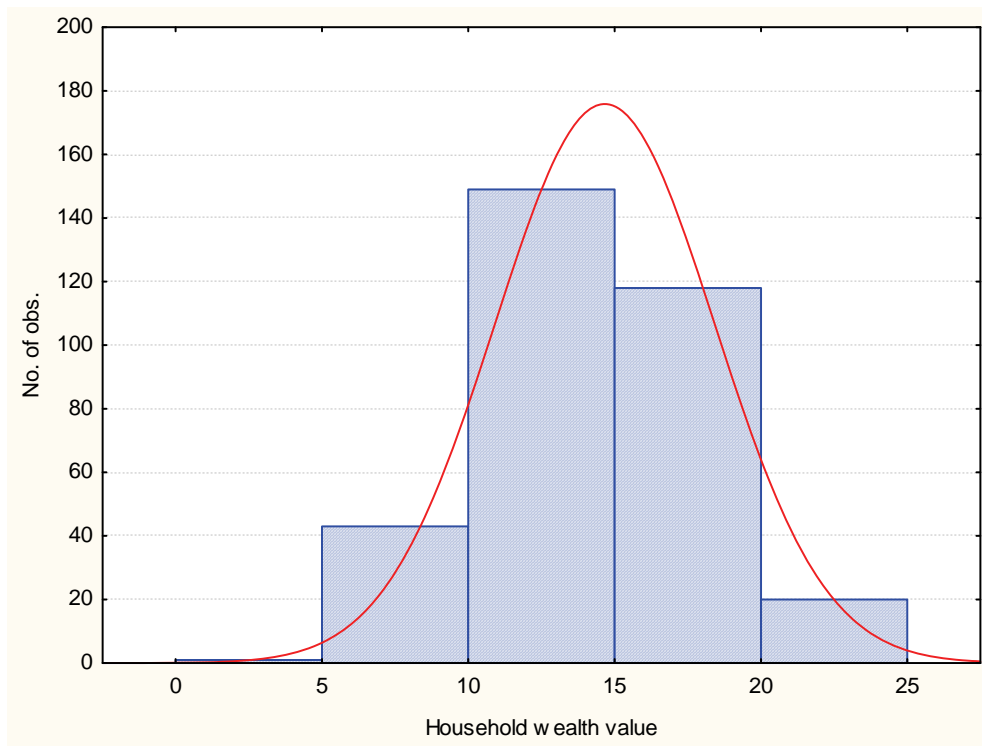
**Table 3.2: Key assets for wealth categorization and their associated wealth indicator values**

Physical asset	Wealth Indicator Value
Radio	2
Bicycle	2
Axe	2
Knife	2
Goat	3
Sheep	3



**Table 3.3: Frequency table showing assets and the number of households that own them.**

Once the wealth values were assigned for each of the indicators as described above, the total wealth value was calculated for each of the households. The maximum value a household could have is 28 and the minimum value a household could have is 4 (or 0 if they do not own a house). The calculated total wealth values were plotted on a histogram (Figure 3.5). If a household had a wealth value of 0 to 9 they were classified as 'low', if wealth value was 10 to 19 they were deemed 'medium', and 20 and higher was deemed 'high'.



**Figure 3.4: Histogram showing the wealth values of households.**

### 3.5 Statistical Analysis

When analyzing the wealth categories three statistical tests were used; Maximum likelihood chi-square (Sokal & Rohlf, 1994), Non-parametric Kruskal-Wallis tests (Kruskall & Wallis, 1952), and Non-parametric Mann Whitney tests (Mann & Whitney, 1947). Non-parametric tests were done when analyzing wealth categories since they were not normally distributed. Each of these statistical tests were significant when  $p \leq 0.05$ . The lower the p-value the less likely the result and a p-value of 0.05 correspond to a 5% chance of an outcome (Schervish, 2006).

**Maximum likelihood chi square test:** was used when analyzing wealth indicators with like categorical data (categorical versus categorical data). The maximum likelihood test approximates the log likelihood ratio, and this test will result in the same conclusion as a commonly used chi-square test (Sokal & Rohlf, 1994).

**Kruskal-Wallis one-way analysis of variance by ranks:** is a non-parametric method for testing equality of population medians among groups. It is an extension of the Mann-Whitney U test when analyzing three or more groups (Kruskal & Wallis, 1952). This test

was used when comparing wealth categorical data with continuous data. Many interview questions asked respondents to rank various assets, activities, spending, etc

***Mann-Whitney U test:*** is also a non-parametric test and was used in this study to compare wealth categorical data with continuous data with only two groups. The Mann-Whitney assesses whether two independent samples of observations come from the same distribution and is almost identical to an ordinary parametric two sample t-test after ranking over the combined samples (Mann & Whitney, 1947). This test was used when comparing categorical data that had only two groups versus continuous data, for example when hunger (yes or no) was analyzed with total household *machamba* area.

In addition to analyzing wealth categories against various household attributes, some other statistical analysis were done to analyze months of food insecurity versus head of household gender, and months of food insecurity versus total household *machamba* area. These statistical analyzes were done using Bootstrap analysis and Spearman rank test, respectively.

***Bootstrap:*** Bootstrapping is a practice of estimating properties of an estimator (such as variance) by measuring those properties when sampling from an approximating distribution. When a set of observations can be assumed to be independent and identically distributed, it can be implemented by constructing a number of re-samples of the observed dataset. These re-samples are obtained by random sampling and replacement from the original dataset. Bootstrapping allows one to gather many alternative versions of the single statistic that would ordinarily be calculated from one sample (Efron & Tibshirani, 1993).

***Spearman rank correlation co-efficient:*** is a non-parametric measure of correlation. It assesses how well an arbitrary monotonic function could describe the relationship between two variables without making any assumptions about their relationship (Spearman, 1904).

### **3.6 Chapter summary**

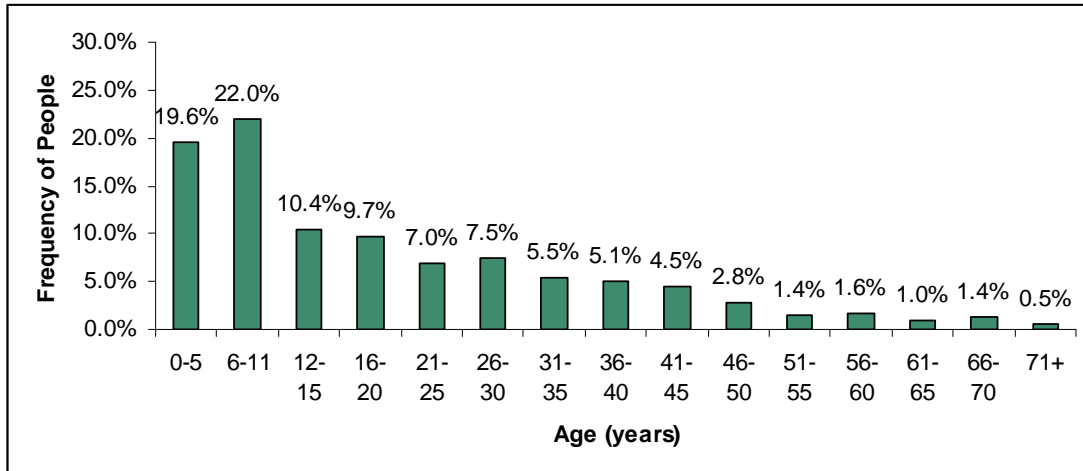
The methodology of the study used quantitative and qualitative data to evaluate rural household livelihoods. The methodology that was used and the data collected in this study can be used and adopted again after the establishment of plantations at planned periods to monitor development, impacts, and impact mitigation measures.

## **CHAPTER 4: RESULTS**

This chapter presents the results of this study. The first section includes the results of the evaluation of the current status of rural households prior to the introduction of plantation forestry. This section describes household sustainable livelihoods framework (SLF) assets; human, physical, natural, and financial. Towards the end, the chapter presents the results on household perceptions regarding how forestry activities impact them. The final section provides a summary of input that was gathered through key informant interviews.

### **4.1 General household information**

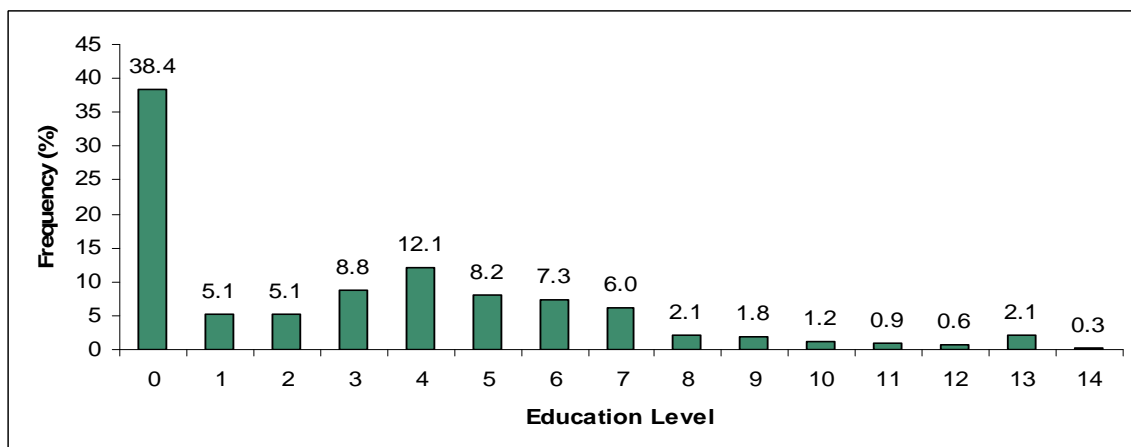
A total of 331 households were interviewed in the Sanga district, of which 201 were answered by males (60.7%) and 130 were answered by females (39.3%). Male headed households made up the majority of the sample population; 91.2% of the households were male headed and 8.8% were female headed. Completion of the wealth categorization of households resulted in; 8.8% low, 81.6% medium, and 9.7% high wealth households. Female headed households occurred significantly ( $p \leq 0.05$ ) more in the low wealth category than male headed households, who were found more in the high wealth category. The average number of people per household was 6. The number of household members significantly ( $p \leq 0.05$ ) contributed to wealth of household; more household members provided more wealth. Islam was the dominant religion in the Sanga; 90.6 % of the households were Muslims, 9.1% were Christian, and the remaining 0.3% was other. The average age of all sampled household members was 20 years old, and the majority of the sample population (52%) was below the age of 15 years (Figure 4.1). The average age of the head of household was 42.



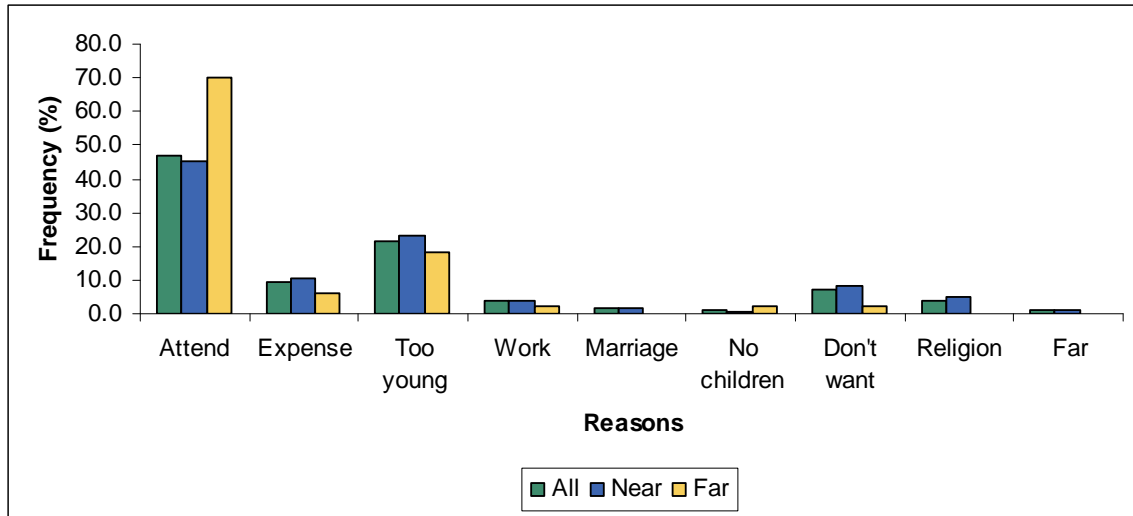
**Figure 4.1: Age distribution of all household members**

## 4.2 Education

The education levels extend from grade 1 to 14. Levels 13 and 14 are technical levels beyond the normal curriculum of levels 1 to 12. There were a number of adults attending adult education programs in the district. Figure 4.2 shows the frequencies of the highest education levels of the head of households. The results show that 38.4% of the heads of households did not have any formal education, and 61.6% had at least one year of education. The mean education level of heads of households was 5.0 with a standard deviation of 2.87. The levels of education of household heads did not significantly influence household wealth. This means that households with higher education did not necessarily have more wealth than the less educated ones.



**Figure 4.2 Education levels of heads of households**



**Figure 4.3: School attendance of children**

Figure 4.3 shows the households responses regarding school attendance for their children. The results were categorized into three groups; all households, households in communities situated near Lichinga, and households in communities situated far from Lichinga, in order to determine if there was a difference in school attendance for children in more isolated communities located further from the urban centre than those living closer to Lichinga. Overall, 47% of all households reported to have children attending school. In communities far from Lichinga, 70% of children were attending school, whereas in closer communities only 45% of children were attending school. There was a significant ( $p \leq 0.05$ ) difference between children living in far communities and those living in communities near Lichinga; children living in far communities were more likely to attend school. Just over 20% (21.5%) of the all households reported that their children were too young to attend school, 9.4% of all the households said it was too expensive, and 6.9% reported that their children did not want to attend school. The wealth of the households did not significantly influence children's attendance in school; wealthier households were no more likely to send their children to school than less wealthy households.



### 4.3 Health care and frequent illness

Table 4.1 shows where households go for medical attention, the majority use either health centres (43.8%) or health posts (41.9%) located within communities throughout the Sanga district.

**Table 4.1: Percentage and number of households receiving medical attention.**

<b>Sources of Medical Attention and Medicines</b>	<b>Percentage (%) (n=329)</b>
Health Centre	43.8 (145)
Health Post	41.9 (139)
Traditional Doctor	5.7 (19)
Hospital	4.5 (15)
Missionary	3.0 (10)
Private Health	0.3 (1)
Did not respond	0.6 (2)

Table 4.2 shows the most commonly reported frequent illnesses by 57% of the households. The results indicated that there was not a significant difference between household wealth and frequency of illness.

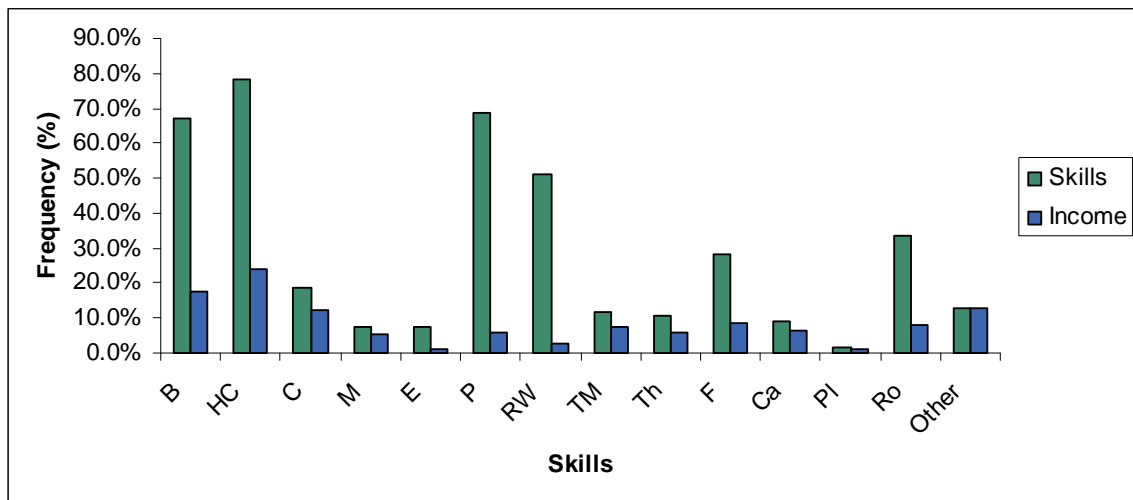
**Table 4.2: Percentage and number of households experiencing frequent illness**

<b>Illness</b>	<b>Percentage (%) (n=189)</b>
Malaria	36.5 (69)
Stomach Pain	15.3 (29)
Headache	11.6 (22)
Cough	9.5 (18)
Measles	4.8 (9)
Asthma	3.2 (6)
Tuberculosis	3.2 (6)
Throat	2.6 (5)
Chest Pain	2.1 (4)
Epilepsy	2.1 (4)
Others*	9.1 (17)

\*Other illnesses include: constipation, diarrhoea, eyesight, fever, joint pain, respiratory problems, rheumatism, and toothache

## 4.4 Household skills and income

The most common household skills include; brick making, home construction, Portuguese language, reading and writing, fishing, and roofing (Figure 4.4). Households with the following skills; carvers, mechanics, traditional doctors, carpenters, and others; have a higher likelihood of making an income however fewer households have these skills. In the 'other' category, many of the skills and associated incomes were from business owners, teachers, labourers, and other local services (tailors, sawmills, bricklayers, nurse). Agricultural skills were not noted since all households with the means to cultivate can manage their *machambas*, and all but two households sampled had *machamba* land. The only significant ( $p \leq 0.05$ ) difference noted was in wealth and fishing; more households in the medium and high wealth households received an income from fishing. There were no low wealth households that reported income generation through fishing.



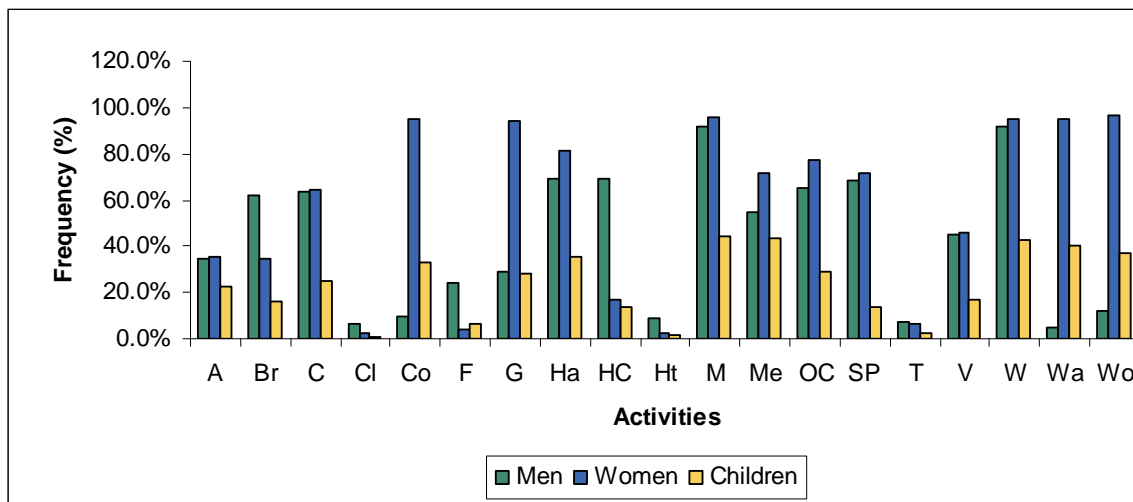
B=Brick layer, HC=Home Construction, C=Woodcarver, M=Mechanic, E=English, P=Portuguese, RW=Read and write, TM=Traditional medicine, F=Fishing, Ca=Carpenter, Pl=Plumber, Ro=Roofer

**Figure 4.4: Household skills and frequency of households that receive an income from the associated skill.**

## 4.5 Household Activities

Households perform a number of routine activities throughout the year; some activities are done year round while others are done seasonally. Certain activities are preformed by

certain household members (men, women, and/or children). Figure 4.5 shows which household members were responsible for each of the principle activities done in the communities. The activities that were done primarily by women include; cutting grass, cooking, and collecting wood and water. Activities that were done across gender include; tending animals, vegetables, tobacco, cassava, maize, and other crops, working for income, selling products, collecting medicine and harvesting crops. Women were reported to do more activities than men in the duties done by both men and women. Male dominated activities include; brick making, house construction, coal, hunting, and fishing. Less common activities done among all the households include; tobacco, coal, hunting and fishing. Children help out in all activities but the results do not show any activities solely done by children.



A=Animals, Br = Brick making, C = Cassava, Cl = Charcoal production, F = Fishing, G = Grass, Ha = Harvest crops, HC = House construction, Ht = Hunting, M = Maize, Me = Collect medicine, OC = Other crops, SP = Sell products, T=Tobacco, V = Vegetables, W=Work, Wa=Collect water, WO = Collect wood

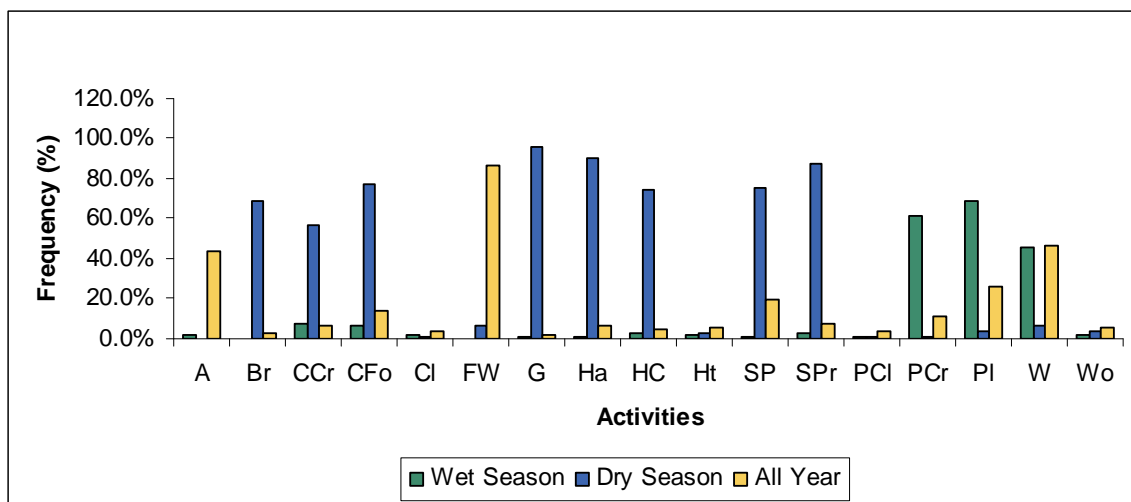
**Figure 4.5: Summary of regular household activities and by whom they are performed**

As noted above, some activities are done year round while others are done seasonally, Figure 4.6 indicates the time of year when the principle household activities are done (wet season<sup>3</sup>, dry season<sup>4</sup>, or all year round). During the wet season the activities are typically related to crop production such as; planting vegetables and planting crops such

<sup>3</sup> Wet season is from December to March (Ministério da Administração Estatal, 2005)

<sup>4</sup> Dry season is from May to October (Ministério da Administração Estatal, 2005)

as maize, cassava, and beans. Activities that are done throughout the year include; animal tending and collecting firewood. The following activities were done by a fewer number of households; harvesting wood for building or carpentry, charcoal collection and production and hunting, but these activities were performed year round. Through field observations, charcoal collection and production was done by more households than what was reported. Activities that are done in the dry season include; grass cutting, brick making, selling products, food collection in native woodlands, collecting vegetable crops, harvesting crops and preparation of soils in *machambas*. During the wet season when work is plentiful in *machambas*, 46% of households worked off their *machambas* for income, and 47% of households worked year round wherever they could find work.



A=Animals, Br=Brick making, CCr=Collect Crops, CFo = Collect food, CI = Collect Charcoal, FW – Fire wood, G = Grass, Ha = Harvest, HC = House construction, Ht = Hunting, SP = Sell products, SPr = Soil preparation, PCI = Produce charcoal, PCr = Produce crops, PI = Plant *machambas*, W = Work, Wo = Wood.

**Figure 4.6: Summary of when (time of year) activities are performed by households**

## 4.6 Household *Machambas*

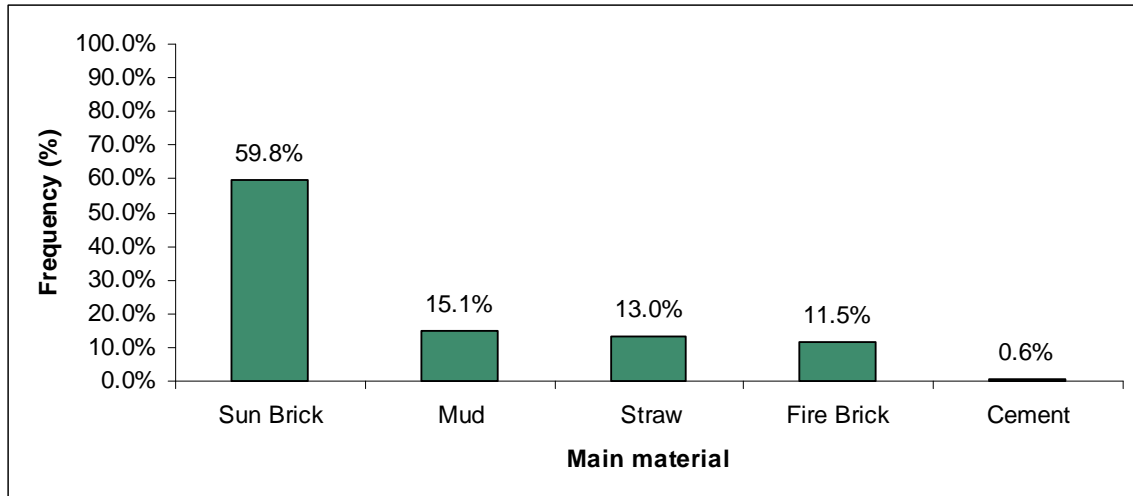
*Machambas* are household agricultural plots of land and are vital to the livelihoods of rural households. They are the main source of food and income for the majority of the households (99.4%). The average number of *machambas* a household had was 1.64 and the average size of a *machamba* was 2.55 hectares in size. The amount of *machamba* land farmed by the household contributed significantly ( $p \leq 0.05$ ) to the wealth of the

households; households with more land had more wealth than households with only a small amount of land. Some households must travel long distances to their *machambas* with 38.4% of the households in the Sanga district moving away from their primary homes to live at their *machambas* each year. The average number of months that these people stayed at their *machambas* was 3.4 months.

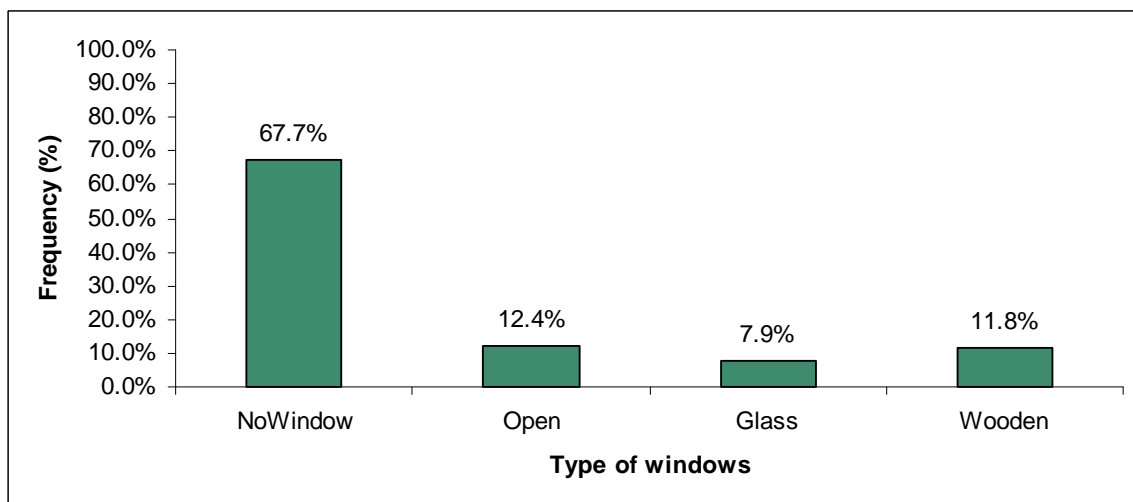
Land availability for *machambas* was reported to be sufficient for 86.3% of the households. For those that responded that there was not enough land (13.7 %), the following coping strategies were employed; 65.8% buy food, 15% collect food, 15% borrow food, 2.4% work, and 2.4% fertilize to help their *machambas* last longer. No significance was found between wealth categories for those households that reported there was insufficient land available for *machambas*.

#### **4.7 Housing type**

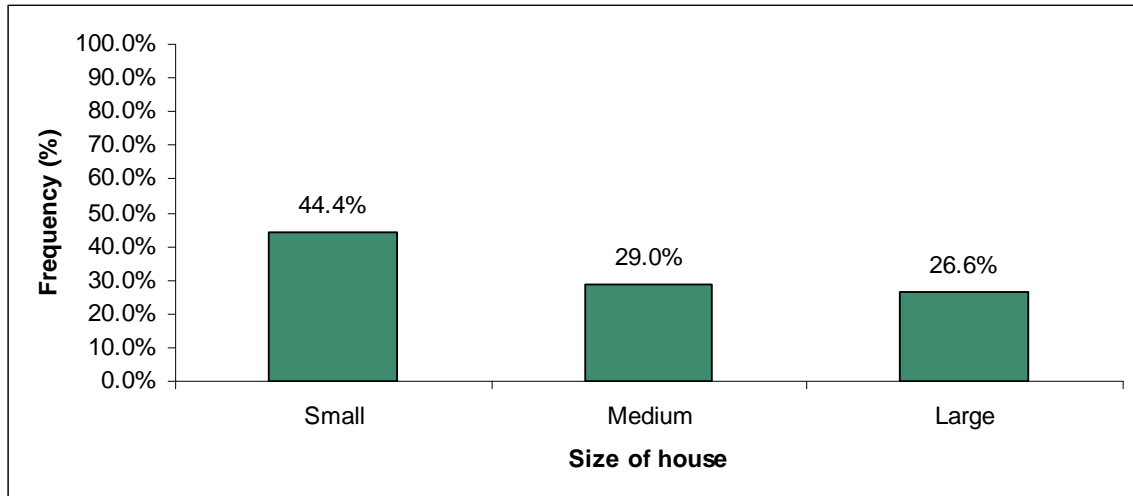
The average number of houses for each household was 1.94. The type of house a household had was an indication of wealth and a wealthy house was described as large, made of fired bricks, with a zinc roof, and glass windows. Figures 4.7 - 4.10 show the results of the types of materials and house descriptions. The most frequently used material for the construction of the main part of the house was sun dried bricks (59.8%). Bricks that were dried using fire were the most costly, and were used by only 11.5% of the households. Most houses did not have any windows (67.7%) in their homes, the most expensive windows to use were glass and only 7.9% of homes had glass windows. The majority of homes were classified as small (44.4%), 29% were medium sized, and 27% were large. The most commonly used roofing material was grass (93.4%). Zinc or aluminium roofs were very expensive for many households and only 6.6% of the houses interviewed had a zinc roof, these households were considered wealthy.



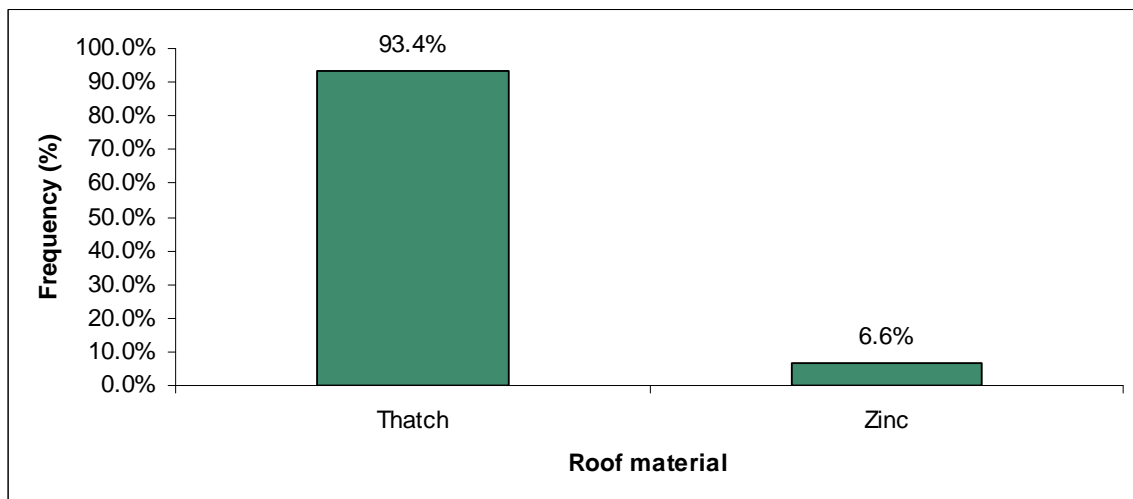
**Figure 4.7: Summary of the main housing material of the households**



**Figure 4.8: Summary of the window types of houses**



**Figure 4.9: Summary of the house sizes**



**Figure 4.10: Summary of the roofing materials used on houses**

## 4.8 Household assets

The result of the asset ranking and assessment is summarized in Table 4.3. From the table, it is clear that 76.4% of the interviewed households had a bicycle. Other assets that are owned by the majority of the households (>65%) include; radios, axes, knives, and hoes.

**Table 4.3: Percentage of households with assets, mean rank and standard deviation (SD), and average number assets owned per household.**

<b>Asset</b>	<b>Percentage (%)</b>	<b>Mean Rank (SD)</b>	<b>Average per household<sup>+</sup></b>
Vehicle	0.9	3.00 (0.00)	1.7
Cattle	0.9	3.00 (0.00)	6.7
Hoe	66.8	2.73 (0.58)	3.2
Bicycle	76.4	2.01 (0.81)	1.2
Cell Phone	6.0	2.00 (0.89)	1.3
Axe	86.1	1.93 (0.75)	1.5
Bed	37.5	1.92 (0.76)	1.4
Other*	15.7	1.91 (0.81)	6.8
Bank Account	3.6	1.83 (0.41)	1
Goats	23.9	1.78 (0.76)	5.8
Motorcycle	4.5	1.67 (1.00)	1.26
Plough	1.5	1.67 (0.58)	1.4
Knife	79.5	1.61 (0.65)	1.3
Radio	69.2	1.58 (0.60)	1.5
Sheep	4.5	1.50 (0.71)	6.1
Chicken	35.7	1.47 (0.61)	5.9

<sup>+</sup>Average per household is not an overall average, since not all households possess it is only the average for households that own that particular item.

\*Other assets include such items as; doves, ducks, rabbits, sewing machine, tools, kitchen utensils, tables, or television.

The most important assets owned by >65% of households, from most to least importance include; hoe, bicycle, axe, knife, and radio. The most important livestock owned by households from most to least importance include; cattle (but very few households even had any), goats, sheep, and chicken.

## **4.9 Agricultural Crops**

Table 4.4 indicates how agricultural crops were used by rural households namely for income, consumption or both. The most commonly cultivated crops for consumption include; maize, beans, sweet potatoes, potatoes, cassava, nuts, sunflower, vegetables, other crops, paprika, tobacco, and cotton. Other cultivated crops for consumption include; sugar cane, sorghum, rice, and sesame. The most commonly cultivated crops for income were; beans, maize, potato, sweet potato, cassava, vegetables, nuts, sunflower, other crops, tobacco, and cotton.



The ranking of crops (Table 4.4) based on their use revealed that the top five ranked crops for consumption are as follows; maize, beans, potato, tobacco, and cotton. The top five highest ranked crops for sale include; beans, tobacco, maize, cotton, and potato. Cassava was ranked significantly ( $p \leq 0.05$ ) more important for consumption in low wealth households than in medium and high wealth households. No significance was determined for other crops used for consumption, and no significance was found between any of the crops ranked for sale across wealth categories.

**Table 4.4: Percentage and mean rank with standard deviation (SD) of household cultivating agricultural crops used for consumption and sale.**

Consumption			Sale		
Crop	Percentage (%)	Mean Rank (SD)	Crop	Percentage (%)	Mean Rank (SD)
Maize	98.8	2.86 (0.45)	Beans	92.4	2.67 (0.60)
Beans	94.9	1.76 (0.50)	Tobacco	6.9	2.47 (0.74)
Potato	66.8	1.68 (0.76)	Maize	80.7	1.98 (0.61)
Tobacco	3.0	1.67 (0.58)	Cotton	1.5	1.83 (0.98)
Cotton	1.8	1.60 (0.89)	Potato	51.4	1.72 (0.80)
Sweet Potato	75.5	1.47 (0.58)	Other*	8.2	1.54 (0.76)
Other*	10.6	1.44 (0.62)	Sweet Potato	48.6	1.50 (0.80)
Cassava	64.4	1.42 (0.58)	Vegetables	38.1	1.43 (0.73)
Nuts	54.7	1.16 (0.37)	Cassava	45.3	1.42 (0.67)
Sunflower	46.5	1.10 (0.31)	Nuts	36.3	1.35 (0.55)
Vegetables	46.2	1.10 (0.31)	Sunflower	15.4	1.28 (0.49)
Paprika	7.9	0.00 (0.00)	Paprika	2.4	0.00 (0.00)

\*Other crops include; banana, garlic, sorghum, pumpkin, rice, and sugar cane

## 4.10 Use of Natural Resources

### 4.10.1 Indigenous trees

Table 4.5 shows a summary of the indigenous trees of most importance to rural households. There was no significance between the importance of trees and wealth of households.

**Table 4.5: Most frequently (%) reported trees used by households (please note: not all of the trees reported by households are presented; only the top 5 are reported)**

Tree 1	Freq.	Tree 2	Freq.	Tree 3	Freq.	Tree 4	Freq.	Tree 5	Freq.
Mango	31.1	Banana	13.6	Papaya	11.4	Pine	15.8	Eucalyptus	24.0
Banana	15.1	Mango	12.7	Pau-ferro	9.4	Eucalyptus	12.2	Pine	22.8
Jujube*	16.0	Jujube	11.8	Banana	9.0	Mbango**	8.6	Mbango	7.6
Peach	4.8	Pau-ferro+	7.2	Mango	9.0	Banana	7.9	Papaya	6.3
Orange	4.5	Papaya	7.2	Jujube	7.7	Jujube	7.2	Jujube	6.3

\*jujube – fruit - *Ziziphus Mauritania*, +Pau-ferro – wood – *Swartzia madagascariensis*, \*\*Mbanga – wood – *Pericopsis angolensis*

#### 4.10.2 Land uses

Various land classes were observed during the study namely; *machambas*, old abandoned *machamba* lands, deforested areas, natural forested areas, *dambos* or wet *machambas*, glasslands, river zones, and sandy soil areas. *Dambos* or wet *machambas* are small household agricultural plots of land located in wet soils, in these soils households plant vegetables such as; tomatoes, lettuce, and cabbage. Natural forests were ranked the most important land class overall, followed by sandy soils, *machamba* land, old *machambas*, river zones, wet *machambas*, grasslands, and deforested areas (Table 4.6). Ranking of important land classes was consistent across wealth categories, with the exception of wet *machambas* in medium wealth households. Wet *machambas* were significantly ( $p \leq 0.05$ ) more important for medium wealth households than low or high wealth households.

**Table 4.6: Results of ranking land classes of most importance**

Land Classifications	Ranking Mean (SD)	Valid N
Natural forest	2.76 (0.53)	290
Sandy soils	2.00 (0.85)	12
<i>Machambas</i>	1.87 (0.67)	217
Old <i>machambas</i>	1.81 (0.69)	74
River zones	1.70 (0.71)	166
<i>Dambos</i> or wet <i>machambas</i>	1.53 (0.67)	151
Grasslands	1.43 (0.65)	37
Deforested areas	1.41 (0.68)	46

The land class that households were most willing to give up for forestry development (Table 4.7) was old *machambas*. Old *machambas* refers to the abandoned lands which are no longer used. This was followed by natural forest, *machambas* (that are currently in use), river zones or lands along rivers, deforested areas, grasslands, sandy soils, and finally wet *machambas*. No significance was found in responses across wealth categories, therefore there were no wealth categories that were more or less significantly willing to give up any specific land class.

**Table 4.7: Results of ranking land classes households would be willing to give up for forestry**

Land Classifications	Ranking Mean (SD)	Valid N
Other (not willing to give up any lands)	2.58 (0.79)	12
Old <i>machambas</i>	2.55 (0.74)	244
Natural forest	2.47 (0.81)	54
<i>Machambas</i>	2.24 (0.75)	122
River zones	1.87 (0.58)	54
Deforested areas	1.75 (0.67)	142
Grasslands	1.74 (0.61)	114
Sandy soils	1.53 (0.72)	189
Dambo or wet <i>machambas</i>	1.47 (0.69)	47

#### 4.10.3 Firewood

An average of 1.8 people in each household spends about 3.6 hours per day collecting firewood. The majority of households 90.9% collect their own firewood, 5.4% buy and collect firewood, 2.7% use charcoal rather than firewood, and 0.9% buys all of their firewood. No significance was determined across wealth categories in relation to how firewood is acquired by the household; the wealth of the household did not affect they acquired firewood. Additionally, no significance was found in the amount of time spent collecting firewood in each of the wealth categories.

#### 4.10.4 Use of traditional medicine

Many households (40.8%) reported the use of traditional medicines, and wealth of households did not significantly contribute to traditional plant use. The average number of times per year household members collects their own plants for medicine was 196 times per year or 3.8 times per week. Overall, households that use traditional plants

acquire their plants by; buying (55.2%), collecting (28.4%), and buying and collecting (16.4%). The majority of households (59.2%) reported that they do not use traditional medicines. Significantly, there was no differentiation between wealth classes and their decision to not use traditional plants for medicine.

#### **4.10.5 Water availability**

Overall, 34.4% of the households reported that they did not have any problems acquiring water and that water was readily available year round. Households that did have problems acquiring water reported that the most difficult months for acquiring water were from August to January. Most households (65.6%) reported low water availability for one month per year, 43.8% had difficulty for 2 months, 20.6% had difficulty for 3 months, and only 3.6% had difficulty acquiring water 4 months of the year.

#### **4.11 Household spending**

Table 4.9 shows where households spend their income and what percentages of households spend income in each of these areas. The areas include (most frequent to least); clothes, hygienic products, medical fees, food, milling, agricultural supplies, livestock/animals, school, paying debts, other, and putting money into savings. Other items category includes; business expenses, transportation, gas, vehicles, and bicycles.

In addition household expenditure, Table 4.8 summarizes the ranking results of how much income was allocated to different spending areas. Areas from most to least costly for all households were as follows; milling costs, other items (i.e. business expenses, housing, transportation), clothes, medical fees, livestock, food, school, agricultural supplies, hygienic products, debt, and finally savings. High wealth households ranked milling spending significantly ( $p \leq 0.05$ ) higher than low wealth households.

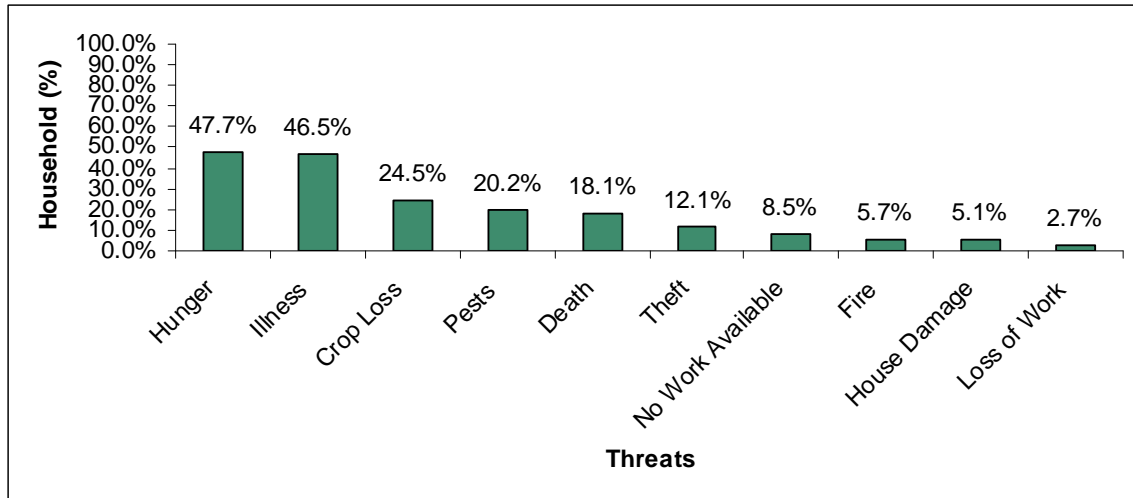
**Table 4.8: Frequency of households spending, mean rank and standard deviation (SD) of spending.**

<b>Cost Items</b>	<b>Percentage (%)</b>	<b>Mean Ranking (SD)</b>
Milling	74.0	5.20 (1.85)
Other*	10.6	4.97 (3.16)
Clothes	95.5	3.83 (1.99)
Medical Fees	78.5	3.64 (1.81)
Livestock	34.1	3.30 (1.74)
Food	76.7	3.15 (1.86)
School	22.6	3.11 (1.89)
Agriculture Supplies	45.0	2.88 (1.42)
Hygienic Products	90.9	2.74 (1.89)
Debt	23.9	2.60 (1.79)
Savings	9.7	2.01 (1.56)

\*Other cost items include; business expenses, house, transportation

#### **4.12 Threats, coping mechanisms and food insecurity**

Figure 4.11 shows the primary threats suffered by rural households in the last year and the percentage of households that experienced each threat. The most common threats experienced by households were hunger (47.7%), illness (46.5%), loss of crops (24.5%), and damage to crops by pests (20.2%). Hunger results from crop failure due to too much rain or wind, pests or livestock damage, inability to work due to an illness, and theft of food or money. Other threats experienced by households include; theft (12.1%), death of a household member (10.1%), no work (8.5%), bush fires (5.7%), house damage (5.1%), and unemployment (2.7%). Many household threats were inter-related, for example crop failure could be experienced as a result of pests, illness, pests, bush fires, etc



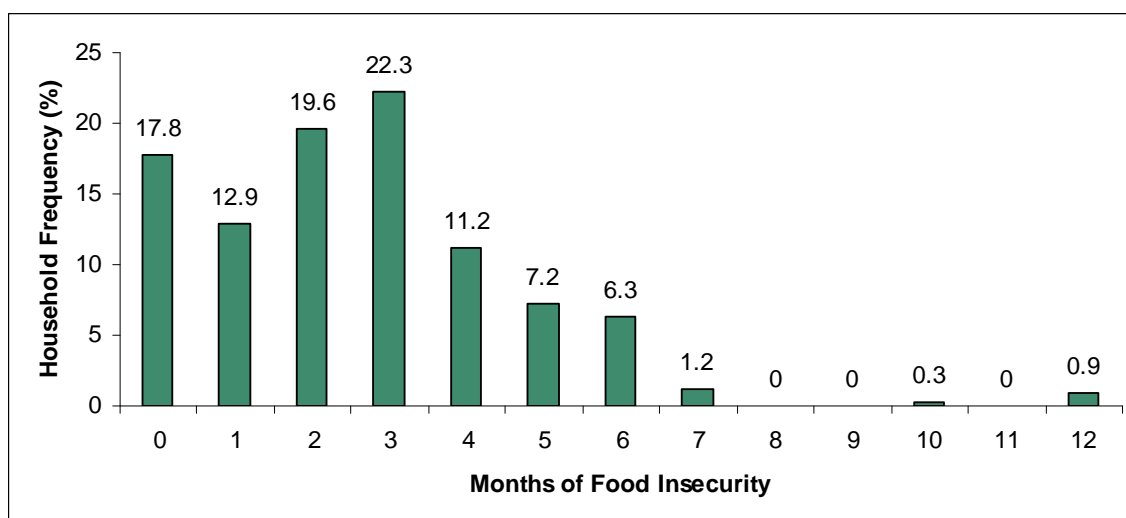
**Figure 4.11: Frequency of threats experienced by households.**

Table 4.9 presents the results of the coping mechanisms of households. Of the households that experienced hunger, 63.3% of them coped by working for income. Wealth contributed significantly ( $p \leq 0.05$ ) to hunger, low wealth households experienced hunger more frequently than medium and high wealth households. A significant ( $p \leq 0.05$ ) relationship between hunger and total household *machamba* area was found, households with more land were less likely to suffer from hunger. Working for income was also the primary coping mechanism for dealing with crop loss, illness, loss of employment or no work, and house damage. Low wealth households suffered significantly ( $p \leq 0.05$ ) more illness threats than medium and high wealth households. Medium wealth households dealt significantly ( $p \leq 0.05$ ) more with the issue of no work being available than the low and high wealth households. Households coped with death in the family, theft, and damages to crops by selling assets. Loss due to theft in addition to sale of assets was dealt with by selling crops. Households that suffered from a bushfire were required to migrate to other areas. There were no significant differences found in households of different wealth categories in relation to crop loss, death, loss of work, theft, house damage, fires, or pests.

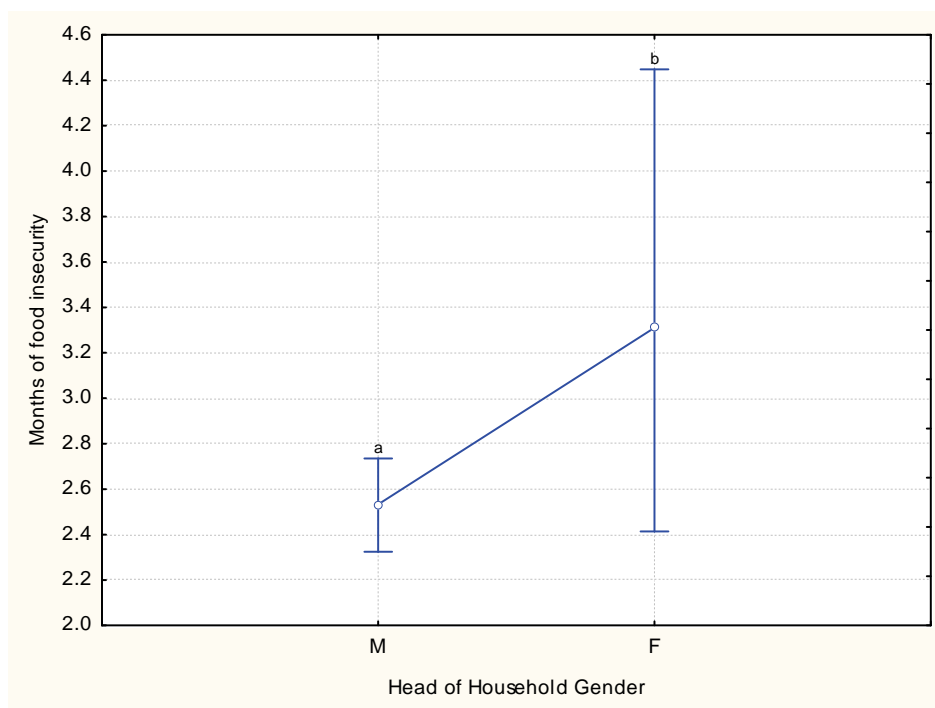
**Table 4.9: Frequencies of coping mechanisms used by households to deal with threats**

Threats	Coping Mechanisms (%)			
	Work	Sell Assets	Sell Crops	Migration
Hunger	<b>63.3</b>	29.8	6.2	0.6
Crop Loss	<b>51.8</b>	34.6	9.9	3.7
Illness	<b>52.8</b>	25.7	20.7	0.7
Death	38.3	<b>40.0</b>	15.0	6.6
Loss of employment	<b>50.0</b>	12.5	12.5	25.0
No Work	<b>53.8</b>	34.6	11.5	0
Theft	15.1	<b>39.4</b>	<b>39.4</b>	6.1
House Damage	<b>35.3</b>	17.6	11.7	35.2
Bushfire	23.1	15.4	23.1	<b>38.5</b>
Pests	29.1	<b>41.8</b>	18.2	9.1

Over 80% of the households interviewed reported at least one month in the year when they suffered food insecurity. Figure 4.12 shows the frequencies and the length of period the households experienced food insecurity. Female headed households suffered a significantly ( $p \leq 0.05$ ) greater number of months of food insecurity than male headed households (Figure 4.12). A significant ( $p \leq 0.05$ ) relationship was also found between household *machamba* area and number of months of food insecurity with households with more land suffering fewer months of food insecurity.



**Figure 4.12: Months of food insecurity experienced by households**



**Figure 4.13: Results of bootstrap analysis of head of household gender and number of months of food insecurity.**

The time of year when most households experience food insecurity is during the summer months (wet season) when they are running low on food crops from the previous planting season (Table 4.10). Overall, 50.1% of the households reported food insecurity during the summer months. Spring (15.1%) and spring/summer (14.2%) were also difficult times of the year for food insecurity in households. Very few households reported food insecurity during autumn (1.2%), winter (0.3%), and throughout the year (1.2%).

**Table 4.10: Time of year households suffered from food insecurity**

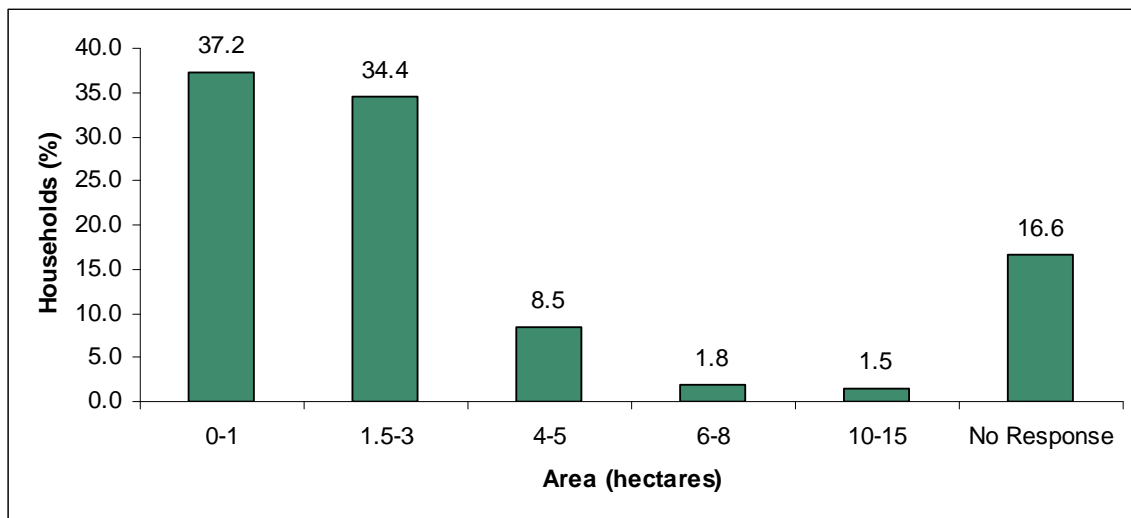
Time of year	Frequency (%)
Spring (Sept - Nov)	15.1
Summer (Dec – Feb)	50.1
Spring and Summer	14.2
Autumn (March – May)	1.2
Winter (June – Aug)	0.3
All year	1.2
Did not experience insecurity	17.8



### 4.13 Forestry awareness, participation willingness, and perceptions

Households were asked if they were aware of forestry development plans for the area, and 39.6% of the households answered 'yes' that they were aware, and the remaining 60.4% answered 'no' that they were not aware of such plans. Those households that answered 'yes' heard about forestry development plans from; community (21.4%), local government (11.5%), public consultations (3.9%), school (0.3%), and others were not sure (1.2%).

Overall 87% of the households would be willing to plant trees on their own land for a forestry company; while 11.8% were not willing and 1.2% was not certain. The average number of hectares households had available for planting trees was 2.1. Figure 4.14 shows the frequencies of land availability for planting. High and medium wealth households had significantly ( $p \leq 0.05$ ) more land available for commercial forestry than low wealth households.



**Figure 4.14: Frequency of land available for planting by households that were willing to participate in planting program.**

The areas where households would establish the plantations were as follows; 34.7% would plant near or in the community, 25.9% on old *machambas*, 28.7% on *machambas*, 1.2% on sandy soils, 0.6% in river zones, 0.6% did not have land to plant, 0.3% were not

sure where, and 7.8% did not respond. There were no significant differences in responses among the households according to wealth with respect to where households would establish the plantations. In addition, wealth was not a significant factor in household's willingness to plant trees for commercial forestry.

#### **4.13.1 Perceived impacts and benefits of forestry on community**

Households were asked a series of questions in order to understand their perceptions of forestry and how they thought forestry would benefit and impact their community. In the case of all perception responses, household wealth did not significantly influence perception responses. Employment (64.6%) was the most common community benefit cited by households followed by; increased cash flow for local markets (14.2%), no benefits (8.2%), better social services (7.5%), better roads (4.5%), more wood (0.3%), shade (0.3%), and minimized erosion (0.3%) (Table 4.11). Many households (48.3%) felt that forestry would not result in any impact on their communities (Table 4.12). The most frequent concern expressed by households is that family members would be working outside the home (24.5%) and would therefore not be available to perform current household duties. This concern was followed by; fewer resources available (7.8%), less land for agriculture (6.6%), increased traffic on roads (5.4%), and land accessibility (1.2%).

**Table 4.11: Summary of household perceptions of benefits forestry will have on community**

<b>Community Benefits</b>	<b>Frequency of Households (%)</b>
Employment	64.6
More money for local markets	14.2
No benefits to community	8.2
Better social services (schools, hospitals, etc...)	7.5
Better roads	4.5
More wood available	0.3
Shade from trees	0.3
Minimize erosion	0.3

**Table 4.12: Summary of household perceptions of impacts forestry will have on community**

<b>Community Impacts</b>	<b>Frequency of Households (%)</b>
No impacts	48.3
More traffic on roads	5.4
Family members working outside of home	24.5
Less resources available	7.8
Land restrictions/ less access to land	1.2
Less land for agriculture	6.6
No opinion	0.9
Less water available	2.4
Immigrants (increase in population)	2.4

#### **4.13.2 Perceived impacts and benefits of forestry on family**

The most common response to household benefits of forestry was income (57.4%). This was followed by education for their children (27.8%), food security (9.7%), forestry would create no benefits to the household (3.3%), better homes (1.2%), new business opportunities (0.3%), and better life (0.3%) (Table 4.13). Many households (54.4%) felt that forestry would not result in any negative impacts to their household. The perceived negative impacts that followed include; less family members to perform household duties (16.6%), less land for agriculture (15.4%), decreased resource availability (7.8%), land accessibility (3.3%), less water (1.2%), and an increase in population from immigrant workers (1.2%) (Table 4.14).

**Table 4.13: Summary of household perceptions of benefits for family if they were employed by Forestry Company**

<b>Family Benefits for forestry workers</b>	<b>Frequency of Households (%)</b>
Income	57.4
Education for children	27.8
Food security	9.7
No benefit to family	3.3
Able to have a better house	1.2
New business	0.3
Will have a better life	0.3

**Table 4.14 Summary of household perceptions of impacts on family if they were employed by Forestry Company**

<b>Family Impacts for forestry workers</b>	<b>Frequency of Households (%)</b>
No impact on family	54.4
Less family members to perform household duties	16.6
Less land for agriculture	15.4
Availability of resources	7.8
Less access to land	3.3
Less water available	1.2
Immigrants (increase in population)	1.2

Creation of indirect employment (35.0%) and better infrastructure (38.4%) were the two most common responses to the household benefits for those hypothetically not directly employed by Forestry Company (Table 4.15). As many as 19.9% of the households thought that forestry would not bring any benefits to the family, this perception was followed by; more wood available (4.8%), no opinion (0.6%), would bring good benefits (0.6%), and increase water availability (0.3%). The number of households that thought there would be no benefits has increased from 3.3% (employed by Forestry Company) to 19.9% (not employed by Forestry Company).

No impact on family (51.3%) was the most frequent response to impacts of forestry on households (Table 4.16). This was followed by less available resources (11.5%), less land for agriculture (10.3%), more traffic on roads (9.9%), increase in population from immigrant workers (5.4%), and decrease in water availability (5.1%).

**Table 4.15: Summary of household perceptions of benefits for family if they were not employed by Forestry Company**

<b>Family Benefits for non forestry workers</b>	<b>Frequency of Households (%)</b>
Creation of indirect employment	35.0
Better infrastructure	38.4
No benefits to family	19.9
Availability of wood	4.8
No opinion/ Not sure	0.6
Generally will bring good benefits	0.6
More water available	0.3

**Table 4.16 Summary of household perceptions of impacts on family if they were not employed by Forestry Company.**

<b>Family Impacts for non forestry workers</b>	<b>Frequency of Households (%)</b>
No impact on family	51.3
More traffic on roads	9.9
Less available resources	11.5
Less water availability	5.1
Less land for agriculture	10.3
Immigrants (increase in population)	5.4
Land restrictions, less access to lands	3.9
No benefits to family	2.1
No opinion	0.3

#### **4.13.3 Perceived impacts of forestry on culture and tradition**

During the interview, households were asked how they felt about females working away from the home in a forestry plantation; 80.9% of the households were fine with this, 9.7% said they did not want females working, and 9.4% did not have an opinion.

Table 4.17 shows the results of perceived impacts of introducing the forestry on local culture and traditions. Change in traditional land use (29.3%) was the most common concern expressed by households. This was directly followed by no say in plantation management (22.3%), change to family with members working outside the home (14.5%), change to religious customs (13.9%), influences by outsiders (13.0%), and environmental impacts (0.3%). Only, 6.3% of the households thought that forestry would have no impact on their local culture and traditions and 0.9% did not respond.

**Table 4.17: Summary of households perceived impacts on local culture and tradition**

<b>Impacts on local culture and tradition</b>	<b>Frequency of Households (%)</b>
Change in traditional land use	29.3
Outsiders influencing local culture and traditions	13.0
Change to religious customs	13.9
Change to family by members working outside the home	14.5
No say in plantation management	22.3
No impact	6.3
Environmental impacts	0.3
Did not respond	0.9

#### 4.13.4 Impacts on water and land availability

Households were asked how they thought forestry plantations would impact water availability. Overall, 82.2% of the households felt that forestry would result in an increase in water (Table 4.18). Followed by 9.1% of the households thought that water availability would remain the same, 6.9% thought water would decrease, and 1.8% had no opinion or did not respond to the question. Households were asked whether they thought there would be enough land for forestry activities in the area. The majority (67.1%) of households responded that there would be enough land available for everyone (plantations and rural residents) (Table 4.19). Overall, 21.7% of the households responded that there was not enough land for everyone, 10.3% thought land availability would remain the same, and 0.9% did not have a response.

**Table 4.18: Households perceived impacts on water availability with introduction of plantation forestry**

<b>Impact on water availability</b>	<b>Frequency of Households (%)</b>
Increase water	82.2
Decrease water	6.9
Will be the same	9.1
No opinion	0.3
Did not respond	1.5

**Table 4.19 Households perceived impacts on land availability with introduction of plantation forestry**

<b>Impact on land availability</b>	<b>Frequency of Households (%)</b>
Enough land for everyone	67.1
Not enough land	21.7
Will be the same	10.3
Did not respond	0.9

#### 4.14 Key informant interviews

During key informant interviews, informants were asked informal questions regarding the introduction of forestry in the study area. In particular, questions were formulated to gain an understanding of the livelihood strategies of rural residents. Key informant interviews

also helped to formulate relevant household interview questions and to help apply the correct wording. In addition, key informant interviews were used to solicit input from individuals familiar with rural livelihoods on what potential impacts may be created, and what challenges a forestry company may face.

#### **4.14.1 Potential impacts**

Everyone that was interviewed thought that forestry plantations would create positive impacts 'if' the company put in place adequate programs to assist rural households with land use changes. Key informants identified the following positive impacts; employment (both direct and indirect), economic diversification, improved infrastructure and health care within the communities and city of Lichinga, and better education.

#### **4.14.2 Potential forestry development challenges**

The informants identified a number of challenges that forestry companies may be faced with when initiating forestry plantations. The main challenges that were identified can be summarized as follows:

- Education – currently the rural residents are not well educated and very few would be able to perform duties beyond manual labor which is usually seasonal employment. Currently residents will not be able to take on professional level roles that would allow them to work full time. Many families begin the school year by sending their children to school, but when the planting season comes the children in many cases need to be taken out of school to help farm the land. The school schedule is not flexible to accommodate for this and children are unable to complete their levels. There are also some communities that do not have schools making it impossible for children to get an education. Many rural residents do not want their daughters to attend school, in their culture the daughter will stay with the family even after they get married. If their daughters are educated there is a fear that they will leave and there will be no one to stay and take care of the family.

- Shifting agriculture – households practice shifting agriculture and will use plots of land for short periods of time and then move to a new plot. Apparently once agriculture plots are abandoned farmers do not return. Forestry plantations will limit their ability to shift and may create land conflicts. Many households can only manage small plots of land due to limited resources (i.e. people to work the land, tools).
- Culture – people living in the rural communities are very traditional and follow practices that may hinder private sector development. These people have been practicing their semi-nomadic way of life for generations. Many households practice polygamy and have several wives. Children at the age of pubescence undergo circumcision rituals and begin their preparatory journey to adulthood. It is at this time that many girls are taken out of school. Traditional leaders in the communities and districts continue to play a significant role. Outsiders must get approval from traditional leaders before pursuing any activities in the communities. Also, many people are not accustomed to working under the conditions and expectations of others.
- Bush fires – during the dry season there are many bush fires that are started by people throughout the area. Some of the reasons fires are started are; pest control, hunting to herd the animals in a particular direction, to clear land, and others for no apparent reason. The issue of bush fires was raised by informants since they thought it possible that rural residents may use fire during times of conflict with Forestry Company.

#### **4.15 Chapter summary**

This chapter presented the results of household interviews and interviews with key informants. Wealth categorization results indicated that the majority of the population is categorized in the medium wealth category (82%), and that diversity of household income activities is quite limited and that rural households all follow similar livelihood patterns. Results also indicated that all natural resources in the area are used by households including proposed forestry areas. When households were asked about their perceptions regarding forestry activities near their communities, most felt that there



would be no negative impacts, and thought they would most benefit from employment and income opportunities. The chapter that follows will discuss the results.

## **CHAPTER 5: DISCUSSION**

The chapter presents a discussion of the socio-economic profile, livelihood strategies, and the potential socio-economic impact of introducing plantation forestry on rural households in the study area.

### **5.1 Current socio-economic profile of households**

Household socio-economic status was stratified into wealth categories based on wealth indicators. The majority (81.6%) of the sample population was categorized as medium (Section 4.1). It is suspected that with economic development, these wealth indicators will evolve and require continuous modification as development in the study area resumes. For example not long ago, bicycles were considered as indicators of wealth as not many people owned them (see Augustine et al., 2005). From a nationwide study in 2005 to the current study done in 2008, household bicycle ownership has risen from 46% (Augustine et al., 2005) to 76% found in the study area (Table 4.3). Therefore, since the majority of the population owns a bicycle they are no longer considered a wealth indicator.

Wealthier households possessed more physical and natural assets than less wealthy households; therefore particular household assets were identified as wealth indicators (Table 3.2). The World Bank (2008) also confirmed that households with the capacity to acquire productive assets such as more land, labor, livestock, seeds, and tools were less likely to be defined as poor, and that productive assets were useful in defining poverty at the household level. During the time of the study it appeared that the wealth gap that existed between the three wealth categories was minimal, and that all of the households pursued the same livelihoods strategies. However, poor households were those mainly headed by female and old people, and those with frequent illnesses, less labor, less land, smaller houses, and fewer assets. This confirms the findings of other researchers elsewhere (Neefjes, 2000; Cramer & Pontara, 1998; World Bank, 2008).

In Mozambique gender relations are characterized by women's subordinate status. The study indicated that male headed households were significantly ( $p \leq 0.05$ ) wealthier than female headed households in the study area. This confirms Cramer and Pontara (1998) report that women are usually the most disadvantaged since they have higher dependency ratios and more difficulty accessing wage labor. The majority of households were headed by males (91.2%) with only 8.8% headed by females (Section 4.1). This is contrary to observations made by Walker et al. (2006) in other parts of Mozambique.

A common perception is that employment in the area from forestry will help alleviate rural poverty (World Bank, 2008), by providing wage earning opportunities to rural households thus influencing socio-economic status. Tschirley and Benfica (2001) reported that wages enabled households to escape poverty by opening up opportunities such as; self employment activities, and asset acquisition including wealth indicators such as homes built with better materials. The current study presented similar results in that wealthier households were those that had been able to diversify their income through small family businesses, labor, cash crops, fishing, and other non subsistence related activities. In reports written by Tshirley and Benfica (2001) and Cramer and Pontara (1998) the authors present opposing arguments pertaining to employment creation impacts on disadvantaged households in Mozambique. Tshirley and Benfica (2001) suggests that only the social elite will benefit, whereas Cramer and Pontara (1998) indicated the importance of creating employment opportunities for disadvantaged households such female headed households. Therefore, disadvantaged households will require assistance (e.g. child care services for female headed households and infrastructure to reduce time spend on household chores) in order to enable them to work outside of the home to ensure equal access to income opportunities (Sida, 2007).

### **5.1.1 Factors contributing to household wealth**

The greatest contributor to wealth was the amount of household members the household possessed. Households with a greater number of members and *machamba* land were significantly ( $p \leq 0.05$ ) wealthier than smaller member households (Section 4.1 and Section 4.6, respectively). This finding is supported by observations made by Ellis (2003) and Neefjes (2000) where households with more family members were able to

cultivate and tend more land and were therefore found to have more *machamba* land. Significant ( $p \leq 0.05$ ) relationships between wealth and food availability (food insecurity and hunger) implies that wealthier households produce more food and suffer less hunger (Section 4.12). Tschirley and Benfica (2001) also confirmed that wealthier households cultivated a greater value of food crops and 50% more cash crops. Therefore, it can be suggested that wealthy households with more households labor are able to cultivate more land and diversify their land use; thus producing more food and cash crops. This increased ability to produce more cash crops results in more household income for purchasing assets and better housing materials, thus attributing to their wealth status.

In addition to having the ability to diversify their land use and cash crops, wealthier households also participated in more livelihood activities resulting in more diversified income sources (Section 4.4). It can be implied that wealthier households have more human resources as well as tools and finances (fishing supplies and money to purchase fishing permit) to conduct these additional activities. This is supported by Tshirley and Benfica (2001) who found that the key income earning determinant amongst rural households was more wealth and the numbers of household members.

In the current study it was observed that wealthier households suffered significantly ( $p \leq 0.05$ ) less illness than low wealth households (see Section 4.12), therefore household health was also an important factor in the success of the household. It can be implied that households that suffer less frequent illnesses have more available labor for cultivation, and for pursuing other livelihood activities that contribute to income. This is in line with other findings in other parts of Mozambique (Forum for Food Security, 2004).

In this study, the education levels of the head of households held no bearing on household wealth; more educated households were not wealthier than less educated households. This finding is contrary to other studies since people with more education are normally better off (e.g. assets, income, food security, health) than those who are less educated (Cramer and Pontara, 1998; Becker, 1995; Fan et al., 2000, Place et al., 2005). Agriculture and other livelihood activities currently practiced do not require formal education, since these skills are passed through family teaching. Also, wealthy

households were not more likely to send their children to school, which implies that childhood education was not held in high regard. Therefore, it can be speculated that as more income opportunities become available in the study area, education will most likely hold more of a bearing on household wealth, and investment in household education will become more lucrative. The results also showed that specialized skills did not significantly contribute to household wealth. Households that possessed less common skills such as carvers, carpentry, mechanics, traditional doctors, business owners, teachers, and other service providers were not significantly wealthier than other households. Forestry development in the area may create more of a demand for these skills and better salaries (Tschirley & Benfica, 2001; Hyde, 2004).

## **5.2 Current livelihood strategies**

All of the livelihood strategies categorized by Scoones (1998) were pursued by the rural households in this study. These categories include agricultural intensification and extensification, diversification, and migration. Livelihood strategy assessments discussed below were based on field observations, key informant interviews, and data collected during household interviews. All in all, there were many households that depended on a combination of livelihood strategies to survive and it appeared that households shift livelihood strategies depending on assets that were available to them, or threats that they were experiencing during any given period of time.

Field observations and discussions with key informants indicate that the most typical livelihood strategy pursued by households was agricultural extensification and migration. Agriculture extensification relies on increasing production by cultivating more agriculture land or increasing livestock (Scoones, 1998). These two livelihood strategies were frequently pursued in combination. Interviews indicated household's difficulty in purchasing fertilizers and having access to other tools for intensification therefore, households were required to increase *machamba* lands in order to increase production. Migration was a livelihood strategy pursued for a similar reason as extensification; due to the inability to purchase fertilizers, it was observed that households were required to migrate to new *machamba* lands every 2-3 years. Once *machambas* are abandoned, community members indicated that they do not return to these *machambas*. However,

their perception of time was observed to be obscured and when individuals were asked how long they use something they would indicate it was a very long time or forever, when in fact what they felt was a very long time was only one to five years. Therefore, it was unclear if in fact after perhaps 10 years they would return to abandoned lands to re-cultivate. It was in these abandoned *machambas* where communities envision plantations to be established. If households do return to abandoned *machambas* some years afterwards, forestry impacts on rural households will be much more significant. It was also observed that 38.4% of households (Section 4.6) were required to temporarily move to their *machambas* since they were too far from their existing homes to travel daily. Field observations and informal discussions with community members indicated that many households had migrated to their current communities post war and some more recently migrated to access agricultural land or because of wildfires that had destroyed their previous homes.

Agricultural intensification is concerned with receiving more production from a unit of land through the use of fertilizers, machinery, pesticides, irrigation, and other management techniques that enhance production (Scoones, 1998). A few households reported that they had received assistance from local government (13%) and NGO's (14%) in the form of agricultural education, tools, seeds, fertilizers, and small loans to help them with intensification of their *machambas*. Agricultural intensification was not typically done unless assistance was provided, but many households commented that if forestry was to be introduced, households would need further assistance to pursue this livelihood strategy. Therefore, with respect to sustainable human development in the area, if forestry is to be successful this livelihood strategy will need to be pursued by households in combination with diversification.

Diversification which Ellis (2000) defined as "the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living". The study indicated that the vast majority of the households were practicing shifting subsistence agriculture as their primary livelihood means, and for the most part the diversity of crops grown amongst households was minimal (see Section 4.9). However households with the available assets were

diversifying on their farm land by growing crops for both consumption and income (Table 4.4), and discussions with households indicated that they were open to opportunities to continue diversifying their crops and improving their agricultural practices to have more productive and marketable crops. The ability for households to diversify their income sources will signify an improvement in their livelihood security, therefore diversification should not be constrained (Ellis, 1998). In order to promote diversification households will need assistance in accessing new markets (cultivate different products, transportation of products to outside markets, and non-agricultural markets). Forestry employment and the potential creation of indirect employment (see Bryceson, 2002; Hyde, 2004) will help households diversify their livelihood strategies by lessening their dependence on food production agriculture.

### **5.2.1 Livelihood portfolios**

Livelihood portfolios are the combination of activities that households pursue (Scoones, 1998). Field observations indicated that most households had very similar livelihood portfolios. The most important household livelihood activity was agriculture which was accomplished primarily in the wet season (December to March). Activities performed on a day to day basis were; collection of water and fuel wood, cooking, and tending to children and livestock are primarily done by women and these activities consume much their time (Section 4.5). The World Bank (2008) suggests that if women didn't have to spend so much time doing these activities they would have time available for income opportunities (e.g. education, wage labor). The development of infrastructure such as a rural water supply could help reduce the amount of time women spend on household chores (World Bank, 2008). The number of household involved in non-agricultural businesses such as hunting, fishing, charcoal and wood collection in the study may have been underestimated since they require permits and/or are illegal, thus making households reluctant to admit they were doing them. Selling traditional plants may have also been underestimated since households believe medicinal plants should not be discussed with 'outsiders'.

The results of this study showed that women do more activities and at a higher frequency than men. Similar findings were reported by Sida (2007), who estimated that women

spend on average 14 hours per day working compared to men who work on average 6-8 hours per day. Sida (2007) also indicated that women were primarily responsible for subsistence crops, while men were responsible for the cash crops. A report produced by the World Bank (2008) suggested that men are primarily responsible for the cash crops since they control the cash. The results of this study however showed that both men and women were responsible for cash crops; this may be due to the population density in the rural communities in the study area in comparison to other areas in Mozambique. The Niassa province has the lowest population density in the country (Ministério da Administração Estatal, 2005), and it can be suggested that there are more resources available (water, food, and fuelwood), therefore women can spend less time collecting these resources and can spend more time to conduct cash earning activities.

Children help out in all activities but the results do not show any activities solely done by children. The frequency of childhood activities was low; however this may have been a result of the ages of the children. It was observed that many of the children were young; 20% of the entire sample population was 5 years old or less (Figure 4.0). Older children (more than 12 years old) may have been categorized as adults by interviewees since this is the time when they begin circumcision rituals and when many young girls are taken out of school to work.

### **5.2.2 Coping mechanisms**

Hunger and illness were the two most common threats experienced by 47.7% and 46.5% of the households, respectively (Figure 4.10). Household hunger was experienced as a result of numerous factors such as crop failure, illness in the family, pest damage to crops, inability to work, insufficient tools to work the land, etc. Those households with more capital (human, financial, physical, natural) are better able to cope with hunger and illness, since they can sell assets, work, and have money to buy food, sell crops, and migrate to other areas. Working was the coping mechanism most frequently (63%) adopted by households experiencing hunger (63%) and illness (52.8%) (see Figure 4.10). Notwithstanding, it was unclear from this study how much employment was available to rural households, where they were working, and whether they were paid in cash, or *ganho-ganho*. World Bank (2009) reported that *Ganho-ganho* is a coping mechanism



adopted in rural areas in times of shocks and stress, and when few activities are available to the poor. *Ganho-ganho* is also practiced during normal times, and people will work on someone's farm in exchange for food or money (Norfolk, 2004; World Bank, 2008). In the case of illness it is difficult to understand how working could be a feasible coping mechanism, since illness would impede on capability to work. It is most likely that illness was experienced during a particular time of the year, thus inhibiting their crop production and requiring them to find work in order to cope, or perhaps off farm work was less strenuous for those suffering from illness than *machamba* work.

Apart from working, the sale of assets was another important coping mechanism for households, particularly when dealing with theft, pests, and death in the family. The sale of assets was also used to deal with other threats as well such as; hunger, crop loss, and no work. In rural communities of Mozambique, the World Bank (2008) also found that a common coping strategy was to draw down assets (selling or liquidating) assets, despite having a smaller asset portfolio. Another coping strategy that was commonly adopted was to do nothing and just try to get by (World Bank, 2008). During this study, households were not asked this option, but perhaps households in the study area may be commonly adopting this option as well. Forestry related impacts such as; land use changes, resource availability, and reduction in household labor may trigger households to cope by selling their assets, migrating, or theft.

### **5.3 Natural resource use**

Rural livelihood strategies are typically heavily reliant on natural resources (Scoones, 1998) and for the households in this study this statement was certainly found to be true. The natural forestlands were ranked the most important land class and are used for a variety of household activities such as; fuel wood, food collection, hunting, harvesting timber for construction, charcoal, and traditional medicines. During the hunger season (summer months of December to March) the natural forests are essential for rural livelihood strategies since they are an important source of food and for resources to generate an income (Table 4.11). This safety net feature of the miombo woodlands or forestland has also been highlighted by others (see Akinnifesi et al., 2008; Chirwa et al.,

2008). Natural forestlands are cleared and *machambas* are established and used for both subsistence and as the primary source of income for households.

While, *Machambas* were ranked as important to households for reasons already described, old *machambas* that are left abandoned also play an important role in rural livelihoods. Important tree species such as mango, banana, jujube (*Ziziphus mauritania*), peach, orange, and papaya that were left uncut continue to exist and are fruit producing trees used for consumption and income. Although important, households were most willing to give old *machambas* up for forestry development. It is in these old *machambas* where forestry developments is planned as it assumed it will have the least impact on rural households; and are acceptable areas for plantations under the international Forest Stewardship Council (FSC) standard (FSC, 1996). However, forestry in these areas will impact on the availability of fruits to rural households as discussed earlier.

Sandy soils were ranked as the second most important land class however it was only ranked highly by 12 households (see Table 4.6). Sandy soils are not normally desirable lands for agricultural but can be sources for different trees for wood, fruits, and plants for food and medicine, and for some households farming. River zones are used for fishing, bathing, cleaning laundry, a water source and for recreation by nearby rural households. *Dambos* or wet *machambas* are important areas for vegetable cultivation and these areas are used for longer periods of time (sometimes more than 10 years). These areas are wetter and have richer soils which allow households to cultivate crops throughout the year.

Medium wealth households ranked *dambos* significantly ( $p \leq 0.05$ ) more importantly than high and low wealth households (see Section 4.10.2). Medium wealth households made up the majority of the study sample population, and it has been discussed that they have more assets (e.g. labor, land, seeds, tools) compared to low wealth households to manage *dambos*. Conversely, high wealth households have the resources to manage *dambos* but appear not to do so. It is conceivable that high wealth households did not rank them as importantly since they do not depend on them as much for food security. At this time, there are no forest activity plans for *dambos*, river zones, and sandy soils;

however they may be impacted indirectly in the event that households become more dependent on them in the consequence of a reduction in natural resources.

Grasslands and deforested areas were not considered as valuable as other natural resources. Grasslands are most notably used for thatch roofing and household's cut grass during the dry season. Field observations indicated that many people also use open lands in addition to old *machambas*, and within the communities and near homes for brick making. Deforested areas were ranked the least important, but apparently are the future sites of *machambas*. It can be speculated that households ranked this land type low since their perceptions regarding land availability in the study indicated that they thought there was sufficient land for everyone; and could therefore access more *machamba* land by harvesting marginal forestland. Thus, even though land is currently bare, it does not mean that it is not valuable to rural households. Hence, there is a strong possibility that planting of forestry plantations, even on bare lands, will create impacts to the households who may want the land in the immediate future.

For purposes of new green field projects, grasslands like river zones and natural forest are considered high conservation value areas and there are currently no plans to establish plantations in these areas (Ferraz & Munslow, 1999).

#### **5.4 Income sources and expenditures**

Off-farm labor was an activity reported by 95% of the sampled households in the study area. However in a study conducted by Cramer and Pontara (1998), it was estimated that only 20% of rural households used hired labor. Since there is a large discrepancy between the current study findings and that of Cramer and Pontara (1998), it is uncertain how many households have actually acquired income from off-farm labor and the extent that off-farm work was contributing to the livelihoods of households in the study area. Households reported some income from other livelihood activities such as; brick making, house construction, and sale of traditional medicines and fruits businesses; albeit without a detailed market analysis.

The most common areas where households spend their income were; clothing, hygienic products, medical fees, food, and milling. These results were consistent amongst the wealth categories although high wealth households reportedly spent significantly more income towards milling than medium and low wealth households. This could be because high wealth households have the financial means to use this service and produce more milling products (i.e. maize, cassava, rice, beans) than other households. It is conceivable that low and medium wealth household's mill their crops manually or sell products without milling them at a lower price. The study showed the most costly expenses were milling, clothing, other (business, transport, housing), and medical fees. Increased income through direct and indirect employment as a result of forestry may have an effect on household spending, for example more income may be allocated to purchasing food in lieu of producing, and households may begin to spend more money on luxury items such as; cell phones, televisions, and entertainment.

None of the crops cultivated by households significantly contributed to household wealth. Many of the households grow very similar crops and the most important cash crops that are currently grown are the crops where households are getting the best prices. At the time of the study, a number of households commented that they were getting good market value on beans which would explain why beans were ranked the most important cash crop. However, the most important cash crops appear to change over time and fluctuate with market prices. In the mid 90's (1996-1997) cotton was the most significant enterprise in Niassa hence it was the most important cash crop (Neefjes, 2000).

## **5.5 Potential socio-economic impacts of introducing forestry industry**

Household benefits and perceptions on impact of introducing forest industry were assessed during the study. The most common benefit that was conveyed by households was employment and the most common perceived family benefit for non forestry workers was better infrastructure (38.4%). Hence, it can be implied that there is an expectation in the community that forestry investments will encourage development in the way of better health care, education, roads, electricity, etc (Tshirley & Benfica, 2001).

The households conveyed a strong willingness to participate in planting trees on their own land for forestry companies, 87% of the households were willing to plant an average of 2.1 hectares of land. High and medium wealth households had more land that they were willing to plant than low income households; therefore low wealth households would require more assistance in order to ensure that they can have the same opportunities and benefits as wealthier households. The majority of households reported that they would like to establish such plantations in or near the community on abandoned *machambas*. Based on these findings, the prospect of the introduction of an out-growers scheme in the study area by the Forestry Company appears quite promising. An out-growers scheme would allow interested households to plant and maintain forest plantations on their household and/or community land (Race & Desmond, 2001).

The most commonly perceived negative community and family impacts were land use change and land availability; water and natural resource availability; less household labor for agriculture and livelihood activities; increase in traffic on roads, and social and cultural changes. The sections that follow below will discuss each of these potential impacts.

### **5.5.1 Land use change and land availability**

The proposed forestry plan for the area is to establish commercial forestry plantations of *Eucalyptus* and Pine. Investing forestry companies will be required under the national land use agreement to obtain Forest Stewardship Council (FSC) certification. Under the requirements of the FSC standard forestry companies will not be able to convert<sup>5</sup> natural Miombo woodlands to plantations (FSC, 1996). Therefore, plantations will be established on already deforested lands; primarily in abandoned *machambas*. However plantations may also be established in existing *machambas*, thus requiring households to relocate their *machambas* to other areas. This was what a forestry company in the study area did, and in a recent media case the company relocated 13 families in Sanga from their current *machamba* land to another area (Aide, 2009). The most obvious and potentially devastating impacts will be those as a result of land use changes, from

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<sup>5</sup> FSC Principle 10.9 (Plantation Conversion): "Plantations established in areas converted from natural forests (after November 1994) normally shall not qualify for certification".

household agriculture to forestry plantations. Impacts of insufficient community agricultural land may include; migration to other areas and further clearing of high conservation value Miombo woodlands, land conflicts, damage to plantations by fire or other means, crop theft, increased reliance on other available resources and marginal lands, and selling assets and/or crops (Maung & Yamamoto, 2008; Clement & Amezaga, 2009; Kumar et al., 2000; Tonts et al., 2001; Heaton, 2005). Non-agricultural income diversification can help households cope with less land availability (Bryceson, 2002) and reduce rural poverty (World Bank, 2008).

Households in general had little concern regarding land availability, and the majority (67.1%) of households reported that there would be enough land available for everyone; for forestry and agriculture (see Table 4.20). Households generally expressed anticipation for forestry to be introduced in the area. The fact that people seemed so anxious for forestry development to begin may have influenced their perception and/or responses; thus making them reluctant to express any negative concerns that they had in fear that the project would be cancelled.

Current customary land tenure ship is weighted towards the communities having the final say and granting approval to activities on their settled land. The land law recognizes traditional land ownership and the rights of rural residents to use and occupy land. Hence communities within the study area treat the forestry concession areas as belonging to their communities. However, in Mozambique the state is ultimately responsible for state land and the state delegates land to government administrations, local communities and the private sector (Nhantumbo et al., 2001). The issues regarding land tenure ship in Mozambique may have grand implications to the success of a green field forestry project in the area, and the boundaries between land rights and authorities of government and communities do not appear to be clearly defined.

### **5.5.2 Water and natural resource availability**

Most of the households (82.2%) thought that forestry plantations would increase water availability (Table 4.19). There is a belief that trees create water and colder temperatures, which was pointed out during household interviews. This is contrary to believes in many

other countries and forestry regions. In these other areas the perception is that forestry plantations deplete water resources and cause drought (Ramadhani et al., 2002). Forestry plantations require water year round and regardless of the local acceptance of plantations, the Forestry Company must take a proactive and responsible approach and begin water monitoring studies and ensure water levels for neighboring farms are adequate. The importance and potential impacts of forestry on natural forests and natural resources have been discussed in section 5.3, but the most controversial concern is the conservation of existing Miombo woodlands. Measures may need to be put in place to conserve them from further clearing. To promote ecological and economic stability in the community lands or common pool resources (CPR), community based natural resource management is the most viable option (Adhikari et al., 2004).

Also, livelihood opportunities within the forestry plantations must also be investigated. Perhaps there will be opportunities for communities to use plantations for non-forestry uses such as; honey production, charcoal production, fuelwood, fodder for livestock (Davidson, 1995), and mushroom cultivation (Buyck, 2008).

### **5.5.3 Reduction in household labor**

The importance of available labor in the households has been extensively discussed in Section 5.1.1. If household members must work outside of the home, there will be fewer people to perform these duties and may result in less food production, children having to work at home rather than attend school, or inability to perform other household activities. Those who work for Forestry Company should be able to hire labor or offset their inability to work at home by purchasing goods (Cramer & Pontara, 1998). Nevertheless, the issue of members working outside of the home was an impact with which households were concerned.

### **5.5.4 Increase in traffic**

Households were concerned about the increase in traffic on roads. In the Sanga district the communities are primarily situated along main roads and many people use these roads on a daily basis to transport products to local markets and for general transportation. The roads are not conducive to heavy traffic and transport trucks that will one day need to be

used to transport logs. Children are commonly found on the roads and heavy traffic will be an important safety concern given the proximity of the houses to the main roads. Livestock in the communities also roam freely and are found frequently on the road. It is not uncommon for livestock to be killed by passing vehicles.

### **5.5.5 Cultural and social impacts**

There is concern that the introduction of forestry and the availability of employment in the area will result in an influx of migrant workers and/or outsiders who may take available jobs and influence their culture and traditions. Given the current low availability of skilled labor, outsiders will be needed to perform management and technical duties. The majority of rural people in the area at this time will only be able to carry out manual labor duties. It is possible that migrant workers may arrive from surrounding regions in search of manual labor jobs (Cramer & Pontara, 1998). The rural residents are very traditional and there is concern that outsiders and migrate workers may disrupt their customs such as; religious traditions, community leadership structure, marriage and family customs, and circumcision rituals.

Forestry may influence gender relations, since employment by Forestry Company will allow women equal opportunities (i.e. positions and salary). In Mozambique women seek a husband for financial security (Pontara, 2001), therefore it can be implied that as women gain more financial independence, this may also influence the number of female headed households in the future and there may be more family separations or women choosing not to get married. In households where women are working, traditional roles may change and families with young girls may see advantages to allowing their daughters to continue their educations and remain in school. In general, with respect to childhood education the creation of other livelihood opportunities may help change households attitudes toward education, making education for their children more of a priority and a possibility with increased income.

The majority of households thought that the greatest benefits of forestry to their families and the community would be the creation of employment and income both directly and indirectly. However, the creation of employment and income may create cultural and



social impacts. Social and cultural issues that may be created include prostitution, increases in alcohol consumption, a rise in crime rates and gender equity (Forestal Oriental, 2006), changes to traditional family structure (Cramer & Pontara, 1998), and a greater wealth gap between households (Tschirley & Benfica, 2001). Culturally, communities customarily operate under a traditional leadership system where each community has appointed leaders and they make the decisions. There is concern that the communities will have no control or say in Forestry Company decisions. If communities feel powerless on their own land there will be a risk of land disputes and conflict.

## **5.6 Chapter summary**

This chapter discussed the current socio-economic profiles of the rural households indicating there are currently minimal wealth gaps between households since the majority of households follow very similar livelihood strategies. The discussion on current use of natural resources indicated that all of the land types in the study area are used by households therefore; forestry plantations will have an impact on household accessibility to land and resources. Other potential socio-economic impacts were also discussed which include; changes to the household and family unit with members working outside of the home, the increase in traffic and how it may impact public safety, and finally cultural and social impacts including how forestry may impact local traditions and customs.

The final chapter (Chapter 6) that follows will conclude the findings of this study and will provide recommendations for mitigating any potential adverse socio-economic impacts as a result of proposed forestry activities.

## **CHAPTER 6: CONCLUSION AND RECOMMENDATIONS**

This final chapter presents the study conclusions and recommendations based on the final objectives set at the outset of the study focusing on mitigating socio-economic impacts of forestry development. Recommendations to mitigate adverse socio-economic impacts are presented along with corresponding FSC Standard requirements.

### **6.1 Conclusion**

Forestry will impact rural residents in the proposed afforestation area both positively and negatively, and it will be important that these impacts are monitored and reported as green field projects progress. The review and analysis of this study has resulted in the formulation of recommendations to help offset any negative impacts that may transpire as a result of forestry development. It is important to note that recommendations may require modifications as a result of continuous monitoring. Monitoring should proactively identify any unforeseen socio-economic impacts. In addition, most of the recommendations presented here meet international FSC certification requirements (FSC, 1996). Hence, by implementing the following recommendations any Forestry Company investing in development will also meet applicable FSC standard criterion.

#### **6.1.1 Current status of rural households prior to forestry**

The study concluded that although household are categorized into three wealth categories, there are minimal wealth gaps between these wealth categories. Most of the household livelihoods depend heavily on subsistence agriculture and marginal lands (natural forest, rivers, wet areas, grasslands). There is a possibility that employment opportunities created by forestry will create larger wealth gaps between wealth classes due to disparities between wage earning households and non-wage earning households.

#### **6.1.2 Socio-economic impacts of forest plantations**

Based on the response from the study area, it was concluded that the most commonly perceived positive socio-economic benefits of forest plantations were creation of

employment and better infrastructure (e.g. schools, health care services, and roads) while the adverse socio-economic impacts were land use change and land availability, water and natural resource availability, less household labor for agriculture and livelihood activities, increase in traffic on roads, and social and cultural changes. Table 6.1 presents the positive and negative socio-economic impacts, including the specific aspects that will be affected.

**Table 6.1: Summary of the potential socio-economic impacts of industrial forestry on rural households, and associated mitigation recommendations and FSC Standard Criterion**

Potential socio-economic impacts (positive and negative)	Mitigation recommendations	Relevant FSC standard requirements*
Employment Creation; a) access to more assets b) self employment opportunities c) poverty alleviation d) food security e) skills development and education	Monitoring program	<p>FSC Criterion 7- 7.1 b) Description of the forest resources to be managed, environmental limitations, land use and ownership status, socio-economic conditions, and a profile of adjacent lands.</p> <p>FSC Criterion 7- 7.2 The management plan shall be periodically revised to incorporate the results of monitoring or new scientific and technical information, as well as to respond to changing environmental, social and economic circumstances.</p> <p>FSC Criterion 8 Monitoring shall be conducted appropriate to the scale and intensity of forest management -- to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.</p> <p>FSC Criterion 10-10.8 Appropriate to the scale and diversity of the operation, monitoring of plantations shall include regular assessment of potential on-site and off-site ecological and social impacts, (e.g. natural regeneration, effects on water resources and soil fertility, and impacts on local welfare and social well-being. Special attention will be paid to social issues of land acquisition for plantations, especially the protection of local rights of</p>

		ownership, use or access.
<p>Infrastructure;</p> <p>a) roads and access to outside markets</p> <p>b) health care services</p> <p>c) schools</p> <p>d) rural water systems</p>	Monitoring program	<p>FSC Criterion 7- 7.1 b) Description of the forest resources to be managed, environmental limitations, land use and ownership status, socio-economic conditions, and a profile of adjacent lands.</p> <p>FSC Criterion 7- 7.2 The management plan shall be periodically revised to incorporate the results of monitoring or new scientific and technical information, as well as to respond to changing environmental, social and economic circumstances.</p>
<p>Land use changes:</p> <p>a) relocation of household <i>machambas</i></p> <p>b) migration</p> <p>c) draw down of assets</p> <p>d) land conflicts</p>	<p>Livelihood response program</p> <p>Partnerships for livelihood diversification and agriculture intensification</p> <p>Conflict resolution</p>	<p>FSC Criterion 4 – 4.5 Appropriate mechanisms shall be employed for resolving grievances and for providing fair compensation in the case of loss or damage affecting the legal or customary rights, property, resources, or livelihoods of local peoples. Measures shall be taken to avoid such loss or damage.</p> <p>FSC Criterion 5 – 5.4 Forest management should strive to strengthen and diversify the local economy, avoiding dependence on a single forest product.</p> <p>FSC Criterion 2 - 2.3 Appropriate mechanisms shall be employed to resolve disputes over tenure claims and use rights. The circumstances and status of any outstanding disputes will be explicitly considered in the certification evaluation. Disputes of substantial magnitude involving a significant number of interests will normally disqualify an operation from being certified.</p>
<p>Water and natural resource availability:</p> <p>a) decrease in available water</p> <p>b) conservation of special area (e.g. cultural significance, high conservation value)</p>	Conservation and resource availability	<p>FSC Criterion 3 - 3.3 Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by forest managers.</p> <p>FSC Criterion 5 - 5.5 Forest management operations shall recognize, maintain, and, where appropriate, enhance the value of forest services and resources such as</p>

c) depletion of resources in marginal lands	Partnerships for livelihood diversification and agriculture intensification	watersheds and fisheries.  FSC Criterion 6 - 6.2 Safeguards shall exist which protect rare, threatened and endangered species and their habitats (e.g., nesting and feeding areas). Conservation zones and protection areas shall be established, appropriate to the scale and intensity of forest management and the uniqueness of the affected resources. Inappropriate hunting, fishing, trapping and collecting shall be controlled.
Reduction in wage earning household labour: a) less food production b) less time to perform livelihood activities	Employment equity and local labor preferences	There is no FSC criterion to address household impacts created by family members working outside of the home
Increase in traffic: a) safety of communities along main roads	Health and safety	FSC Criterion 4 – 4.2 Forest management should meet or exceed all applicable laws and/or regulations covering health and safety of employees and their families.
Social and cultural influences: a) influx of migrant workers b) employment equity  c) loss of power – no say in management	Employment equity and local labor preferences  Partnerships for livelihood diversification and agriculture intensification	FSC Criterion 4 – 4.1 The communities within, or adjacent to, the forest management area should be given opportunities for employment, training, and other services  FSC Criterion 4 – 4.4 Consultations shall be maintained with people and groups (both men and women) directly affected by management operations.
d) outsiders influencing culture and local traditions e) increase in prostitution, crime, alcohol	Monitoring program	FSC Criterion 2 - 2.2 Local communities with legal or customary tenure or use rights shall maintain control, to the extent necessary to protect their rights or resources, over forest operations unless they delegate control with free and informed consent to other agencies. FSC Criterion 4 – 4.4 Management planning and operations shall incorporate the results of evaluations of social impact.  FSC Criterion 8 Monitoring shall be conducted appropriate to the scale and intensity of forest management -- to assess

abuse, wealth gaps	the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.
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\*FSC Criterion indicators have been adopted from FSC (2006)

## 6.2 Recommendations for mitigating adverse socio-economic impacts

The information from this study will serve as base line data to monitor socio-economic impacts as forestry developments continue. In addition, other socio-economic development initiatives underway have been described by others including; agriculture, tourism, infrastructure investments, government programs, and various NGO programs (Manhiça, 2008). It is hoped that poverty alleviation and rural development will be better articulated in the future with this information. The following section will describe the recommended socio-economic mitigation measures. In addition to potential positive and negative socio-economic impacts, Table 6.1 also references associated recommended mitigation measures and where applicable, FSC Standard requirements. These recommended measures should be adopted by investors initiating forestry development in the study area.

### Recommendation 1: Monitoring program

Establishing a monitoring program that periodically evaluates household socio-economic status, livelihood strategies, and forestry perceptions is critical throughout the implementation process of forestry. The methodology used in this study, should serve as a useful guide in collecting household data. However, adjustments to wealth indicators and forestry perception questions will be necessary as development continues in order to adequately evaluate socio-economic status, assets, and wealth gaps. Future household surveys should obtain more information regarding wage labor, income data in order to analyze wealth gaps between households. In addition, monitoring as development progresses should also include an assessment of infrastructure development (market access, roads, health care, schools), and any social issues that may arise. Such a monitoring program should indicate; positive and negative impacts from forestry and the need for additional mitigation programs.

## Recommendation 2: Partnerships for livelihood diversification and agriculture intensification

To promote livelihood diversification and agriculture intensification in the communities and to help rural households become less dependent on agriculture as their primary livelihood activity. Intensification will also promote more sustainable agricultural land use by keeping farmers from having to migrate to other *machambas* every 2-3 years and/or the need to move to another community to access more land. Changing households agricultural practices will be critical to the success of a green field project, especially if as mentioned in the discussion households do in fact return to abandoned *machambas* after several years. If households continue to practice shifting agriculture the Miombo woodlands will continue to decline as a result of deforestation for arable land. Livelihood diversification beyond forestry and small holder agriculture (household *machambas*) would be valuable particularly in helping disadvantaged households not directly employed in forestry. These potentially disadvantaged households will be particularly susceptible to negative impacts associated with land use change and forestry (Tonts et al., 2001).

Promotion of these livelihood initiatives can be accomplished by Forestry Companies becoming actively engaged in supporting and developing partnerships with local NGO's, state agencies, and local communities through existing community based natural resource management programs (CBNRM) and agriculture assistance programs (Salomão & Matose, 2007). CBNRM programs will help rural households pursue other livelihood activities to help diversify their livelihoods. In addition to CBNRM programs the Forestry Company can promote diversification and indirect employment in the community by; investigating livelihood opportunities within plantation resources (charcoal production, livestock grazing, honey production, and mushroom cultivation), launching a third party out-growers scheme (Race & Desmond, 2001), and initiating a community advisory group to build relationships with local communities. The community advisory groups will allow local communities the opportunity to hear directly from Forestry Company about management plans and communities will also be given the opportunity to have their voices heard.

Agriculture intensification practices can be promoted by supporting and establishing partnerships with NGO's and state agencies in the area such as, Irish Aid, SIDA, and government agriculture departments. These organizations are carrying out various programs to educate farmers and provide assistance to farmers to promote agriculture intensification and diversification of livelihoods (Irish Aid, 2007; Dougnac, 2008, Manhiça, 2008).

### Recommendation 3: Employment equity and local labor preferences

Some of the case studies in the literature noted that employment creation lead to wealth gaps and that the disadvantaged households were not able to benefit from rural development due to inaccessibility of employment opportunities (Tonts et al., 2001; Tshirley and Benfica, 2001). In these case studies the social elite or wealthier households were the people getting employed. In addition in Mozambique, more labor opportunities are offered to males than females, and when females obtain employment their wages are normally less than men's (Cramer and Pontara, 1998). In order to promote positive benefits to all levels of society, the Forestry Company should hire across all socio-economic and gender classes and provide assistance to employees and their families to allow them to work away from their home (e.g. childcare, access to food markets for purchase, tools and/or labor to reduce time spent in household *machambas*).

Households were concerned with the possible influx of immigrant workers coming into their communities seeking work opportunities. To mitigate this, preference should be given to local labor especially when recruiting unskilled manual labor.

### Recommendation 4: Conflict resolution

Current land tenure is under customary agreements whereby the approval of land use changes for private sector use is granted by communities and local governments. What will happen in the event that communities no longer want to grant plantation land use? Will the government grant approval regardless? With current land tenure ship and laws it is very plausible that land conflicts will arise. When households are required to cope with land use changes and associated impacts (e.g. Limited access or availability of



resources, feelings of powerlessness over communal lands, cultural changes) a possible coping mechanism that may arise is land conflicts. Affected communities and households may resort to non-violent and violent conflict when they become vulnerable to such shocks and stresses. Therefore, it is recommended that the Forestry Company ensure that customary agreements are respected, an agreed upon approval process is in place with all parties involved, and a conflict resolution strategy is prepared. Finding a harmonious balance between the various land uses in the study area will most likely be the most challenging aspect of the green field project and will require much consultation, research, and effort.

#### Recommendation 5: Health and safety

In the proposed afforestation area there are numerous health concerns (e.g. HIV, tuberculosis, malnutrition, malaria). It is recommended that the Forestry Company promotes health and wellness with their employees and their families by offering health and nutrition education, medical check-ups and treatment, and implement measures to protect employees from malaria. The Forestry Company should also promote health and wellness in the communities by collaborating with local health authorities and NGO's. In the study households relayed concerns regarding increased road traffic; therefore, public safety measures should be implemented to ensure company transport does not jeopardize their safety.

#### Recommendation 6: Conservation and resource availability

It was discussed that forestry development may create more pressure on existing natural resources, in particular Miombo woodlands. Households may be forced to harvest Miombo woodlands to open up new arable lands for their crops. Although Miombo woodlands will not be directly impacted by afforestation as they will not be converted into plantations, it is recommended that the Forestry Company implement measures to help conserve natural resources (including Miombo woodlands) in accordance with Wildlife and Forestry laws by participating in local conservation efforts with local communities, associations and private sector. Ideally, if farmers could use agricultural land more sustainability by applying fertilizers and using the same land continuously

(intensification) rather than abandoning *machambas* and further clearing Miombo woodlands for new agricultural land, it would help conserve these woodlands. However, changing agricultural practices takes time and to begin a Green field project today, Miombo conservation programs will be required, and monitoring of further deforestation as a result of plantations must be put in place.

In addition this study has identified the following conservation priorities; fruit bearing trees, community water sources, and areas of cultural significance (e.g. burial sites). Lands that have cultural significance should be mapped out with the assistance of the communities and the Forestry Company should conserve them. Fruit trees remaining in planned afforestation areas will most likely need to be harvested; therefore the company should work with the communities to develop a program to mitigate fruit tree loss, for example a program to plant tree orchards in or near communities.

A water monitoring research project should be implemented immediately to measure the impacts of afforestation on water availability (Brooks et al., 2003). Exotic plantations are believed to have major impacts on water availability and wetlands (Brooks et al., 2003). The Forestry Company should follow best management practices regarding water resource protection (e.g. maintaining riparian zones, planting tree species suitable to drought conditions). If water availability issues arise in communities the Forestry Company should have a response plan in place to provide water to communities in need.

#### Recommendation 7: Livelihood response program

The issue of *machamba* relocation in the study area has already reached media attention (Aide, 2009). Therefore, it is recommended that relocation procedures be carefully drawn out so that if and when a family *machamba* is displaced for forestry development, the immediate response would ensure that the household is given adequate compensation (e.g. land, seeds, fertilizer, tools, labor) in a timely manner so that they can plant and cultivate their crops to provide adequate food and income for their households. Secondly, a trust fund should be set up to assist all of the households who may or have been displaced by forestry plantations. This trust fund could be used to set up a community

outreach program and provide households with some guarantee in case of crop failure, and other disruptions as a result of plantations.

### **6.3 Relevancy of FSC Standard in Addressing Socio-economic Impacts**

The international FSC standard is rather loosely written and the criterion indicators as presented in Table 6.1 can be interpreted to address the majority of the potential socio-economic impacts outlined in this study. However, a regional FSC standard could further address many of the potential socio-economic impacts that were outlined in this study by including the mitigation recommendations in their criterion indicators.

Key areas to be addressed in a regional FSC standard should include; monitoring of wealth indicators, poverty alleviation and status, skills development and education, infrastructure, and indirect employment development. This would help determine whether or not forestry has helped alleviate poverty and has enhanced social and economic development. The FSC standard does not specify any requirements for community partnerships for conservation, sustainable agriculture or diversification of local economy. In a regional standard these types of partnerships should be included as criterion. In addition, FSC participants should be required to have a community outreach program for impacts as a result of relocation, land changes, and health and wellness. A regional standard should also address the land tenure ship issues in Mozambique, to ensure communities are not left out of the land use decisions.

### **6.4 Chapter summary**

In conclusion, the implementation of the recommendations presented above will allow a forestry company to proactively address potential socio-economic impacts and will also allow them to satisfy FSC standard requirements. Once a forestry company begins establishing plantations periodic livelihood assessments should be done every five years, as this will also help to identify further mitigation requirements.

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# APPENDIX I

## Lichinga Rural Household Livelihood Survey

Survey No: \_\_\_\_\_

Date of Survey: \_\_\_\_\_ Name of Surveyor: \_\_\_\_\_

Community \_\_\_\_\_ District \_\_\_\_\_

Sex: \_\_\_\_\_ Name of Respondent: \_\_\_\_\_

Name of Head of Household: \_\_\_\_\_ (if different from above)

### **1.0 Household Members**

1.01 List names, genders, ages, and education levels of all of the household members

<b>Names</b>	<b>Gender (M/F)</b>	<b>Age</b>	<b>Highest Level of Education* (1-14)</b>	<b>Relation to HH Head</b>
HH Head				

1.02 Skills that your household possesses, and indicate those that you acquire an income from (check all that apply)

<b>Skills</b>	<b>Check all skills that apply</b>	<b>Check if income generated from skill</b>
Brick-making		
Home construction		

Wood carving		
Mechanics		
English language		
Portuguese language		
Reading and writing		
Traditional Medicines		
Basket weaving		
Fishing		
Carpentry		
Plumbing		
Roofing		
Other: _____		

1.03 If children are not attending school why? Select one that most applies

Reasons for not attending school	Choose one
Too expensive	
Religious reasons	
Need children to work	
No school available or it is too far	
Other _____	

1.04 Which household members are responsible for what activities (check all that apply)?

Activities	Men	Women	Children
Tending livestock			
Tending Vegetables			
Tending Tobacco			
Tending Cassava			
Tending Maize			
Tending other crops			
Cutting Grass for roofs			
Brick-making			
Cooking			
Home construction			
Working off farm			
Selling goods			
Firewood collection			
Water collection			

Charcoal collection			
Hunting			
Food gathering			
Crop harvesting			
Fishing			

1.05 During which months was your household occupied with activities, check all that apply?

Activities	Wet	Dry	All Year
Tending livestock			
Tending Crops			
Cutting Grass for roofs			
Brick-making			
Cooking			
Home construction			
Working off farm			
Selling goods			
Firewood collection			
Cutting wood			
Charcoal collection			
Charcoal production			
Hunting			
Food gathering			
Vegetable harvesting			
Planting			
Crop harvesting			
Soil preparation			

## 2.0 PHYSICAL CAPITAL

2.01 Description of agriculture lands, please complete table

Agriculture Lands	Type of Machamba (dambo, or dry land)	Ownership (own, lease, or use community land)	Size (hectares)	Use (consumption, sale, or both)	Distance from principle home (meters)	Land Status (in use or not in use)
Plot 1						
Plot 2						
Plot 3						

Plot 4						
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2.02 Do you live at your machamba during part of the year? (Yes/No) \_\_\_\_\_,  
and for how long \_\_\_\_\_ (months)

2.03 In the principle homestead, how many houses does the household have?  
\_\_\_\_\_

2.04 Description of the principle house, check one for each category?

Categories	House features	Check one for each Category
Main material	Made with mud	
	Made with brick (dried in sun only)	
	Made with fire brick	
	Cement	
	Straw	
Windows	No windows	
	With open window(s)	
	Glass pane window(s)	
	Wood	
Roof	Grass roof (thatched)	
	Tin roof	
Size	Small house	
	Medium/average sized house	
	Large house	

2.05 Which of the following do you own? Indicate the number of units that you own, enter '0' if you do not own any. Please indicate the three most important assets, with 1 being most important than 2 and 3.

Assets	No. Units	Importance
Radio		
Bicycle		
Motor bike		
Car/truck		
Cell phone		
Bank account		
Axe		
Large knife/machete		



Plough		
Beds/bed mats		
Goats		
Sheep		
Chickens		
Pigs		
Cattle		
Other (specify): _____		

### 3.0 LAND USE AND RESOURCE AVAILABILITY

3.01 What crops do you grow, and how are they used for consumption, and/or sale?

Crop	Consumption	Sale
Maize		
Cassava		
Tobacco		
Cotton		
Irish Potatoes		
Sweet Potatoes		
Sunflowers		
Groundnuts		
Beans		
Paprika		
Vegetables		
Other crops (specify) _____		

3.02 What are the 3 most important crops for consumption and what are the 3 most important crops for sale (1-3) with 1 being the most important

Crop	Consumption Rank (1,2,3)	Sale Rank (1,2,3)
Maize		
Cassava		
Tobacco		
Cotton		
Irish Potatoes		
Sweet Potatoes		
Sunflowers		
Groundnuts		

Beans		
Paprika		
Vegetables		
Other crops (specify) _____		

3.03 List the names of the five most important trees in the order of importance with the first tree on the list being the most important. Also indicate use of the trees and whether they are used for personal consumption, sale or both (check all that apply).

Trees	Use of tree (i.e. fruit, medicine, fuelwood, etc...)	Check one or both that apply	
		Consumption	Sale
1			
2			
3			
4			
5			

3.04 How do you acquire firewood? Choose one that most applies.

Firewood Acquisition	Check one that most applies
Household buys all firewood	
Household buys some and collects the rest	
Household collected all firewood	
Household does not use firewood, use charcoal	

3.05 How much time (hours) per day to you spend collecting firewood, including travelling time, and how many people in the household collects the firewood daily?

Hours per day \_\_\_\_\_

Number of people collecting \_\_\_\_\_

3.06 Does the household use medicinal plants? (Yes or No) \_\_\_\_\_

If yes, from where do you obtain medicinal plants? Please check one

Household collects plants	
Purchased from community medicinal doctor	
Purchase some and collect some	

per week, If household collect plants, how often are plants collected, number of times month, or year?

\_\_\_\_\_times collected per \_\_\_\_\_

3.07 What months of the year are the most difficult for collecting water? And, indicate how much time (hours) is spent collecting water per day.

Months	Hours spent collecting water

3.08 Do you have enough machamba land for your whole family? (yes or no) \_\_\_\_\_

If no, how do you sustain your food supply?

Food Supply	Check one that most applies to your household
Buy food	
Borrow food from others	
Gather food from forest/uncultivated lands	
Other (specify) _____	

3.09 Indicate with three most important land classes to your household, with 1 being the most important.

Land classes	Rank (1,2,3)
Natural forest land	
Old Machambas	
Cultivated land	
Rivers and streams	
Grasslands	
Cleared or young forested or previously forested land	
Wet lands	
Other (specify) _____	

3.10 If you were going to give land away for forestry which lands are you willing to give up? Check the three land classes you would be willing to give up with 1 being the most important, 2 than 3.

<b>Land classes</b>	<b>Rank (1,2,3)</b>
Natural forest land	
Old Machambas	
Cultivated land	
Rivers and streams	
Grasslands	
Cleared or young forested or previously forested land	
Wet lands	
Other (specify)	

#### **4.0 FINANCIAL CAPITAL**

4.01 Rank your three most important sources of income with 1 being the most important, than 2 and 3,

<b>Income Source</b>	<b>Rank</b>
Selling Charcoal	
Selling Firewood	
Selling Maize	
Selling Tobacco	
Selling Cassava	
Selling Beans	
Selling Vegetables	
Selling other crops (specify)	
Selling Medicinal Plants	
Selling thatching for roofs	
Making and selling bricks	
Off farm labor wages	
Fishing/Hunting	
Selling livestock	
Selling seeds	
Other (specify)	

4.02 What do you do with income? Where income is spent please indicate where most to least amount of money is spent using values of 1 and up, with 1 being the most.

<b>Income options</b>	<b>Yes = 1, No = 2</b>	<b>Money Allocation (1,2,3,4...)</b>
Pay existing debt		
Put it in savings		
Hygienic products		
Purchase food		
Purchase agricultural supplies		
Pay school fees		
Pay medical fees		
Purchase livestock		
Purchase clothes		
Milling		
Other (specify)		

## 5.0 SOCIAL CAPITAL

5.01 Does anyone in the household hold a political appointment? (Yes or No) \_\_\_\_\_  
If yes, what?

---

5.02 What religion is the household?

<b>Religion</b>	<b>Select one</b>
Muslim	
Christian	
Other (please specify)	

5.03 What has the household received as assistance from non government organizations (NGO's), check all that apply.

Did not receive assistance	
Health Training/Education	
Farm Training	
Seeds	
Tools	
Money	
Fertilizer	

Medical assistance	
Other (Specify) _____	

5.04 What has the household received as assistance from government, check all that apply

Did not receive assistance	
Health Training/Education	
Farm Training	
Seeds	
Tools	
Money	
Fertilizer	
Medical assistance	
Other (Specify) _____	

5.05 Does the household belong to any associations or groups (such as farmers assoc.) (Yes or No)

\_\_\_\_\_ If yes, what? \_\_\_\_\_

5.06 Where do you go when a household member needs treatment (i.e. sick, delivery, not well), check one that most applies.

Government hospital	
Missionary hospital	
Traditional nurse	
Traditional doctor	
Health centre	
Health post	
Other (specify): _____	

## 6.0 SHOCKS

6.01 Which of the following problems did your household experience during the last year?

Shock	Yes = 1, No =2
Hunger	
Crop loss	
Illness	
Death	
Loss of job	

Shortage of labor/income	
Theft	
Damage to or loss of dwelling or other structures	
Bush fires	
Pests	

6.02 If household problem (shock) was experienced last year, what was the reason(s)?

---



---

6.03 For each household problem that you experienced, choose one coping strategy that most applied?

	<b>Coping Strategy (Choose one)</b>			
<b>Shock</b>	<b>Sold physical asset</b>	<b>Sold Labor</b>	<b>Sold Crops</b>	<b>Migration</b>
Hunger				
Crop loss				
Illness				
Death				
Loss of job				
Shortage of labor/income				
Theft				
Damage to or loss of dwelling or other structures				
Bush fires				
Pests				

6.03 Currently, for how many months per year does your household experience hunger or food insecurity (not able to provide enough food for all household members)?

---

6.04 During which months do you experience food insecurity?

---

6.05 Is there any frequent illness in the family, if so what?

---

## **7.0 FORESTRY**

7.01 Are you aware of forestry development plans in the region? (Yes or No)

\_\_\_\_\_

If yes, where did you hear of the plans?

Public consultation	
Government	
Community	
Other _____	

7.02 How do you think plantations would benefit your community? Choose one.

Job creation	
More money in the local markets	
Better roads with more access	
Improved social services (schools and hospitals)	
Would not benefit our community	
Other _____	

7.03 If a family member was to obtain employment in the plantations, how do you think plantations would benefit your household? Choose one that most applies to your household.

Income	
Education for children	
Food security	
Would not benefit our household	
Other _____	

7.04 If a household member was employed in the plantations, how would plantations be negative to your household? Choose one that most applies to your household.

<del>Would not be negative to our household</del>	
<del>Less agriculture land available</del>	
<del>Other _____</del>	
<del>Decreased water availability</del>	
Less family member(s) to perform household duties	
Immigrate workers	
Availability of resources (i.e. wood, charcoal, plants, fruits)	
Land Access	



7.05 If your household was not able to obtain employment in the plantations, how do you think plantations would benefit your household?

Increased income through indirect employment (i.e. crops, wood, construction)	
Better infrastructure (roads, schools, hospitals)	
Availability of fuelwood	
Would not benefit our household	
Other _____	

7.06 If your household was not able to obtain employment in the plantations, how do you think plantations will be negative to your household?

Less agriculture land available	
Availability of water	
Availability of resources (i.e. wood, charcoal, plants, fruits)	
Immigrate workers	
Restricted Land Access	
Increased traffic on roads	
Would not be negative to our household	
Other _____	

7.07 How do you think plantations and land changes will be negative to your community?

Immigration of workers	
Men/Women will be working outside the home	
Less agriculture land available	
Decrease in water quantity and quality	
More traffic on roads	
Decrease in availability of resources (firewood, fruit trees, plants)	
Restricted land access	
Would not be negative to community	
Other _____	

7.08 How would you feel about the woman of the household working outside the home?

Ok with wife working on plantations	
Do not want wife working on plantations	
Not sure / No opinion	

7.09 Would you be willing to plant and tend trees on your own land to sell to a company? Yes or No \_\_\_\_\_

7.10 If you were to plant trees on your own land, on which land would you plant the trees? Choose one.

Uncultivated machambas	
Dry cultivated machambas	
Near the household, in the community	
Other (Specify): _____	

7.11 How much land do you have available for growing trees on your land?  
\_\_\_\_\_ hectares

7.12 How do you think plantations will impact water availability? Choose one.

Increase water	
Decrease water	
Will be the same	

7.13 How do you think plantations will impact agriculture land availability? Choose one

Will be enough land for everyone to grow crops	
Will not be enough land for everyone to grow crops	
Will be the same	

7.14 How do you think plantations will impact local community traditions? Choose one

Changes to religious customs (i.e. people having to work on religious days)	
Change in traditional land use	
Change to family by people working outside the home	
Outsiders influencing your local traditions	

Not being able to have a say in plantations management	
Other (Specify) _____	

## APPENDIX II

List of communities in Sanga sampled and numbers of households sampled.

Community Name	Samples Taken in each Community	
	Number Sampled	Percent Sampled (%)*
Lumbiza	5	1.5
Antigos Combantente	1	0.3
Nhamuedje	4	1.2
Chindumb	6	1.8
Selenge	16	4.8
Miala	10	3.0
Ngongote	9	2.7
Lilonge	4	1.2
Empresa Agricola	8	2.4
Mapudje	11	3.3
Maoga	12	3.6
Malivangue	2	0.6
Lipende	16	4.8
Chilapetangongo	20	6.0
Nduica	8	2.4
Casside	2	0.6
Cauedje	2	0.6
Mbangane	2	0.6
Cazizi	6	1.8
Lidjego	16	4.8
Matenda	14	4.2
Licole	39	11.8
Nsauca	1	0.3
AIA Com	1	0.3
Namatite	5	1.5
Lumbizi	10	3.0
Nansenhenge	28	8.5
Mbagarila	8	2.4
Malemia	36	10.9
Bagarila	13	3.9
Sauca	4	1.2

\*Percent Sampled indicates the percentage of the total household sample size (331 households), it does not refer to the percentage of the community population that was sampled