

**SOCIO-ECONOMIC FACTORS INFLUENCING HOUSEHOLD DEPENDENCY
ON FOREST IN MASIDA COMMUNITY FOREST,
ZAMBEZI REGION, NAMIBIA**

ROMANUS MPASI KARUPU

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

2019

ABSTRACT

The purpose of this study was to provide a better understanding of the drivers and effects of dependency on forest resources in Masida community forest in Zambezi region, Namibia. Specifically, the study assessed the livelihood strategies and contribution of forest resources to household incomes, assessed socio-economic determinants of households' dependency, determined extent and consequences of dependency and examined the people's perception on forest dependency. A cross-sectional study was conducted from December 2018 to April 2019. For primary data collection, a semi-structured questionnaire was administered to 185 randomly selected household heads for quantitative data, while qualitative data was collected using key informants' interviews and focus group discussion. Secondary data was obtained from office permit system. Multiple response analysis was used to summarise livelihood strategies and reasons for household dependence. Multiple comparisons using ANOVA analysed the contributions of various income sources to household income. Logistic regression model was used to determine the effect of household's socio-economic characteristics on forest dependence. Descriptive statistics were used to summarise the extent and consequences of dependency, while people's perceptions were assessed using the Likert scale. The study revealed that farming, piecework and social grants are the livelihood strategies and the forest's natural ablution function, provision of free medicine, easy access of forest, cheap acquisition of forest resources, inability to pay for other alternatives and unemployment were motives influencing household forest dependency. The household socio-economic characteristics such as Age, Education of respondents and Hectares of land owned significantly influences forest dependency ($P < 0.05$). Moreover, the study showed that species such as *Colophospermum mopane*, *Terminalia sericea* and *Dichrostachys cinerea* are endangered. In conclusion, the study revealed that local people's perceptions forms a basis for

monitoring the sustainability of forest resources. Lastly, the study recommends that agroforestry, brickmaking and apiculture are appropriate alternatives to lessen reliance on forest.

DECLARATION

I, ROMANUS MPASI KARUPU, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own work done within the period of registration and that it has neither been submitted nor being concurrently submitted for degree award in any other institution.

Romanus Mpasi Karupu
(MSc. Candidate)

Date

The above declaration is confirmed by;

Prof. S.M.S Maliondo
(Supervisor)

Date

COPYRIGHT

No part of this dissertation may be reproduced, stored in any retrieval system, or transmitted in any form or by any means without prior written permission of the author or Sokoine University of Agriculture in that behalf.

ACKNOWLEDGEMENT

I would like to express my hand of appreciation to the Ministry of Agriculture, Water and , Namibia for their financial support that have taken me up to this level to be able to produce this document. I would like to extend my thanks to the support received from the staffs of the Directorate of Forestry, especially the Sibbinda Forestry office, under the leadership of Ms. Tabo Vivian, for hosting me at their station and accommodated my research activities into their busy schedule. Similarly, to Masida community forest management committee, all sampled households and other stakeholders who availed time for me to collect primary data and organizations for opening doors for me to collect secondary data for this research.

Furthermore, I extend my thanks to the Sokoine University of Agriculture Postgraduate Studies, Research, Technology Transfer & Consultancy in general, and specifically, the Department of Ecosystems and Conservation under the College of Forestry, Wildlife and Tourism for assigning an Academic Advisor and a Supervisor Professor Salim M. Maliondo who stood firm and eager to read my work from the development of the research study up to the write-up stage. Special gratitude goes to Dr. Samora, Head of Ecosystems and Conservation for assigning the discussants who shaped the final structure of this document.

Lastly, to my fellow students and the Sokoine National Agricultural Library (SNAL) staffs for assistance during data analysis and in the searching of relevant journals and books, to ensure that my work comply with the University guidelines.

DEDICATION

This work is entirely devoted to the Grace of the Almighty God for protecting, guiding and keeping me safe and healthily to reach this milestone. I also dedicate this study to my wife, Karupu Ruth N. for finding time to encourage me to work hard and stood firm in my absence to take care of my family responsibilities of school children, relatives and other social obligations, also to my siblings although it took them time to communicate with me, but the little you did, gave me strength to fight hard.

Lastly, to my mother, Widow Karupu Regina Runguro, the single role you took after our father passed on few months before I departed for study was a path that we should follow, to be determined and have faith in God that all is possible and achievable in the name of God.

TABLE OF CONTENTS

ABSTRACT	ii
DECLARATION	iv
COPYRIGHT.....	v
ACKNOWLEDGEMENT	vi
DEDICATION	vii
TABLE OF CONTENTS.....	viii
LIST OF TABLES	xii
LIST OF FIGURES	xiii
LIST OF APPENDICES.....	xiv
LIST OF ACRONYMS AND SYMBOLS	xv
CHAPTER ONE	1
1.0 INTRODUCTION.....	1
1.1 Background Information	1
1.2 Problem Statement	2
1.3 Justification of the Study	4
1.4 Objectives	5
1.4.1 Overall objective	5
1.4.2 Specific objectives.....	5
1.5 Research Questions	5
1.6 Conceptual Framework of the Study	6
CHAPTER TWO	9
2.0 LITERATURE REVIEW	9
2.1 Forest Dependency in General.....	9
2.2 Community Forest Livelihoods	10
2.2.1 Types of livelihood benefits.....	10

2.2.2 Types of livelihood assets.....	11
2.3 Forest dependency in Namibia	12
2.4 Contribution of Forest Resources to Household’s Total Income	13
2.5 Socio - economic Factors of Household Dependency on Forest	14
2.6 Consequences of Forest Dependency.....	15
2.7 Forest Dependency Perceptions of Forest Users	17
2.8 Resource Users’ Perceptions on Natural Resource Management.....	17
CHAPTER THREE	20
3.0 MATERIALS AND METHODS	20
3.1 Description of the Study Area	20
3.1.1 Location and size.....	20
3.1.2 Climate.....	21
3.1.3 Soils and agricultural potential	21
3.1.4 Land types, natural vegetation, and forest resources.....	21
3.1.5 Inhabitants, administration and services.....	22
3.1.5.1 Organizational set up of the community	23
3.1.5.2 The management body and benefit distribution in Masida community forest.....	24
3.2 Research Design.....	25
3.2.1 Sampling design	25
3.2.2 Sample size determination	26
3.3 Data Collection	27
3.3.1 Primary data	27
3.3.1.1 Households’ livelihood strategies, perceptions and dependency of household on the forest.....	27
3.3.1.2 Household survey	28
3.3.1.3 Focus group discussions.....	29

3.3.1.4 Key informants' interviews	29
3.3.2 Secondary data	30
3.4 Data Analysis	30
3.4.1 Household dependency on the forest, livelihoods and the extent of dependency on forest and perceptions	30
3.4.2 Analytical Model for determining the socio-economic factors of forest dependency	33
3.4.3 Description of the variables used in the model	34
CHAPTER FOUR.....	38
4.0 RESULTS AND DISCUSSIONS	38
4.1 Livelihood Strategies and Contribution of Forest Resources to Household Income	38
4.1.1 Household livelihoods activities	38
4.1.2 Livelihood assets	38
4.1.2.1 Social assets.....	39
4.1.2.2 Physical assets	39
4.1.2.3 Natural assets.....	40
4.1.2.4 Financial assets	41
4.1.2.5 Human assets	41
4.1.3 Linking forest livelihoods benefits to forest dependence	41
4.1.3.1 Direct livelihoods benefits	42
4.1.3.2 Indirect livelihoods benefits	44
4.1.4 Contribution of forest resources to total household income	45
4.1.4.1 Forest resources income and forest dependency	45
4.1.4.2 Contribution of forest resources to total households income	47
4.2 Socio-economic Factors Influencing Household Dependency on Forest	49
4.2.1 Socio-economic characteristics of respondents	49
4.2.2 Socio-economic factors influencing households dependency on forest	51

4.2.3 Reasons influencing household to depend on the forest.....	54
4.3 Extent and Consequences of Forest Dependency on Forest Resources.....	55
4.3.1 Purposes of forest resource collection from the forest	56
4.3.2 Extent of use and consequences of dependency to forest resources	57
4.3.2.1 Firewood	57
4.3.2.2 Thatch grass.....	59
4.3.2.3 Wild fruits	60
4.3.2.4 Poles.....	61
4.3.2.5 Droppers.....	63
4.3.2.6 Timber	63
4.3.2.7 Medicinal plants	64
4.4 People’s Perception to Forest Dependence in Relation to the Sustainability of Forest Resources	66
4.4.1 People’s perception on forest resources importance	66
4.4.2 People’s perception on the availability of forest resources	67
4.4.3 People’s perception on forest resources collection	68
4.4.4 Peoples’ perceptions on the level of dependency to forest resources	69
4.4.5 Alternative interventions to support forest resource conservation.....	70
CHAPTER FIVE	72
5.0 CONCLUSIONS AND RECOMMENDATIONS.....	72
5.1 Conclusions	72
5.2 Recommendations.....	73
REFERENCES	74
APPENDICES.....	87

LIST OF TABLES

Table 1: Sampling frame and sampling size of Masida community27

Table 2: Livelihood strategies that influences household forest dependency 39

Table 3: Multiple comparison of sources of incomes in Masida CF 48

Table 4: Socio-economic characteristics of respondents in Masida community 50

Table 5: Socio-economic factors influencing household’s dependency on forest 52

Table 6: Reasons for depending on Masida community forest 55

Table 7: Purposes of forest resources collection by Masida community 57

Table 8: Sources of energy for cooking in Masida CF 57

Table 9: Harvested species for firewood in Masida CF 57

Table 10: Frequencies and quantity of firewood harvested by households 58

Table 11: Species harvested for commercial firewood in Masida CF 59

Table 12: Frequencies and quantities of thatch grass collected in Masida CF 60

Table 13: Preferred species for poles in Masida CF 61

Table 14: Frequencies and quantities of poles collected by households 62

Table 15: Tree species harvested for poles from 2008 - 2017 62

Table 16: Species harvested for droppers from 2009 - 2014 63

Table 17: Forest resources harvested for various purposes from 2009 - 2014 64

Table 18: People’s perception on the importance of forest products 67

Table 19: People’s perception on helpfulness of forest products 67

Table 20: Perceptions on forest resource availability in Masida CF 68

Table 21: The peoples’ perceptions on forest resource collection in Masida CF 69

Table 22: People’s perception on the level of forest dependence 69

Table 23: Interventions suggested by households towards forest conservation 71

LIST OF FIGURES

Figure 1: Conceptual framework of the study	8
Figure 2: The location of Masida community forest	20
Figure 3: The main villages of Masida community forest	22
Figure 4: The Sampled households distribution of Masida community	28
Figure 5: Forest benefits mean ranks in Masida CF	42
Figure 6: Pairwise comparisons of the direct livelihoods benefit in Masida CF.....	43
Figure 7: Indirect livelihoods benefits of Masida CF	45
Figure 8: Forest dependency ratio in the villages of Masida CF.....	46
Figure 9: Percentage contribution of forest resources, non-farm resources and Agriculture income to the total household income	47
Figure 10: The reasons for the disappearance of some forest resources.....	56
Figure 11: Thatch grass species used in Masida CF.....	60
Figure 12: Species of wild fruits collected in Masida CF.....	61
Figure 13: Medicinal plant species in Masida CF	65

LIST OF APPENDICES

Appendix 1: Community forest benefit distribution plan	87
Appendix 2: Household questionnaire	88
Appendix 3: Focus group discussion checklist	95
Appendix 4: Checklist for key informant interviews (traditional leader)	96
Appendix 5: Checklist for key informant interviews (community forestry officer)	97
Appendix 6: Checklist for key informant interviews (conservancy officer)	98
Appendix 7: Checklist for key informant interviews (constituency development committee)	99
Appendix 8: Checklist for key informant interviews (forestry government official)	100
Appendix 9: Checklist for key informant interviews (Linyanti constituency office)	101
Appendix 10: Checklist for key informant interviews (DAPEES government official)	102
Appendix 11: Data record form for the permits acquired by the community from 2007 - 2017	103
Appendix 12: Cochran's Q test statistics of mean ranks	104
Appendix 13: The description of pairwise comparisons of benefits in Masida CF	104
Appendix 14: Sources of income in monetary term in Masida CF	105
Appendix 15: Sources of income by response in Masida CF communities	105
Appendix 16: ANOVA of the various income sources in Masida CF	105
Appendix 17: Household income categories of Masida CF communities	106
Appendix 18: Model coefficient, Summary and Hosmer & Lemeshow test	106
Appendix 19: Percentage of accurate classifications	107
Appendix 20: Factors influencing household dependence on Forest	108

LIST OF ACRONYMS AND SYMBOLS

⁰ C	Degree Celsius
ADC	Agricultural Development Centre
AMTA	Agro-Marketing and Trade Agency
CBFM	Community Based Forest Management
CF	Community Forest
CFN	Community Forest Namibia
CIFOR	Center for International Forestry Research
DAPEES	Directorate of Agricultural Production Extensions and Engineering Services
DBH	Diameter at Breast Height
DOF	Directorate of Forestry
FAO	Food and Agricultural Organization
FMC	Forest Management Committee
GDP	Gross Domestic Products
ICF	International Climate Fund
Kg	Kilogram
M ³	Cubic meters
MAWF	Ministry of Agriculture, Water and Forestry
MM	Millimeters
N\$	Namibian Dollar
NAFOLA	Namibia's Forested Lands
NGO	Non-Governmental Organization
NPC	National Planning Commission
NRC	National Research Consortium
NTFP	Non-Timber Forest Product
SSA	Sub-Saharan Africa

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Forests provide a wide range of goods and services to sustain livelihoods for forest-dependent communities prone to abject poverty (Bwalya, 2013; Schaafsma *et al.*, 2014; Rahman *et al.*, 2017). Globally, it is estimated that more than 350 million people around the world depend on forests for their livelihoods. The majority of these are rural people who live within or adjacent to dense forests on which they depend for their subsistence and income (Abdullah *et al.*, 2016; Fikir *et al.*, 2016; Ojea *et al.*, 2016). In Sub-Saharan Africa, more than 70 % of the population depends on forests and woodlands for their livelihoods. The forests and woodlands supply approximately 60% of all energy (Mohammed *et al.*, 2015; Odunwole *et al.*, 2015; Fikir *et al.*, 2016). In Namibia, about 62% of the population live in rural areas and depend on natural resources for their livelihoods (Riehl *et al.*, 2015; Krug, 2017; Vrabcová *et al.*, 2019). Several studies have been conducted in Sub-Saharan countries on local community dependency on forest and related socio-economic factors. A study by Ofoegbu *et al.* (2017) in South Africa elucidated that the purposes for which forest resources are utilized and the extent to which they are harnessed, are dictated by the households' socio-economic characteristics which if well managed, are an effective and sustainable way of promoting forest-based climate change initiatives.

Elsewhere, Bwalya (2013) estimated 30% of total household incomes of rural households in Zambia was earned from harvesting and selling forest products. Garekae *et al.* (2017) assessed household forest dependency from a forest reserve in Botswana. Recently, Mukete *et al.* (2018) estimated that forest resources contributed 34.1% of the average total

rural household income compared to 36% from agriculture. Vedeld *et al.* (2007), based on 51 case studies across 17 developing countries, revealed that forest income accounted for about 22% of the total household income. These studies on forest-dependent households have inspired some of the policymakers in many developing countries including Namibia, to decentralize forest management by adopting Community Forest Management strategy (Rai *et al.*, 2016).

Although forest dependency is a common phenomenon, the drivers of the household's dependency on forest resources vary across households depending on their demographic and socio-economic characteristics (Adam and Tayeb, 2014; Jain and Sajjad, 2016). Various studies on factors influencing household forest dependency have found that factors differ in the degree of dependency geographically, over time and across communities, in different countries. These differences are largely due to disparities in the socio-economic conditions, values, beliefs, goals, and preferences of that community. However, the differences will not be static over time, resulting in changing forest resource dependency over time (Bwalya, 2013; Misbahuzzaman and Smith-Hall, 2015; Bhandari and Jianhua, 2017; Garekae *et al.*, 2017).

Therefore, given the context-specific realities, there is a need for developing countries such as Namibia to better understand how household dependency on the forest resources is associated with different socio-economic factors. In particular, there is a need for a study to identify socio-economic determinants of household dependency on forests in the Zambezi region, Namibia.

1.2 Problem Statement

Sustainable forest management has been a challenge experienced in most sub-Saharan Africa (SSA) countries, due to rising challenges and pressures (Odera, 2004).

This emanated from the failure of the centralized management system to decrease resource use pressure through enforcement, due to insufficient resources for forest services and the people-state conflicts on forest ownership, management and controls. As such encroachment and conversion of forest to agriculture and settlements has taken place especially in forest areas close to human settlements (Brown and Schrenkenberg, 2001). However, in many SSA countries it was realized that the exclusion of communities' right to natural resources and the forest has made the forest policies, legislation and tenure operations to be incapable of lessening the degradation and loss of forests. In recent times, SSA countries have adapted the Community Based Forest Management (CBFM) of different types in different countries, and new ones continue to emerge in many countries. The concept has now turned from state-people collaboration to people-state where the state supports the efforts of the people (Wily, 2002). Thus, many developing countries both rich in forest and those with only woodland savannahs such as Namibia are implementing CBFM as an effective approach of managing the forest resources. The CBFM is an initiative whereby communities are empowered with responsibilities and legally secured rights to manage the resources and have received benefits which have improved the forest cover and reduced the forest degradations (Kajembe *et al.*, 2003). The CBFM idea has created a favorable environment within a short time and many developing countries in SSA forest service departments including Namibia are in the process of establishing CBFM, backed up with bilateral or international Non-governmental Organization (NGO) support. The only hindrance in the concept is the formulation of costs and benefit sharing mechanisms/formula. Although Namibia is not a forest-rich country, the woodland savannah plays an important ecological and socio-economic role, supplying wood and timber for a variety of uses, as well as non-timber forest products (Mbongo *et al.*, 2014; Suleiman *et al.*, 2017; Jannat *et al.*, 2018; Vrabcova *et al.*, 2019). Given the wide range of services provided by the forest, often, people tend to exploit the forest

resources in an unsustainable manner, leading to the depletion of the resource base (Pokharel *et al.*, 2013; Nelson *et al.*, 2015). This is a common problem facing most developing countries, including Namibia where, due to poverty, high pressure is exerted on the remaining forest resources (Pokharel *et al.*, 2015; Jain and Sajjad, 2016; Awono and Levang, 2018). However, little is known and documented about the specific socio-economic factors that influence community dependency on forest resources in the Zambezi region, Namibia. This study is therefore intended to fill this knowledge gap by providing a better understanding of the socio-economic factors that influence household dependency on forest resources and their effects on the availability of forest resources in Zambezi region, Namibia.

1.3 Justification of the Study

The findings of this study will provide specific recommendations to enhance the sustainable utilization and management of the forest resource by the forest management body in the Zambezi region, Namibia. Zambezi region is most wooded and favourable for agriculture (Kamwi *et al.*, 2015). Conducting a study in this region will help the relevant authorities to formulate policies that are beneficial for equitable, sustainable resource management and conservation of biodiversity that may help to reduce dependency or pressure on forest resources. The findings will further shed more light on possible alternative approaches for communities to embark on instead of mainly relying on forest products alone. The study synopsis is in line with the Strategic research areas of the Directorate of Forestry (DoF) number two on Forest product (value-added) research and number six on Economic, policy and sociological research. The study will also address the strategic objectives of economically sustainable utilization in a relatively scarce resources in the northern part of Namibia and provide an understanding of the economic, policy and sociological aspects of forest management and utilization of forest products for

development in Community forests (Government Gazette of the Republic of Namibia 2001, 2005). The outcome of this study is therefore intended to inform the policy makers at local level up to national level on the status of resource utilization and will lay a benchmark of a holistic approach development.

1.4 Objectives

1.4.1 Overall objective

The overall objective was to provide a better understanding of the drivers of household forest dependence and their effects on forest resources in the Zambezi region, Namibia.

1.4.2 Specific objectives

The specific objectives were to:

- i. Assess household livelihood strategies and contribution of forest resources to the total household income in the study area.
- ii. Assess socio-economic determinants of household dependency on forest resources in the study area.
- iii. Determine the extent and consequences of forest dependency on forest resources in the study area.
- iv. Examine the people's perceptions of forest dependency in relation to forest resource sustainability in the study area.

1.5 Research Questions

The study strives to answer the following questions:

- i. What are the livelihood strategies that household embark on and what is the proportion of forest income to the total household income in the study area?

- ii. What are the determinants of household's dependence on forest resources in the study area?
- iii. What are the effects of forest dependency on the forest resources in the study area?
- iv. What are the people's perceptions of the dependency on the sustainability of forest resource in the study area?

1.6 Conceptual Framework of the Study

Conceptual framework has been used by several studies as a systematic approach to assess the relationship between people and forest (Newton *et al.*, 2016; Mananura *et al.*, 2014; Kamwi *et al.*, 2018; Suleimann *et al.*, 2017). In this study the theory by Adam and Tayeb (2014) was adapted to be used as a conceptual framework to guide this study. The theory was used to identify the relationship between forest, people and dependency aspects that focus on defining the socio-economic determinants of households' dependence on forest of Masida community forest in Zambezi region. The Conceptual framework comprises of three different connections namely; socio-economic determinants, forest dependence and attitudes towards conservation (Adam and Tayeb, 2014).

These aspects are used to outline the mutual benefits of each dimension to each other. Since forest dependence is a multifaceted phenomenon, the characterization of forest-dependent people varies considerably in terms of its contribution to people's livelihoods (Mananura *et al.*, 2014). In this framework the forest is defined as source of products and services. Livelihoods in this context is used to define a means of making a living, comprised of capabilities, assets, and resources used in daily activities (Mananura *et al.*, 2014; Kamwi *et al.*, 2018).

Interrelated models are contained in this frame work. The households' socio-economic characteristics of household influences forest dependency, the forest resources determines the livelihood strategies and activities that communities will pursue and the attitudes towards forest management (conservation and utilization) will determine whether the forest use is sustainable or unsustainable and call for conservation interventions. The institutions (Forest Management body, Directorate of forestry, and other stakeholders) play a role in designing the conservation intervention and regulate the access to resources in a community forest. The processes within the Institutions such as forest Acts, policies and legislations will be used to guide the implementation of interventions through the permit system, and law enforcement to ensure that forest users adhere to the set laws towards the sustainability of resources. The framework information is vital for understanding the relationship of livelihoods assets and forest dependence, and understands people – forest relationship for resource sustainability and conservation of biodiversity.

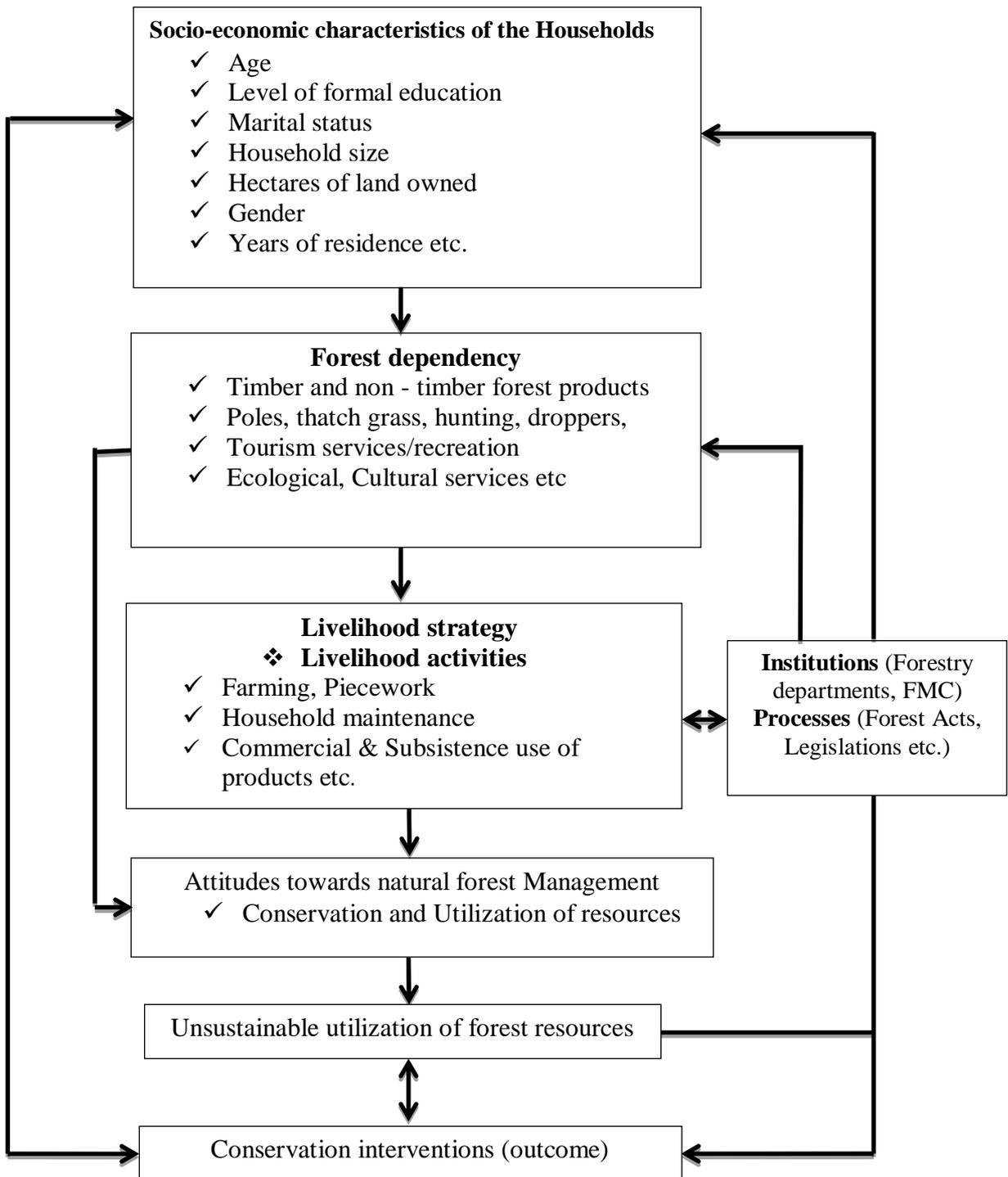


Figure 1: Conceptual framework of the study

Source: (Adapted from Adam and Tayeb, 2014)

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Forest Dependency in General

Several studies have reported that forest provide goods and service to over 800 million up to 1.6 billion people globally. Majority (70%) of this are in sub-Saharan countries where they live in rural areas and depend heavily on natural resources for food and income, where the forests supply about 60% of their daily energy (Mohammed *et al.*, 2015; Odunwole *et al.*, 2015; Fikir *et al.*, 2016). The forest resources serve as a safety net in time of economic crisis thus helps in poverty alleviation (Schaafma *et al.*, 2014; Abdullah *et al.*, 2016). In developing countries conservation of the biodiversity has been a challenge due to human dependence for both direct and indirect benefits derived from the forest such as collection of non-timber forest products and service it renders such as provisional, regulation, cultural, and ecological services (Adam and Tayeb, 2014).

Forest dependency is variously defined by different authors and mainly refers to forest-dependent people in various contexts (Miah, 2014; Larson *et al.*, 2017; Newton *et al.*, 2016). In most of the literature, the term was used to refer to forest-people interaction and its definition and description was brought to relate to specific aspects of looking into the relationship between forests and people's livelihoods (ICF, 2014). In this study, the term dependency was used to agree with other authors that focus on the context of people and forest use inferring that forest-dependent people's livelihood are reliant on forests to some degree, and is conditional on forest-derived benefits (Belcher *et al.*, 2015; Newton *et al.*, 2016). Several studies consider people-forest dependency based on their subsistence and commercial livelihoods derived from forest products and services (Timko *et al.*, 2010; Tieguhong and Nkamgnia, 2012; Timko and Kozak, 2014; Schaafsma *et al.*, 2014;

Teshome *et al.*, 2015; Newton *et al.*, 2016; Fikir *et al.*, 2016). The dependency is then ranked from high to low, based on the benefits and use pattern (subsistence or commercial) indicated by a household as derived from the forest for their livelihoods.

2.2 Community Forest Livelihoods

Community forest concept is a strategy that most of the policy makers in the developing countries are striving to adopt (Rai *et al.*, 2016). The declaration of a community forest is a devolution strategy that involves a shift of authority and control from the state to local communities to manage the area for their own benefits (Thoms, 2008; Schusser, 2013, Vrabcova *et al.*, 2019). This devolution entails handing over the accountability, responsibility and costs of management of the area to the established management body.

2.2.1 Types of livelihood benefits

In developing countries, community forest plays a vital role that involves provision of both direct and indirect livelihoods benefits to the rural inhabitants. These benefits include forest products, services and capabilities. The direct livelihoods include construction materials, timber, foods, fuels, medicines, natural ablution and many more. The indirect livelihoods benefits are obtained through the forest provision of ecological services such as improvement of soil fertility, fodder, windbreaks on farmlands watershed protection and erosion control (Thoms, 2008; Vrabcova *et al.*, 2019).

The establishment of a community forest offers the capability benefits such as opening opportunities for skill developments and social networks to the beneficiaries especially when the management body establishes income generation activities that are used to support schools, construction of community building, village electrification, community fire breaks, and home improvements through salaries. Shackleton *et al.* (2007) reported in

their study on forests and livelihoods in South Africa that one-sixth to one quarter of total commercial livelihoods is contributed by forest resources. In another study Mahanty *et al.* (2006) described three provisioning benefits derived from the forest by households ranging from forest playing an important role as safety net function for communities to troubled or lean times, secondly, the acquisition of basic needs supplied by forest such as weaving fibers, firewood, medicinal plants etc. Lastly, the utilization of forest becomes a mean to save scarce cash resources. The safety-net function of the forests occurs through (a) the generation of temporal cash in local or regional markets through selling of forest resources, (b) utilizing of lesser- known forest resources and (c) substitute purchased commodities through increased consumption of the already used forest resources (Shackleton *et al.*, 2007).

2.2.2 Types of livelihood assets

The community forest direct and indirect livelihoods have impacts on different livelihood assets. These assets are; natural, human, capital, physical and social assets. When community forests are managed collectively, the livelihoods contribution of forest becomes more reliable and stable. The community forest indirect livelihoods impacts are by improvement of natural assets through effective forest resource protection and regulations for it to be able to regenerate and increases in forest products volume that increases the benefits. On the other hand, the indirect livelihoods impact includes opportunities for other livelihoods diversifications as well as improvements in all other remaining four assets (Dev *et al.*, 2003; Kamwi *et al.*, 2015). Some of the improvement in human assets are through assistance of projects such as German funded Community Forest Namibia (CFN), government DoF, World Bank and NAFOLA (Namibia Forested Lands) through skills training, literacy and empowering craft centre's management body. The financial asset is improved through the sale of forest products and collection of

membership fees, while the physical assets are improved through the development activities and upgrading of community infrastructures. The social assets are enhanced through the income generation opportunities and diversification of household livelihoods, when marketable products and their markets are accessible (Thoms, 2008).

2.3 Forest dependency in Namibia

Studies conducted in Namibia, reveals that about 62 % of the country's population lives in the north west and north east regions and they depend on forest resources and agriculture for their livelihoods sustenance (Mbongo *et al.*, 2014; Riehl *et al.*, 2015; Kamwi *et al.*, 2015; Krug, 2017; Vrabcova *et al.*, 2019). However, Namibia like any other developing countries, has experienced challenges in applying traditional centrally - controlled forest management approaches because local people rely heavily on forest resources for their livelihoods (Pokharel *et al.*, 2015). Namibia has also faced forest degradation resulting from high dependency on forest resources for the majority of rural people and this has led to challenges in forest management efforts, and this has motivated a shift in the forestry legal framework towards participatory resource management and access rights from the state to the local community. The new trend in forest resource management acknowledges the direct dependence on natural environmental resources by the majority of the population that live in rural areas in Namibia (Mogotsi *et al.*, 2016; Vrabcova *et al.*, 2019). According to NNRC (2002), the household dependence on wild forest products were mostly in the northern regions of the country in the Kavango, Ohangwena, Oshikoto and Omusati region. About 33% of total household consumption in rural areas was estimated at the national level to have come from the wild forest food and products. In the Zambezi region, it was estimated that about 50% of the rural communities rely on wild forest food for their sustenance. The harvested forest resources include bush meat (from game and fish), poles for constructions and woodcarvings, thatching grasses, firewood (as a primary

source of energy, were about 93 % of use in rural households) and medicinal products and wild fruits (nuts, fruits, leaves, roots and barks). The same study reported that the indirect use of natural ecosystem is of greater value to survival, and the direct use of natural ecosystem contributes over 30% to the Gross Domestic Products (GDP) of Namibia.

Several studies conducted in Namibia have demonstrated the role of forest resources in the economy of forest inhabitants in the North West and North East regions of the country. Study by Mbongo *et al.* (2014), revealed that socio-economic benefits of community forests lie primarily on provision of forest products that enhance rural livelihoods and study by Kamwi *et al.* (2015) on livelihood, land use and land cover change in Zambezi region indicated that illegal logging is one of the drivers of land use and land cover change, while the collection of non-timber forest products is one of the livelihood coping strategy. Parviainen (2012) assessed the role of community forestry in rural livelihood and poverty alleviation, focusing on net benefit generation in community forest and comparing cost and benefit analysis. However, the socio-economic determinants of forest dependency and its impact on forest resources in the Zambezi region, Namibia is not so far documented. Therefore, this information gap necessitates the need for such a study in the region.

2.4 Contribution of Forest Resources to Household's Total Income

Many development countries has been encountering poor yields from agriculture and high unemployment rate and this has brought an increasing demand for forest resources to provide cash income generation (Steele *et al.*, 2015). Forest resources are considered to be a source of cash income by most rural households in developing countries. In Sub-Saharan Africa forest-related enterprises generate cash income to more than 15 million people from resources such as charcoal sales, small-scale saw milling, fuel wood, handicraft and

commercial hunting (Mwera, 2017). Study by Malleson *et al.* (2014) in Cameroun and Nigeria reported that communities who lives in rural areas generated high income from non- timber forest resources and farming than those living in towns. In another study by Suleiman *et al.* (2017) revealed that forest resources contribution to household income is of paramount important as they provide a safe net to households living within or closer to forest and forest resources contributed about 40% to their total household income. This entails that it is not appropriate to restrict access to forests, but rather decentralise the management of forests in rural areas to the local communities under a concept of Community forest.

2.5 Socio - economic Factors of Household Dependency on Forest

The household's reliance on forest resources in developing countries has been widely discussed (Adam and Tayeb, 2014; Malleson *et al.*, 2014; Sunderland *et al.*, 2014; Mananura *et al.*, 2014; Kamwi *et al.*, 2015; Ojea *et al.*, 2016; Endamana *et al.*, 2016; Jannat *et al.*, 2018; Vrabcova *et al.*, 2019). This has increased the interest of creating alternative policy, monitoring and maintenance of the forest and its resources (Van Laerhoven, 2010). There are several factors that contribute towards the household's forest dependency including land ownership, household distance to forest, nature, and extent of forest resource utilization and related income and expenditure (Nelson *et al.*, 2015). Jain and Sajjad (2016) reported that socio-economic factors such as household size, land holding size, education, age, livestock populations and market access influenced household dependency, while Ofoegbu *et al.* (2017) find length of residency and gender in addition to what was reported by Jain and Sajjad (2016). In another study Suleiman *et al.* (2017) found farm size, household income and occupation to influence household's dependency on forest resources. The roles of the forest towards the community's livelihoods have created an important relationship or mutual dependence between the

forest and the communities, and this relationship is hard to be separated (Adlina *et al.*, 2013). However, Lepetu *et al.* (2009) and Muhammed *et al.* (2010) suggested that the dependency of the household's towards forests is highly problematic but they did not relate or analyse the effect of the household's livelihood pattern and dependency towards the forests comprehensively. The forest dependency is also considered problematic when the forest resources are used commercially (Jannat *et al.*, 2018). Newton *et al.* (2016) reviewed 155 different characterizations of forest-dependent people, and further characterized the relationships between people and the forest into different dimensions. This study used the taxonomy of relationships between forest and people as suggested by various authors. Components of the dimension comprised of a) dimension that focus on 'forest' b) dimension that focus on 'dependent' and c) dimension that focus on 'people'.

2.6 Consequences of Forest Dependency

Namibia's important source of energy, food for people and livestock and medicine are located in the north and northeastern woodlands of the country. About 64% of the total land cover of the country is covered by wooded savannah and 20% is dry woodlands. Namibia 's socio-economic activities in the northern part such as shifting agriculture based on slash and burn, cutting of construction poles and harvesting of fuel woods are the main causes of deforestation and forest resource degradation. Back dated to 1996 by Mendelsohn and Roberts (1997) study, the Zambezi region was estimated to clear a total land area of 20 000 square kilometers for agriculture alone and this was on the riverine woodlands. The fuel wood annual consumption was estimated at 672 331 metric tons. In another study in Namibia, NPC (2001) estimated the fuel consumption in the Zambezi region to reach 1.1 million metric tons a year by 2006. Vigne (2000) revealed that in Zambezi region, excessive forest fire is a problem and it disturbs forest ecology, destroyed trees, retards tree growth and hinders seedling regeneration.

In Namibia there is a dearth of information on the contribution of forest resources to GDP, However, estimation of annual values is used. For example, Vigne (2000) estimated that forest resources contributed 7.9 % to total GDP at market prices. This was summed up from the contributions from construction of poles, tourism, fences for crop protections and firewood harvesting. Although these estimates were made, it is difficult to put the real contribution of these products to the rural livelihood of Namibia by economists. Thus, NPC (2001) concluded that while it is difficult to quantify the contribution in economic terms, Namibia's northern woodland and savannah ecosystems support the majority of the people through the provision of many essential ecological services to the health of the environment and supply of energy, construction materials, wild fruits, medicine, browse and grazing. In Namibia, on both freehold and communal rangeland, bush encroachment is a phenomenon linked to overgrazing, and loss of productive grazing land causes huge losses in the livestock industry.

The extent of the community's forest resource utilization can be identified through the different forest-based activities that are being carried out by the community members (Muhammed *et al.*, 2010). Forest resource utilization can further be identified based on types of forest resources being exploited. More often, the unsustainable forest management and utilization of forest resources has led to an increase in deforestation rate, and potential loss of water catchment areas (Nelson *et al.*, 2015). In addition, heavy dependence on forest resources often contributes to the increased rate of soil erosion, landslides, deforestation, and forest degradation, thus endangering the forest ecosystem integrity and biodiversity value (Pandit and Bevilacqua, 2011; Mujawamariya and Karimov, 2014).

Forests are being exploited for various activities, creating worries on sustainable management. In fact, forests adjacent to community settlements are exploited by different

companies and agro-industries without any consideration for local peoples' needs, hence degrading their natural potential along the line (Awono and Levang, 2018). Consequently, there is a strong need to promote a sustainable management plan for the community's forest resource utilization and establish a constructive relationship between the community and the forests.

2.7 Forest Dependency Perceptions of Forest Users

Better knowledge of dependency on forest products provides empirical support for further forest policy orientation towards rural livelihoods improvement based on forest dependency especially non-timber forest products valuation. Increasingly, the majority of rural households, especially women and children, extract NTFPs to generate additional income (Angelsen *et al.*, 2014; Awono and Levang, 2018) and that the harvest of forest products especially NTFPs is an ancient activity mainly controlled by women (Awono and Levang, 2018). Assessing how men and women access, manage and use different forest products in the world tropical forests, the study found that Africa was the only region in the world where women dominated the NTFPs sector. In contrast, the energetic nature of the young people propels them to indulge in forest extraction activities which are often labour intensive and require physical strength; this has been validated by various studies elsewhere (Fonta and Ayuk, 2013; Adam and Tayeb, 2014; Thondhlana and Muchapondwa, 2014; Ahmad and Stacey, 2016).

2.8 Resource Users' Perceptions on Natural Resource Management

Understanding the behavior of the community towards the use of resources in their daily lives is of utmost importance to consider the perception of local people towards the changes in resource availability. Thus, in monitoring the changes in common-pool stocks (natural resources used by majority of people) availability, local perceptions of the small-

scale societies form a basis. McCarthy *et al.* (2014) reported that in designing successful sustainable management of natural resources, the local perception has been considered by the small - scale societies as critical. Other author contend that decisions regarding governance and management of natural resources are not based on scientific knowledge in many parts of the world because such knowledge is often absent (Fernández-Llamazares *et al.*, 2015). Leclerc *et al.* (2013) stated that the perceptual information about environmental change is directly acquired through local perceptions and encompasses embodied experience. It is in view of this that to date, it is still debated whether the experience of local people on environmental changes can be considered as perception or knowledge, since the perceptions are inherently not articulated in a form that is easily accessible to others (Yeh, 2016).

However, these terms are used interchangeably, one author used knowledge (Riseth *et al.*, 2011), while Oldekop *et al.* (2012) used perception to refer to accounts of environmental changes as reported by local societies. The study by Fernández-Llamazares *et al.* (2016) used the term '*change perception*' and '*availability perception*' to define the individual evaluation of the changes in the stock of a given resource over time and to define the individual's evaluation of the available stock of a given resource at the present moment respectively. Chimello de Oliveira (2018) remarked that perception gives a better reflection of the historical environmental status rather than the ecological dimension of the changes undergone. The study further narrated that perception might fall short in precision from an ecological standpoint, but it is important in informing the sustainable management of resources.

In Namibia, there is an effort to take NTFPs from woodlands and savannahs as a potential to increase its economic contributions. The value and use of NTFPs has increased in

pharmaceuticals, cosmetics and beverage industries. This initiative has been taken up by the government through the Ministry of Agriculture, Water and Forestry, where women co-operatives are organized and it has shown that NTFPs has potentials for exploitation. The initiative has led to the formation of task teams to promote indigenous plants that will contribute to higher household food security, income and employment creation. Statistics from NRC (2000) and NPC (2001) is that Directorate of Forestry (DoF) in its value addition strategy has enabled households to gain some income from the sale of wild fruits and sale of alcoholic drinks in north-central and Kavango regions and established international market for *Harpagophytum procumbens* sales.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Description of the Study Area

3.1.1 Location and size

The study was conducted in Masida Community Forest in Linyanti Constituency, Zambezi region. This is an area amongst the first 13 community forests that were declared in 2006 by the Government. This is an area where local communities in the communal lands of Namibia have obtained the rights to manage forests, woodlands and other types of natural vegetation according to the provisions of the Forest Act No. 12 of 2001 (Schusser, 2013). Masida community forest is located approximately 70 km west of Katima Mulilo town and 40 km east of Kongola along the Trans Caprivi Highway. The study area (Figure 2) comprises of 6 villages of Kapani, Kansoko, Sabelo, Masida, Taulo, and Sitanta. It covers an area of 19 325ha. The study area has a population size of 343 households. It borders Mudumu National park (South), Makanga Village (East), Zambezi State forest (North) and the Community forest of Lubuta (West).

MAP FOR MASIDA COMMUNITY FOREST

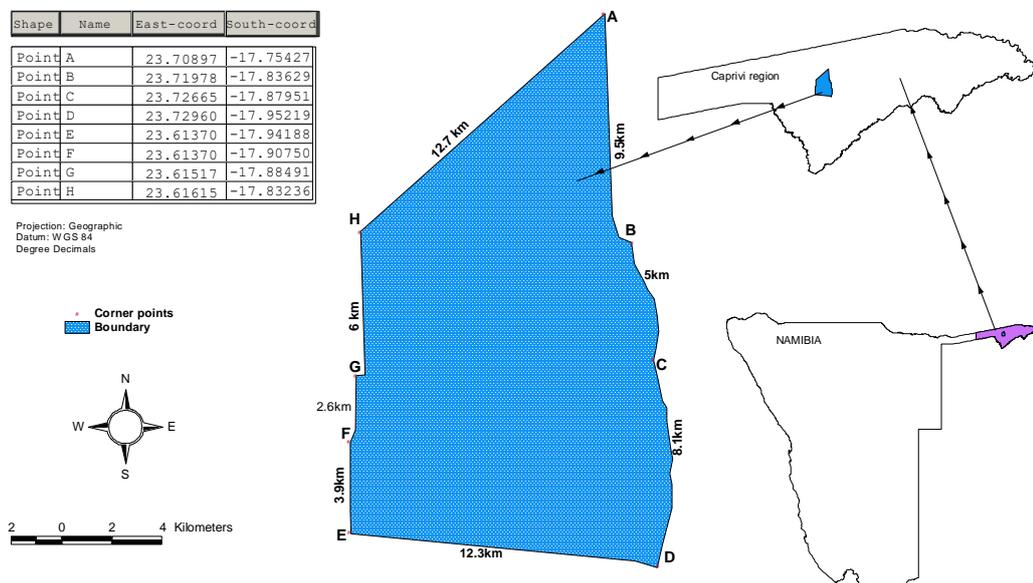


Figure 2: The location of Masida community forest

3.1.2 Climate

The area receives a mean annual rainfall between 550 to 650 mm with a variation of 34 to 36%. The rainy season starts in November and ends in April, with the major rainfall occurring in February (Environmental profile of Zambezi”, Mendelsohn *et al.*, 2002). The mean temperature is 22⁰C and a maximum of 34⁰C to 36⁰C with a minimum between 2⁰C and 4⁰C (Jones, 2015; Krug, 2017).

3.1.3 Soils and agricultural potential

The soil type is sand north of the Trans-Caprivi Highway and clay-loam south of the main road. There is a great deal of small scale or local variation. Cropping potential is indicated as being poor; the crop fields are covering an area of 1 300 ha. Crop farming occurs on both sides of the tarred road and stretches south to the old gravel road.

The main crops are maize, millet, and sorghum complemented by pumpkins, groundnuts and beans. The grazing potential is moderate and grazing pressure is medium, with higher pressure around water points and cattle posts.

3.1.4 Land types, natural vegetation, and forest resources

The two land types are Mopane woodlands with pockets of Kalahari woodlands south of the Trans-Caprivi Highway and pure Kalahari woodlands north of the highway. The mopane woodlands are dominated by *Colophospermum mopane* – *Aristida congesta* (13 787 ha) and *Colophospermum mopane* – *Burkea africana* woodlands (64 ha). In the Kalahari woodlands, *Burkea africana* – *Pterocarpus angolensis* – *Guibortia coleosperma* woodlands are found in pockets south of the road (2346 ha). The vegetation north of the road is dominated by *Baikieae plurijuga* savannah- shrubland (2546 ha) and woodland (583 ha). The most dominant tree species are *Colophospermum mopane*, *Terminalia*

sericea, *Burkea africana*, *Guibortia coleosperma*, *Baikieae plurijuga*, and *Pterocarpus angolensis*. The woodlands are patched by the *Aristida congesta*, *Cymbopogon excavatus* and many different grass species (Giess, 1998; Kamwi *et al.*, 2015, 2018).

3.1.5 Inhabitants, administration and services

The area of Masida community forest (Fig. 3 and 4) hosts approximately 1100 inhabitants. Masida community forest falls in the Sub-khuta of the Mafwe Royal court at Chinchimane. The sub-khuta functions with an Induna Silalo (Traditional authority), his deputy (Ngambela) and his Advisor (Natamoyo).

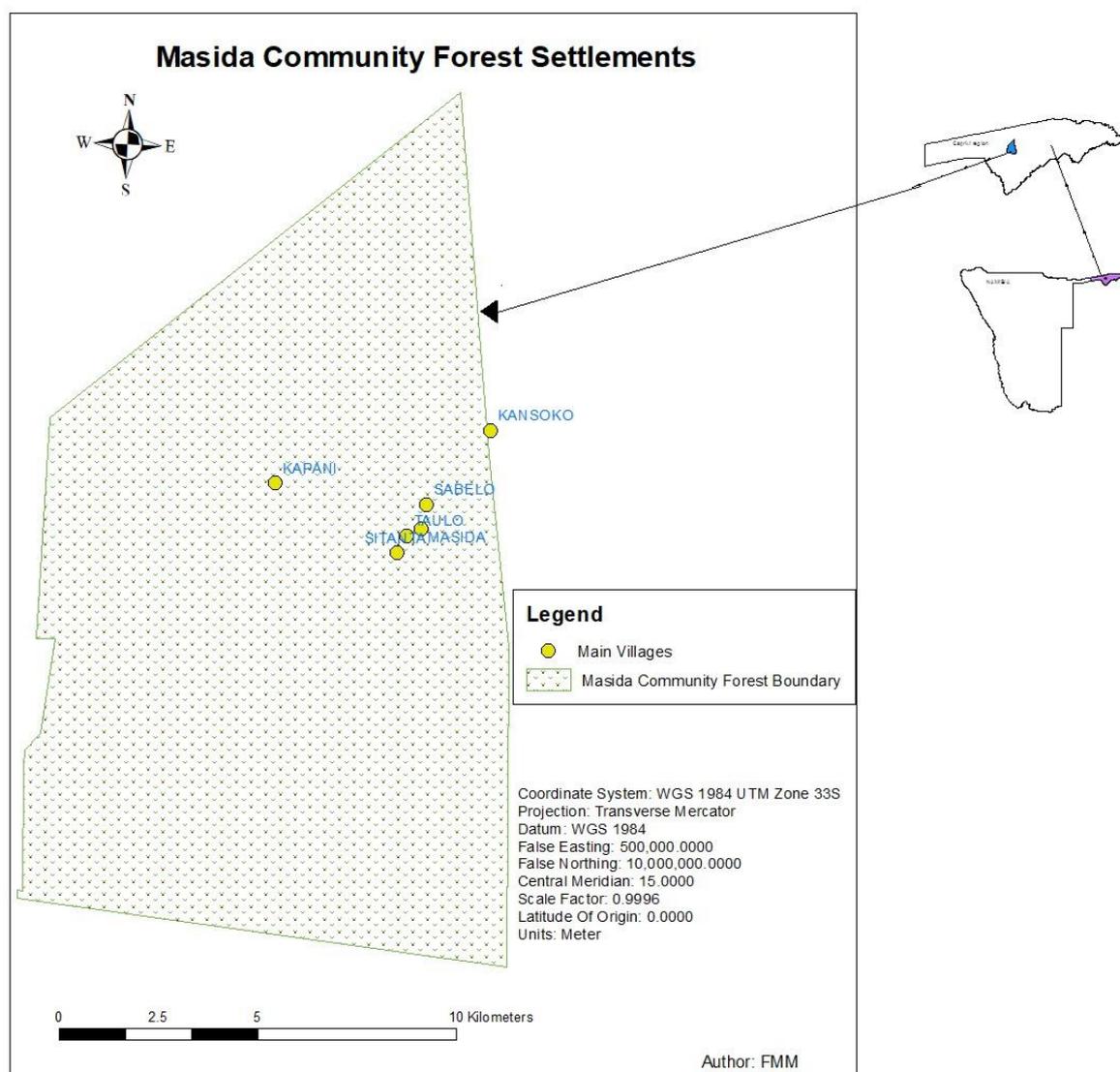


Figure 3: The main villages of Masida community forest

According to the Community Forest management body, most of the disputes and cases are settled at the Sub-khuta level. Royal Khuta handles cases related to land – issues, and assaults. Masida CF area forms north-eastern community of the Linyanti constituency. The head quarter is situated at Kapani. Masida CF residents go to the nearest health care centre at Sibbinda for health care or sometimes to the primary health care clinic located west of the area at Sachona.

There is a combined school building within the community forest. The telephone services and electricity are currently (2018/2019) being installed. The responsible Agricultural Development Centre (ADC) and the sub-station of the Directorate of Forestry (DoF) are located at Sibbinda.

3.1.5.1 Organizational set up of the community

In Masida CF area, there are different types or categories of inhabitants, ranging from Farmers i.e. - Households who owns pieces of land for agricultural crop cultivation and sell surplus for income. Pastoralists, are households who own livestock (cattle and goats) that they graze freely in the forest, and get income from the sale of livestock and from renting them to others who own agricultural fields to use animal draught power for ploughing their field at an agreed fee to be paid to the owner. Businessmen/women are households who own shebeens and cuca shops in the area that get income from sales of basic necessities including forest products. Under the Civil servants category, are households with people who are employed in private companies and government workers, and are the main suppliers of piecework job to others and they have secured salaried job. The unemployed; are household members without any kind of job, but depend on piecework job and some on remittances from relatives who are working in different parts of the region or country. All this mentioned organizational set up relies on forest at

different levels in the study area. However, one household might fall in one or all categories.

3.1.5.2 The management body and benefit distribution in Masida community forest

Community forests in Namibia are established under the provision of the Forest Act of 2001(as amended 2005) after meeting certain conditions prescribed by the legislation and declared by the Minister of Agriculture, Water and Forestry. The community forest is managed by the management authority referred to as Forest Management Committee (FMC) on behalf of the community forest members as per provision from the forestry legislation. All the benefits derived in the community forest by the FMC are distributed according to the benefit distribution plan as set in Section 15 (2) (g) of the Forest Act of 2001 that states that “The Community Forest Management agreement must provide for the adequate reinvestment of the revenues of the Community forest and the equitable use or distribution of the surplus.” The plan identifies how any surplus incomes are to be used to provide benefits equitably meaning “fairly” rather than “equally” (Government Gazette of the Republic of Namibia 2001, 2005). The distribution matrix is set up for all community forests that cover the benefits (Appendix 1).



Plate 1: Masida Community Forest Office

3.2 Research Design

3.2.1 Sampling design

The study was a cross-sectional study and used both qualitative and quantitative approaches. Qualitative data was collected using key informant interviews and focus group discussions. Quantitative data was collected using questionnaires, permit system data forms and literature reviews from previous studies. A total of seven key informants were purposively chosen, comprising of traditional authority, village leader and stakeholder for the interviews. Focus group discussions were held at community forest office with a total of ten selected representative members from two villages per discussion and a total of three discussions were held. The discussions were based on checklist questions to inspire the discussion. The study was conducted from December 2018 to April, 2019.

The study used households as sampling unit and the head of the households as observational units. The study sampled households from all six villages in the area. A simple random sampling technique using computer random numbers was used to select households to be included in the sample. The village households were taken as a proportion of the total area households. This gave each household in the area an equal chance of being selected in the sample and all choices were independent of one another (Kothari and Garg, 2014).

3.2.2 Sample size determination

To determine the sample size to be used for this study, the formula by Jamane (1967) cited by Suleiman *et al.* (2017) was adopted for determining the appropriate sample size. The formula minimizes sampling error and bias as it draws a representative sample from the target population (Suleiman *et al.*, 2017).

The Formula denotes:

$$n = \frac{N}{1 + (e^2)N}$$

$$n = \frac{343}{1 + (0.05^2)343} \quad n = 185 \text{ Households}$$

Where n was the Sample size (household) to be estimated;

N is the definite population (Total households) in the study area,

e is the significance level (0.05).

A sample size of 185 households as respondents for the household survey was derived after substituting the total households of 343 in the formula. To get specific household respondents from all six villages of the study area, a list of all households within the six villages was acquired from the Community Forest office which was updated in December 2018, the same month when the study was introduced in the area. Village representatives recorded all households (census) in their respective villages.

The total number of households per village was used as a proportion of the study population to the derived total area sample size to get the sample size in each village (Table 1). This was done to get a representative sample to be included in the study total sample size (185). Simple random sampling technique was applied to select households to be interviewed from the total village households. For example, in Table 1 Kansoko village had 64 total households, we take the 64 as a proportion of the 343 study population to the study sample size 185 as; $64/343*185$ this gives 34 households as a proportional sample size of Kansoko village to the total 185 households to be interviewed in the whole study area (Suleiman *et al.*, 2017). The observational unit was the household head independent of his/her gender status, who is 18 or above years old or a representative in the case of the head of the household being absent during the time of the interview. This member of the household had to be able to narrate the household socio-economic status.

Table 1: Sampling frame and sampling size of Masida community

S/N	Village	Sampling frame	Proportion	Sampling size
1	Kansoko	64	$64/343*185$	34
2	Sabelo	67	$67/343*185$	36
3	Masida	30	$30/343*185$	17
4	Taulo	87	$87/343*185$	47
5	Sitanta	51	$51/343*185$	27
6	Kapani	44	$44/343*185$	24
	Total	343		185

3.3 Data Collection

3.3.1 Primary data

3.3.1.1 Households' livelihood strategies, perceptions and dependency of household on the forest

Primary data was collected from the field (Fig. 4), through a semi-structured questionnaire (Appendix 2) administered to the respondents through face to face interviews. The household questionnaires comprised of sections that inquired data related to socio

economic and demographic characteristics, livelihoods, resource utilization, and perceptions. The answers from checklist questions of focus group discussions (Appendix 3) and key informants interviews (Appendix 4 – 10) were used to triangulate information obtained from the respondents (Langat *et al.*, 2016).

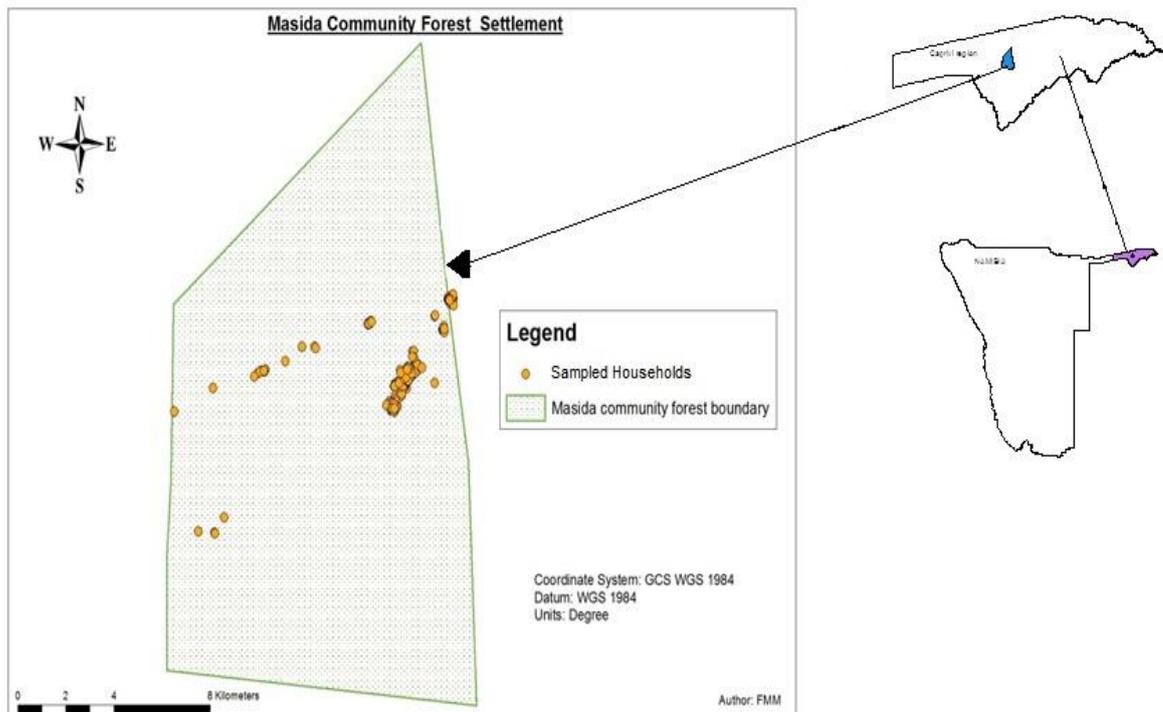


Figure 4: The Sampled households distribution of Masida community

3.3.1.2 Household survey

The semi – structured questionnaire was used and it contains both open and closed-ended questions, which was translated to respondents into Sifwe, the vernacular language commonly spoken in the area. The questionnaire was pre-tested by taking 5% of the total households that gave a total of 10 households. The household respondents that were interviewed during the pre-testing of the questionnaire were not part of the respondents during the onset of the study. This exercise helped to assess appropriateness and the structure of the questionnaire (Kothari and Garg, 2014). Thereafter, the pre-test results were used to adjust the questionnaire accordingly.

To assess people's perceptions on forest importance, the forest resource availability and extractions, a Likert type scale questions was used (Jannat *et al.*, 2018). The Likert scale on the perception of the level of dependence on the benefits from the forest was recorded as; Low (1), Medium (2), High (3), and Very high (4). The referred period of the forest resource availability and the resource extraction (collection) was based on before the area was gazetted (given the user right by the government) 2007, and after the area was gazetted up to 2018 when the study commenced in the area.

3.3.1.3 Focus group discussions

The discussions with community members were held at the community forest office considering gender representation after the household survey to discuss in-depth of the pertinent information collected from the household surveys. A checklist with detailed questions on dependency and resource availability was used to inspire the discussion. This enabled a researcher to get some information that was not revealed during the household interviews. This also acted as a means of verifying the data and helps to qualify, strengthen and amend areas that were not clear during household surveys.

A representative number of five members from each of the two villages arranged at a time were considered for the discussions. Discussions comprised of ten members per discussion and a total of three meetings were held in the whole study area. The group discussion members were limited to less than 12 members because more than that might be difficult to control and causes disintegration (Nyumba *et al.*, 2018).

3.3.1.4 Key informants' interviews

These were interviews with purposively selected individuals who are more familiar with the contents of forest resources dependency in the area. This included people from Community forest office, Directorate of forestry staff responsible for the area, village leaders and stakeholders from different ministries identified in the area. The eligible

members selected were those with representative position in the area. Amongst the criteria of eligibility used was that a chosen member has to be a person who demonstrate collective role in conservation of the forest by showing knowledge, communication skills, willingness, and impartiality. This was aimed at ensuring that the key informant would be able to communicate his/her knowledge on forest dependency willingly in a comprehensible manner and known to be unbiased and subjective in the society (Marshall, 1996). A checklist of detailed questions with subjects covered in the focus group discussions was used to obtain detailed information on the extent and consequences of dependency on forest resources. Some of the members with these characteristics were selected during the household interviews based on the observed knowledge by the Researcher during the household surveys. A total of seven interviews were conducted across the study area.

3.3.2 Secondary data

Secondary data were obtained from literature such as journals articles, books, reports, and from the respective government offices responsible for the study area. The data from the questionnaire was complemented with the official data on forest resources permits issued between 2007 to 2017 for resources recorded as harvested during the said period (Appendix 11). This data mostly complemented specific objective number 3 on the extent and consequences of forest dependency on forest resources in the area. This gave an overview of the forest resources used and species preferences in the study area.

3.4 Data Analysis

3.4.1 Household dependency on the forest, livelihoods and the extent of dependency on forest and perceptions

Data collected during fieldwork was compiled, coded, and analysed using IBM Statistical Packages for Social Sciences (SPSS) at 20 version and Microsoft Office Excel 2010. Qualitative data (interviews and discussions) were recorded on a digital camera and was

transcribed immediately after the fieldwork. These data was transformed into text and summarized into contents that were used to triangulate the data collected during the household interviews. Descriptive statistics including frequencies, proportions, measures of central tendency and dispersion were used to summarise the extent of dependency on forest resources use and the socio-demographic data. Pearson's chi-square test was used to analyse the associations of socio-economic characteristics, livelihoods and factors that influence forest dependence (Langat *et al.*, 2016). A binary logistic regression model was used (Jannat *et al.*, 2018; Hosmer *et al.*, 2013) to determine the effect of socio-economic factors influencing households' forest dependency. In estimating the forest dependency of the households, forest dependency was the dependent variable and independent variables were the socio-economic factors. The cross-tabulation was used in the analysis of perceptions on the importance of forest resources, the trend of availability and extractions of forest resources between villages of the study area and a Pearson chi-square test was used to predict the differences. A multiple response analysis was used to analyses open ended questions and multiple comparisons of various sources of income contributions was analysed using ANOVA to distinguish the differences. Multiple response analysis was further used to summarise the repeated responses of respondents on benefits acquired, factors influencing forest dependency and the alternative interventions required to lessen the burden of reliance on forest resources.

When referring to forest resource benefits in this study, resources were grouped into broad categories rather than defining it individually (Timko and Kozak, 2014). Categories were Building materials (poles, rafters, droppers, thatch grass, mud pits) both for own use and for sale; Medicinal (parts of the tree, shrubs, lianas, herbs collected for curing an ailment in the household); Food (collected wild fruits, tubers, bush meat, mushrooms) and Fodder (freely grazing and browsing of livestock).

The data on items collected from the forest was verified from each household during the face to face interviews. The forest dependency of households in Masida community forest was calculated as the proportion of annual income earned from forests resources to the total annual household income (Adam and Tayeb, 2014; Jain and Sajjad, 2016; Langat *et al.*, 2016). The total annual household income was calculated as the sum of all forest products income, agricultural income, salary or wage income, and remittances. Forest product income was computed from the sales of firewood, wild fruits, devil’s claw, poles and droppers which were done by multiplying each product by its market price obtained from the community forest office. Since measuring forest dependency is core in this study, the forest dependence was computed by adapting a formula from Adam and Tayeb, 2014; Langat *et al.* (2016) and derive it as;

$$FI = TFI/ TI \dots\dots\dots(1)$$

Where FI is the Forest Income, TFI is the Total Forest Income and TI is Total Household Income. The Agricultural income was calculated from the sales of the surplus sold to Agricultural Agencies of AMTA and Kamunu. The market price of crops and other agricultural products was obtained from the local agencies and representative office of Directorate of Agricultural Production Extensions and Engineering Services (DAPEES) based at Sibbinda. To determine the level of forest dependence on households, the sampled households were categorized into 3 income groups based on their level of total household income in Namibian dollars (N\$). The Poor group (0 – 1500 N\$), the Moderate group (1501 – 3000N\$) and the Rich group (>3001 N\$). The categories were set by the researcher examining the local condition of income distribution in the area, but do not reflect the general poverty levels in the study area or in Namibia as a country (Langat *et al.*, 2016; Adam and Tayeb, 2014).

The study adapted the strategies used by Jannat *et al.* (2018) by taking the average value across the villages as the cut-off threshold of forest dependency. Household lying below 0.2, that is a household whose income from the forest products accounts for less than 20% of the total annual household income was categorized as “Low forest dependency” and households lying at 0.2 and above whose income from the forest products accounts for more than 20% were identified as “High Forest dependency”. In a logistic regression binomial probability theory, the dependency variable in this study was assigned a value of 1 (one) if the household dependency is greater than or equal to 0.2 and a value of 0 (zero) if the value is less than 0.2.

3.4.2 Analytical Model for determining the socio-economic factors of forest dependency

In this study, the Binary logistic regression model was conducted to identify the socio-economic variables influencing household to depend on forest. Other studies identified the significance of this model to deal with dependency (Jannat *et al.*, 2018; Jain and Sajjad, 2016; Tieguhong and Nkamgnia, 2012; Lepetu *et al.*, 2009). The analysis of this model, projected odds ratios (Y), to determine effects of the independent variables on forest dependence of the respondents. The association between two binary data values was measured using odds ratios. In this case it was hypothesized that the forest dependency of the households was influenced by all the socio-economic characteristics of the households in Masida community forest.

The estimation of forest dependency formula was adapted from Adam and Tayeb (2014);

$$[P_i/(1-P_i)] = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki} \dots\dots\dots(2)$$

Thus, $Y_i = [P_i/(1-P_i)]$

Where:

Y_i is the dependent variable that takes a value of 1 for the subscript i denoting the i^{th} household who depend on forest in Masida CF.

β_0 is the intercept term; and $\beta_1, \beta_2, \dots, \beta_k$ are the coefficients of the explanatory variables to be estimated,

X_1, X_2, \dots, X_k are a matrix of independent variables which are related to forest dependency.

3.4.3 Description of the variables used in the model

In the logistic regression, the dependent variable Y takes a value of 1 if the respondents are high dependent on forest and 0 if otherwise. The chi-square test was used to assess the goodness of fit of the model at 5% level of significance.

Categorical independent variables, assumptions, and their justification are explained below:

(a) Gender

Gender is a dummy variable that indexes the sex of the respondent; it carries a value of 1 for men and 2 for women. On the part of dependence to forest, as expected in a socio-cultural setting both are expected to collect forest resources for subsistence and commercial livelihoods. It only differs in the type of products and the role each will play (Endamana *et al.*, 2016). For example, the harvest of forest products especially NTFPs is an ancient activity mainly controlled by women (Awono and Levang, 2018). Others studies argue that in most part of Africa including Namibia both men and women collects medicinal plants and firewood (Angelsen *et al.*, 2014; Kamwi *et al.*, 2018). It was therefore hypothesized that the female headed household are less likely to be dependent on forest resources than a male-headed households (Suleiman *et al.*, 2017).

(b) Age

The age was recorded in categories where the actual age of the respondent falls in. People of different age group depend on forest for different purpose in Masida CF. As expected, those in younger age are active and can access the forest and extract forest resource for

both subsistence and commercial purposes while as a person gets older his tendency decreases.

The energetic nature of the young people propels them to indulge in forest extraction activities which are often labour intensive and require physical strength; and this has been validated by various studies elsewhere (Fonta and Ayuk, 2013; Adam and Tayeb, 2014; Thondhlana and Muchapondwa, 2014).

(c) Years of residence

This independent variable was recorded as a binary outcome in the years category in which a head of the household falls in. It is assumed that the years of residence is positively related to forest dependence, due to experience of the person to forest resources in the area (Ofoegbu *et al.*, 2017). The forest tends to support the livelihood strategies of the communities who have lived long in the area and have livestock.

(d) Household size

The size of the households was collected in categories, and it is assumed that the larger the family size the more labour and the more mouth to feed (Jain and Sajjad, 2016). This entails that the large household has more labour availability in extraction of forest resources around them and move to larger forest areas (Mujawamariya and Karimov, 2014). Thus it is hypothesized that household size is positively related to forest dependency (Ofoegbu *et al.*, 2017, Suleiman *et al.*, 2017).

(e) Level of formal education

This was recorded in category of the level of formal education attained by the head of the household. It is expected that the level of formal education influences the person's

economic activities. The level of education exposes the understanding of the nature thus negatively related. This is assumed that the higher the level of formal education will reduce his reliance on forest as education increases prospects of diverse employment opportunities (Newton *et al.*, 2016; Jain and Sajjad, 2016).

(f) Occupation status

This was the categories of economic activities a particular head of the household is engaged into for both subsistence and commercial livelihoods. It is assumed that in rural areas people rely more on forest resources because there are few livelihoods options to supplement household food deficit and household income (Suleiman *et al.*, 2017). Thus, the households in formal employment are less likely to depend on forest.

(g) Marital status

This was recorded in categories of the status of the head of the household. It is assumed in rural livelihoods that married or cohabitants and unemployed women are found in the rural areas and they dependent on forest while their married man counterparts they depend less on forest as they go out to urban areas for employment opportunities (Kamwi *et al.*, 2015).

(h) Hectares of agricultural land owned

This was recorded on categories of farm size owned by the households in hectares. The hectares of land owned both already cleared for agricultural crop production or still in it is forested state. Household with less hectares of land rely more on forest for food. It is hypothesized that land holding size is inversely related to forest dependency as they possess alternative means to maintain their livelihood through agriculture (Jain and Sajjad, 2016; Suleiman *et al.*, 2017).

(i) Household category

Households levels of income were collected and set the households into income groups based on their level of total household income. It is hypothesized that rich group households depends less on forest than the poor household group (Langat *et al.*, 2016).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Livelihood Strategies and Contribution of Forest Resources to Household Income

4.1.1 Household livelihoods activities

During this study the livelihoods activities was compiled and resulted that; 60% of the households interviewed indicated that they are unemployed (n =110), relying mostly on piecework (32%), and government social grants for their children (23%). Other livelihoods activities were farming (30%), relying on rain-fed agriculture and few others who are involved in livestock keeping (43%), wage employment (31%), small-scale business (6%).

4.1.2 Livelihood assets

The ecological endowment and the entitlement at the households' disposal entail the choice of strategy that the household will embark upon (Kamwi *et al.*, 2015). This was also observed to affect the type of livelihoods the communities of Masida community forest are comprised of (Table 2).

There is a diverse of capabilities, assets and activities that are facilitated by both social relations and institutional arrangements in the area, thus summarizes their livelihoods differently.

Table 2: Livelihood strategies that influences household forest dependency

Responses to Livelihood strategies influencing forest dependency			
Asset	Strategy	Count	Percent of responses
Social	Remittances, Extension services	162	22.1
Physical	Land and Livestock (Farming)	234	32.0
Natural	Forest resource, protection and regulations (Income generation)	281	38.4
Financial	Salary, Business, firebreak construction, Electricity connection, Boreholes	10	1.4
Human	Skills in Basket weaving, wood carving, and Training in beekeeping, bookkeeping	45	6.1
	Total responses	732	100.0
	Valid cases	185	

4.1.2.1 Social assets

About 10 % of the households revealed that they receive some complimentary income (remittances) from family members and relatives who are not residing in the study area. It was further reported that members of the Forest Management Committee have a platform where they meet with different committees of other community forests to discuss issues related to the management of the forest. The same venue is where decisions of implementing some awareness creation on fire prevention is shared. About 67% of respondents stated that they participate in the awareness creation amongst farmer-to-farmer extension method on the importance of forest. Only 10.7% of the respondents participate in patrolling the forest and report any illegal harvested of resources encountered in the area.

4.1.2.2 Physical assets

(a) Land

Regarding land ownership, 70% of the households interviewed in the study area own 1-3 hectares of land, 9% own 4-6 hectares, 5% own 7 and more hectares while the rest (17%)

do not own land. Those who own land, use it for agricultural crop cultivation. Notably, none of the owned land outside the home courtyards is used for planting of trees (orchards and woodlots) in the area, and the remaining natural forest land is zoned for forest and grazing by the management body of the community forest. It is in these areas where all beneficiaries irrespective of land ownership status can extract forest resources for household uses.

(b) Livestock

The study revealed that cattle and goats are the main livestock owned by the households of Masida community forest. However, the majority of the households (62%) do not own cattle, while only 5% own goats. Among those who own cattle, 59 households own 1-10 cattle, five households own 11-20 cattle, 4 households own 21-30 cattle. Only two households own more than 31 cattle each. Only four households own 1- 10 and 11-20 goats while only 2 own more than 31. The majority of communities of Masida CF keep few livestock. Thus, income from livestock contributes a small amount, suggesting that the owners of livestock in the area keep livestock for wealth prestige.

4.1.2.3 Natural assets

Sustainable forest management is the core behind the proclaiming of the study area as a community forest. During the interview, about 79 % of the respondents cited to have planted trees in their home courtyard as an initiative towards securing foods of the family although not in large scale, ranging from two trees to five in some of the houses. The results of the study further show that 73% of the responded revealed that there is some customary control measure enforced by both the traditional authority and the FMC regarding the protection and regulating of the forest biodiversity conservation, which contributes to the continued production of the forest in providing direct benefits that enhance livelihoods.

4.1.2.4 Financial assets

The results of the study show that 5.4% of the respondents reported that the community forest establishment has contributed to the livelihoods of the communities. It was further observed that during the benefit distribution, the FMC and the Traditional authority are paid a honorarium for managing of the forest. The development fund share has been used to pay for community borehole water fees and the supporting of the vulnerable children with school uniforms.

4.1.2.5 Human assets

It was reported during the Focus group discussions and key informant interviews that FMC executive members on behalf of the communities are supported by different NGO to undergo training in leadership's skills and bookkeeping. However, due to economic instability, most of the trained members vacate the area after acquiring the relevant skills in search of jobs in urban areas. About 24% of the responded revealed that they have acquired skills through the organized short courses in the community forest to harvest forest products and carve woods into different tools that is sold for income generation. It was further reported that the beneficiaries of the community forest resources differ in their entitlements.

The findings of this study show that the community forest is a natural asset that is an endowment. Similar findings have been reported from various studies elsewhere on how different livelihood assets benefit from community forests (Dev *et al.*, 2003; Mahanty *et al.*, 2006; Shackleton *et al.*, 2007; Kamwi *et al.*, 2015; Vrabcova *et al.*, 2019).

4.1.3 Linking forest livelihoods benefits to forest dependence

During the face-to-face interviews, the respondents mentioned various benefits derived from the forest as part of the contributing factor to their dependence on forest.

The respondents revealed that the forest play a major role in providing direct and indirect livelihood benefits. Direct livelihood benefits refer to forest ecosystem services under Provisional services (food, medicine, and building materials). Indirect livelihoods benefits refer to forest ecosystem services under regulatory, ecological and cultural services.

4.1.3.1 Direct livelihoods benefits

Respondents were asked to rank the direct livelihoods benefits based on their value to the household. They ranked the benefits to the household on a scale of 1 (most important) to 5 (least important). Figure 5 shows that forest medicinal value is least important (3.86) followed by food (3.11). Supply of forest based building materials (1.34) considered the most important benefit.

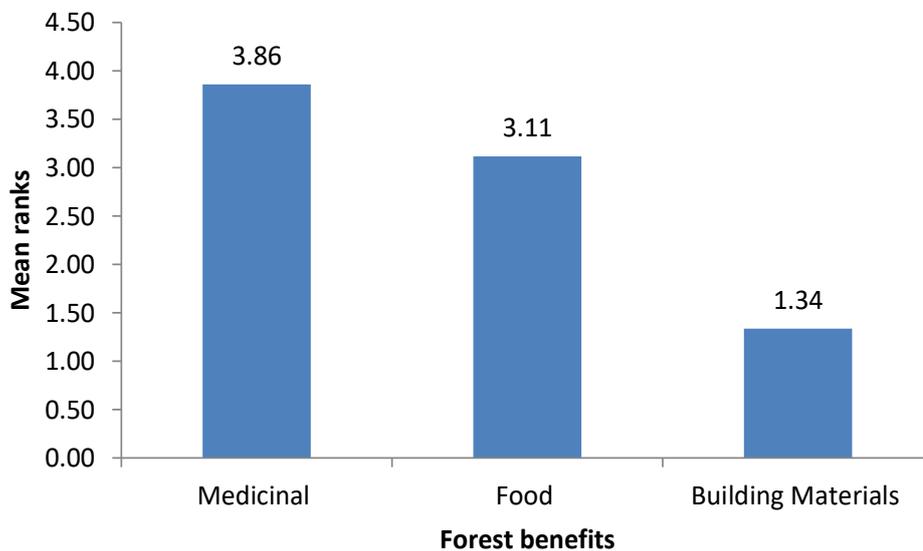


Figure 5: Forest benefits mean ranks in Masida CF

The forest benefits were then subjected to cross tabulation to determine the benefit distribution relationship across the villages using the Chi-square test at 5% level of significance. The results showed that the distribution of food and medicinal benefits differed significantly ($p < 0.05$) across all villages while building materials was not

significant. A non-parametric test was executed to find the associations among the benefits. It was hypothesized that the distribution of the benefits is the same across the six villages.

The results on Cochran's test showed that the forest benefits are significantly ($P < 0.0001$) different across households in the study area, thus the null hypothesis was rejected. Appendix 12 shows the results of the Cochran Q test statistics. The pair-wise comparison of the benefits distribution on Figure 6 shows that all benefits medicinal, food and building material benefits are statistically significant ($p < 0.05$) across the villages. Each node on Figure 6 shows the sample number of successes. The yellow line joins the benefits to show that they are statistically significant. All respondents (100%), cited forest building materials, 81% medicinal, and 89% forest food as a direct livelihoods benefit derived from forest.

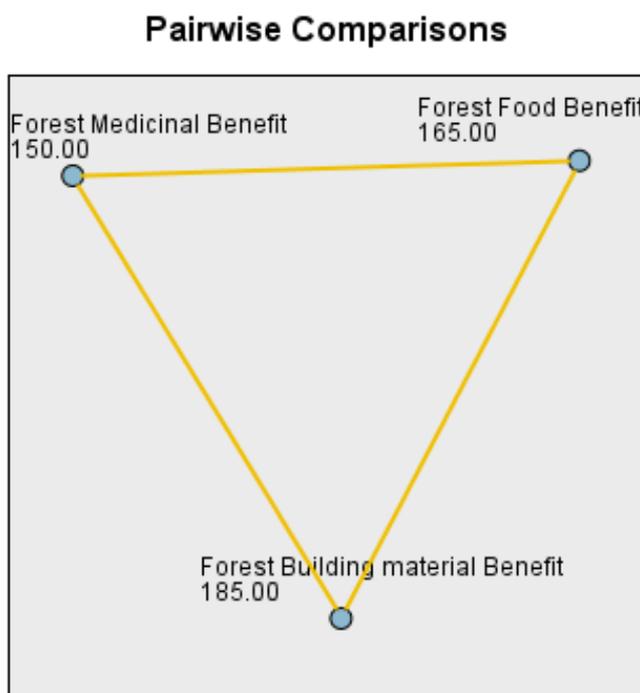


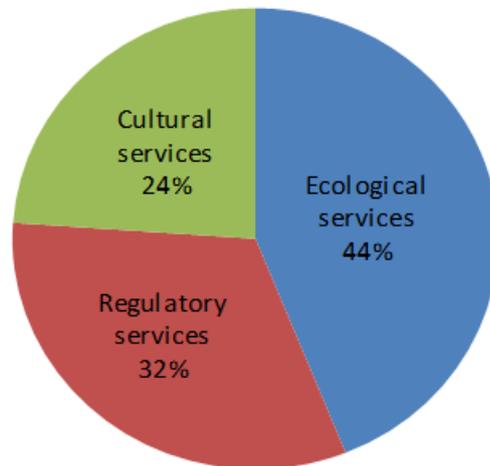
Figure 6: Pairwise comparisons of the direct livelihoods benefit in Masida CF

The mean rank results (Fig. 5) imply that provision of building materials (100%) was highly ranked while medicinal value was the least ranked. Building materials are used by every household in the study area. This result concurs with findings of other studies in Namibia by Kamwi *et al.* (2015) and elsewhere (Fikir *et al.*, 2016; Jannat *et al.*, 2018; Langat *et al.*, 2016; Newton *et al.*, 2016). Further test results (Appendix 12) were carried out to examine the influence of benefits to household forest dependency. The relationship between the all the three benefits was positive and highly significant ($p < 0.05$) (Appendix 13).

These findings agree with studies elsewhere, reporting that forest dependency is diverse and reliance on the forest can be interpreted differently (Newton *et al.*, 2016; Tieguhong and Nkamgnia, 2012; Timko *et al.*, 2010; Timko and Kozak, 2014).

4.1.3.2 Indirect livelihoods benefits

During the household interviews, respondents listed various roles that the forest play into their livelihoods ranging from forest acting as windbreak, enabling gaseous exchange (provides oxygen and absorb carbon dioxide) and regulate the temperature. In addition, respondents further cited other benefits such as provision of shelter to their domestic animals, leguminous plant species such as *Colophospermum mopane* and *Dichrostachys cinerea* enhance soil fertility for agricultural crops, forest hosts their cemetery and sacred places for religious and cultural festivals, and educational and tourism attractions that brings in incomes. After analysis, these responses were categorized into forest ecosystem services. Figure 7 shows that 44% of the respondents revealed that ecological services are the highest indirect livelihoods benefits followed by regulatory service (32%) and cultural benefits (24%) being the least. The findings of this study correspond with study by Thoms (2008) in Nepal and Vrabcova *et al.* (2019) in Namibia, who reported similar indirect livelihoods benefits.



Forest Ecosystem services

Figure 7: Indirect livelihoods benefits of Masida CF

4.1.4 Contribution of forest resources to total household income

4.1.4.1 Forest resources income and forest dependency

Generally, most of the forest resources collected from the community forest area are for own-consumption, and occasionally for sale. The results of this study show that households of Masida CF depend on community forest for diverse forest products and services. The study determined forest dependency of households by assessing the portion of forest income contribution to the total household annual income as shown in Appendix 14.

In this study, the total household income was calculated from agriculture income (Crop income + Livestock income); income from forest products (Medicinal plant sale, e.g. - Devil's claw; Poles, Thatch grass and firewood); and Non-farm income (Salary/wages, Old age grants, Child grants, and business income).

However, the total households' incomes and income from forest products were not significantly different ($p > 0.05$) across all the six villages of Masida community forest. In

contrast, the agricultural income differed significantly ($p < 0.05$) across the six villages of Masida community forest. It further observed that farmers in the study area are adopting the innovations of the mixed cropping and rotational cropping to boost their yield, use inorganic fertilizer e.g. NPK, use of improved crop varieties.

Their source of income is mainly from forest products, although only 16% of the households actively participating in harvesting and sale of devil's claw, poles and other forest products constituting a significant quota. Figure 8 presents the average forest dependency ratio of all households in each villages, showing the Forest dependency ratio varied from 0.05 to 0.3, and Taulo and Sabelo villages had highest dependency.

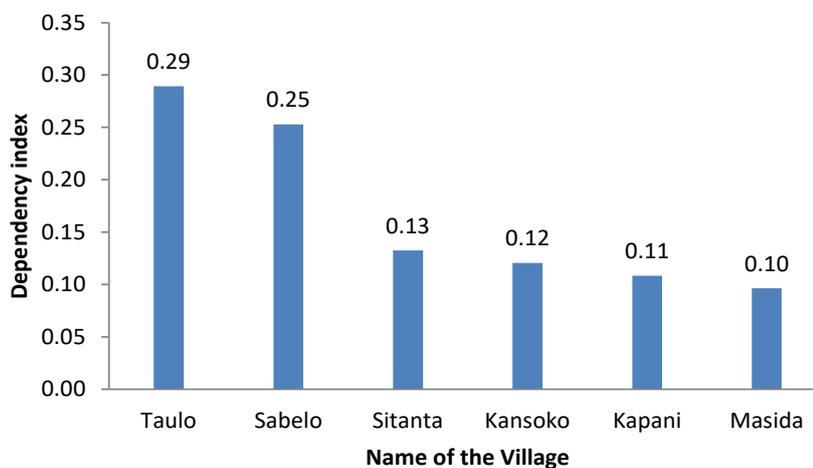


Figure 8: Forest dependency ratio in the villages of Masida CF

Other villages are less dependent on forest resources e.g. Masida, the central village, where most of the development is taking place, and people are less dependent on forest resources as they have other sources of income including salaries, child grant, old age grants. The findings of this study concur with other studies from India and Bangladesh that reported forest dependency in terms of derived income (Jain and Sajjad, 2016; Jannat *et al.*, 2018).

4.1.4.2 Contribution of forest resources to total households income

The results of the contributions of various sources of income provide interesting outcomes. For example, Appendix 15 shows that the forest resources have the highest households' response frequency as the main source of incomes perceived by household heads, but in monetary terms it only contributes 16% to the average annual household income. The other non-forest incomes contribute up to 84% to the respondent's livelihoods (Fig. 9). The results as shown in Appendix 16 further indicates that the contribution of the various sources of households' income to the Masida CF communities are statistically different ($p < 0.05$).

For instance, the average annual income contribution of forest resources per household is N\$ 606.36 as compared to N\$ 421.32 and N\$ 1178.24 per household from Agriculture and non-farm income, respectively. This indicates that the forest dependency of Masida CF residents is categorized as low, suggesting that income is not a good measure of livelihoods dependency in Masida community forest area.

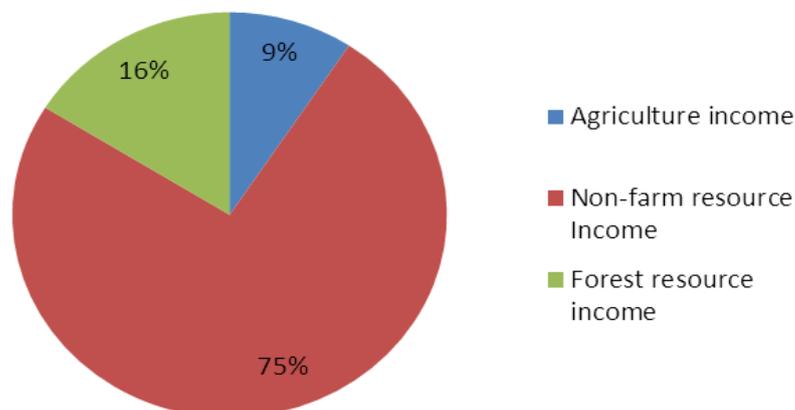


Figure 9: Percentage contribution of forest resources, non-farm resources and Agriculture income to the total household income

Table 3 presents the multiple comparisons of the contributions of different sources of income using ANOVA. The result reveals that the average annual contribution of the non-farm income to the household was significantly ($p < 0.05$) higher than that from Forest resources and Agriculture. However, the annual contributions of income from the sale of forest resources are significantly higher than that of the Agriculture incomes.

Table 3: Multiple comparison of sources of incomes in Masida CF

Comparison Household Sources of Income		Mean Difference	Std. Error	Sig.
Agriculture income	Non-farm Income	-1461.405	59.298	.000
	Forest Income	-153.297	59.298	.026
Non-farm Income	Agriculture income	1461.405	59.298	.000
	Forest Income	1308.108	59.298	.000
Forest Income	Agriculture income	153.297	59.298	.026
	Non-farm Income	-1308.108	59.298	.000

This finding reflects that the sale of extracted forest resources and produce from agriculture is limited. One of the contributing factors to this could be related to the remoteness of the area, and the free accessibility to forest resources and unemployment, meaning that everyone is collecting the same resources from the forest and even trying to sell it, and there are few individuals who will buy it in the area. The same implies to agricultural produce. The contribution of non-farm incomes is high because people who are employed gets salary every month and others get remittances from their relatives outside the study area. This finding of this study concurs with the findings of Suleiman *et al.* (2019) who reported that rural people in remote areas tend to utilize forest resources for subsistence rather than for cash income. In contrast, other studies have reported that agricultural income and forest resources are the most contributing to the total household

income (Malleson *et al.*, 2014; Ojea *et al.*, 2016; Endamana *et al.*, 2016; Jain and Sajjad, 2016).

The results on household levels of income categories show that the 70% of households are in the Poor group category, 20% are in the Moderate category while only 10% were in the Rich group (Appendix 17). Therefore, the dependency on forest in Masida CF may be interpreted in terms of the dimensions that focus on “people” by looking at the people’s strong spatial relationship with forest (Newton *et al.*, 2016) since the people of Masida CF live within or in proximate to the forest (Belcher *et al.*, 2015). Figure 3 shows that most people of Masida CF live within a certain distance to the forest edge. Although the commercial livelihoods of people are not forest-based, their proximity and access to forest resources shows that they depend on the forest as a source of food, firewood and supporting environmental services as reported from other studies (Bose *et al.*, 2012; UNECE, 2014; Timko and Kozak, 2014).

The findings of this study further confirm that household in the lower-income (poor) category are highly dependent on the forest than the higher income category (rich group). This finding is in agreement with results from other studies (Fikir *et al.*, 2016; Teshome *et al.*, 2015).

4.2 Socio-economic Factors Influencing Household Dependency on Forest

4.2.1 Socio-economic characteristics of respondents

The socio-economic characteristics of respondents are shown in Table 4. The average household size per households in the study area is dominantly 3-5 people, comprising 45.9% of the occupants. About 71.4% of the respondents were head of the households and only 28.6% were represented in their absence by their children, wife or husbands and

Table 4: Socio-economic characteristics of respondents in Masida community

	Frequency	Percentage		Frequency	Percentage
Gender of Respondents			Respondent type		
Male	64	34.6	Head of Household	132	71.4
Female	121	65.4	Representative	53	28.6
Age of Respondents			Marital status of Respondents		
18-28	41	22.2	Single	57	30.8
29-39	62	33.5	Married	93	50.3
40-50	44	23.8	Separated	6	3.2
51-60	15	8.1	Widowed	13	7.0
61+	23	12.4	Cohabitant	16	8.6
Size of the household			Level of Formal education		
1-2	22	11.9	None	30	16.2
3-5	85	45.9	Primary	46	24.9
6-8	65	35.1	Secondary	106	57.3
8+	13	7.0	Tertiary	3	1.6
Occupation of Respondents			Ethnicity (Tribe) of Respondents		
Unemployed	110	59.5	Mafwe	165	47.3
Farmer	55	29.7	Mafwe; Zambia	3	0.9
Pensioner	16	8.6	Kwamashi; Zambia	4	1.1
Civil Servant	1	0.5	Masubia	4	1.1
Private Company	1	0.5	Totela	4	1.1
Business Enterprise	1	0.5	Mbalangwe	2	0.6
Others; Specify	1	0.5	Mbukushu	3	0.9
Years of residence in the village					
0-10	32	17.3			
10-20	17	9.2			
20+	136	73.5			

relatives living in the same with the house household head. About 73.5% of the respondents indicated to have resided in the area for over 20 years and 50.3% are married.

Majority of the respondents (89.2%) belong to the Mafwe tribe. Females constituted 65.4% of the respondents interviewed and the majority of respondents were in the 29 – 39 age groups (33.5%). Although the majority of these respondents (57.3%), indicated to have attended formal education up to secondary level, 59.5% of these were unemployed.

4.2.2 Socio-economic factors influencing households dependency on forest

Socio-economic factors that influence households' dependence on forest are presented in Table 5. Results of the Likelihood ratio test (207) of the regression model is significant ($p < 0.05$), the logistic regression model has an explanatory power that explained the total variation in the dependent variable with an overall fitness of (χ^2 value of 48.132, $P < 0.05$). Indicating a significant relationship between the independent variables and forest dependency. The logistic regression model likelihood test ratio, model coefficient, model summary and Hosmer and Lemeshow (H-L) test are shown in Appendix 18.

The model predicted forest dependency with 70 % accuracy (Appendix 19). The pseudo R^2 (0.31) indicating that the independent variables fitted in the model explained 31% of the total variation in the dependent variable. Therefore, these variables can be used as explanatory variables for further studies on forest dependency elsewhere.

The Age of respondents (40 – 50) have a positive coefficient and significant ($p < 0.05$) influence on forest dependency. The upper to tertiary education level also had negative relations and significant ($p < 0.05$). Furthermore, the area of land owned have positive coefficient and significant ($p < 0.05$). The remaining variables did not significantly explain forest dependency, thus the null hypothesis was rejected.

Table 5: Socio-economic factors influencing household's dependency on forest

Predictors	B(S.E)	Wald	Sig.	Exp (B)	95% C.I.for EXP(B)	
					Lower	Upper
Constant	18.5(4019.0)	0.000	1.000	113657496.9		
Age (40 -50)	2.2(1.01)	4.621	0.032*	8.750	1.211	63.214
Education (none)	0.9(1.67)	0.298	0.585	2.512	0.092	68.429
Education (Primary)	-0.8(1.60)	0.252	0.616	0.449	0.020	10.223
Education (Secondary)	-0.97(1.54)	0.403	0.526	0.376	0.018	7.711
Education (Tertiary)		7.639	0.054*			
Hectares Owned (0)	1.2(0.53)	5.016	0.025*	3.269	1.159	9.217
Hectares Owned (1-3)	1.9(0.78)	5.813	0.016*	6.515	1.420	29.889
Hectares Owned (4-6)	2.1(1.03)	4.086	0.043*	7.983	1.065	59.831
Hectares Owned (7+)		8.056	0.045*			

Significant level *p<0.05,

Tests:	X ²	Df	P-value
Model evaluation (overall):			
Likelihood ratio test	206.768	8	0.005
Goodness of fit test:			
H-L Statistics	8.387	8	0.397

Notes: Percentage of Accurate Classification (PAC): Null model = 54.6%; Model with independent variables = 70.3%; Cox & Snell R²: 0.229; Nagelkerke R²: 0.306; Sample size used in the analysis (n) = 185

The findings of this study indicate that the model with independent variables (PAC: 70.3) performs better than the null model (PAC: 54.6). The results shows further that the model performance is statistically significant (χ^2 (8.d.f) = 206.768, p<0.05). The inferential test for goodness of – fit, the Hosmer and Lemeshow (H-L) statistics, indicates that the model fit the data well (χ^2 (8 d.f) = 8.387, p> 0.05). The descriptive measures of goodness of-fit also supports that the model fits the data well (Cox & Snell R² = 0.229 & Nagelkerke R² = 0.306). The results indicate that the constant variable of the model is insignificant and will not be included (p>0.05).

The positive relation of age in the households (aged 40 - 50) to forest dependency in Masida CF was attributed to the fact that at this age, the head of households build houses using materials collected from the forest and use forest resources both for subsistence and for commercial purposes. Similarly, those aged 40 - 50 are people with experience of the forest in identifying forest resources for various uses. Furthermore, the influence of age groups (40 – 50) imply that the majority of the respondents were unemployed, and at active age to get into the forest to harvest forest resources. In contrast, as the age reaches 60 years, the citizens of Namibia are entitled to the old-age social grant and hence their status of unemployment changes and rely less on forest resources. In a study conducted in South Africa, Ofoegbu *et al.* (2017) reported that the age of respondents ($\leq 38-65$) significantly ($p < 0.05$) influenced use of the forest resources.

The primary to tertiary level of education is negatively related to forest dependency, showing that an increase in one unit of the education causes a decrease in the odds of households' high dependency on the forest. Hence, the more educated members are the least found in the area and they have secured employment, and rarely use forest resources in their households. Furthermore, the negative association with education level indicates also that as community members get more educated, their understanding of health vulnerability associated with using the forest as natural ablution facility increases, and build pit latrines or flush toilets. Similarly, Newton *et al.* (2016) and Jain and Sajjad (2016) reported that the higher level of formal education reduces reliance on forest as education increases prospects of diverse employment opportunities. The positive and significant ($p < 0.05$) relationship between forest dependency and the size of the area (ha) owned by Masida CF residents is explained by the fact that households who own larger areas of land tend to clear the forest for expansion of agricultural activities.

4.2.3 Reasons influencing household to depend on the forest

During the pre-testing of the questionnaire to be used for the household interviews, the respondents revealed that the most socio-economic descriptions for households dependence on forest in the area was “The forest provides free medicine, is used as natural ablution (toilet) facility, offers easy accessibility and cheap acquisition of forest resources in the area with high unemployment and low income, and hence inability to spend on alternatives such as gas and electricity (Appendix 20).

During the face-to-face household interviews, it was reported that the inability to pay for alternatives such as electricity and gas was not considered a good reason for dependence to forest resources, especially in the villages of Masida (0%), Kansoko (11.8%) and Sabelo (16.7%). However, this reason was more important in Sitanta (70.4%) and Taulo (68.1%) villages. This result implies that residents in these two villages rely more on forest resources for energy, whereas residents in the other villages can afford to use electricity and gas in their household instead of relying on forest resources.

The relationship between the reasons influencing households and forest dependency status was explored using multiple response analysis. The results (Table 6), show that the majority of respondents cited factors that influence their dependency on forest resource as (a) Forest use as natural toilet facility, (b) Provision of free medicine from the forest, (c) Easy access to the forest without any harvesting restriction (d) Forest resources are cheap to get, (e) The forest provides some income to the unemployed and (f) Use of forest resources because they cannot afford to pay for alternatives such as electricity and gas.

The influence of each of these reasons in all six villages was tested using the Pearson chi-square test and was significant ($p < 0.05$). The results show that provision of medicine (19.3%) by the forest is a strong motive that makes household to depend on forest, followed by natural ablution function of the forest with affordability to pay for alternative

being the least mentioned. This finding can be explained by the fact that Masida CF is a remote area, and residents encounter transport problems to reach the nearest health center located at Sibbinda, 25 km away. This makes people to use forest as a first aid before a patient is taken to the hospital. The ablution facility function is observed in the study area that only houses with an old aged or senior citizen had Pit latrines built by the government in a campaign for the healthcare and reduction of the diseases.

Affordability to pay the utility of electricity and gas was higher in some households where the Northern Region Electricity Supplier (NORED) has installed electricity lines in villages and is continuing to erect poles across all villages, expecting the household to buy the electricity prepaid meter box to install in their houses. However, in the sampled households, only a few (8.7%) have managed to pay for the service and those who afford to be connected majority are using it only for light in the houses, but for cooking and heating, they still use the firewood.

Table 6: Reasons for depending on Masida community forest

Motives contributing to dependence on Forest			
Reasons for Dependence	Code	Count	Percent of responses (%)
Forest provide free medicine	1	150	19.3
Forest serve natural ablution	2	147	18.9
Forest is easily accessed	3	144	18.5
Forest products cheap acquisition	4	140	18.0
Unemployment	5	129	16.6
Cannot afford to pay alternatives	6	68	8.7
Total responses		778	100
Valid cases		185	

4.3 Extent and Consequences of Forest Dependency on Forest Resources

The causes of scarcity of forest resources in Masida CF are shown in Figure 10. The majority of the respondents (74%) attributed the scarcity of forest resources to man-made activities (e.g. overharvesting) and natural causes (e.g. climate change).

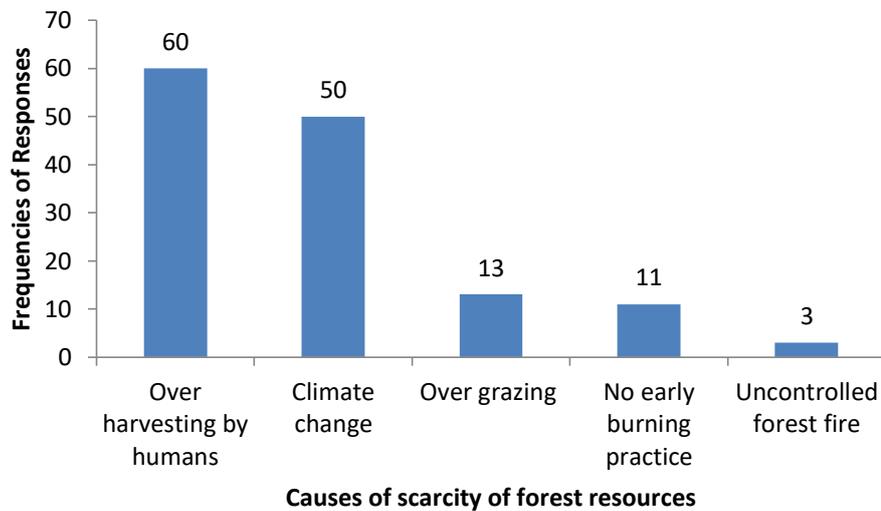


Figure 10: The reasons for the disappearance of some forest resources

A quarter of the respondents reported to have no idea on scarcity or any reason in mind of what could have caused the scarcity of forest resources but these was assumed that these were mainly community members who are involved in the illegal harvesting of resources, but feared prosecution for contravening the law as they harvest forest resources without the required permits. This finding is supported by the study of Kamwi *et al.* (2015) in the same region, that community members fail to disclose their use of the forest for fear of prosecution according to the Forest Amendment Act 2005 (Act no.13 of 2005) for the harvesting of trees in a community forest.

4.3.1 Purposes of forest resource collection from the forest

Table 7 shows that most of the collected forest resources are used for own consumption with firewood and poles and little were collected for sale. This was observed in the study area that no household collects any forest products strictly for sale.

The small portion of the extracted forest resources is sold to the surrounding village markets or shebeens for cash income. Similar findings have been reported in other studies (Jain and Sajjad, 2016; Suleiman *et al.*, 2017; Jannat *et al.*, 2018).

Table 7: Purposes of forest resources collection by Masida community

Collected resources	Own use (%) (n = 185)	Both (Sale and Own use) (%) (n = 185)
Poles	83	17
Timber	2	0
Wild fruits	65	22
Thatch grass	62	28
Firewood	98	2
Medicinal plants	61	25

4.3.2 Extent of use and consequences of dependency to forest resources

4.3.2.1 Firewood

(a) Firewood for own consumption purpose

Use of firewood as a source of energy for cooking was cited by 98% of the households (Table 8).

Table 8: Sources of energy for cooking in Masida CF

Product(s) Used	Number of households
Firewood only	182
Firewood and Gas	1
Firewood and Electricity	2
Total	185

Table 9 shows that 96% of the households across the villages cited *Colophospermum mopane* as the highest targeted tree species for firewood in the area, followed by *Terminalia sericea* (47%). *Acacia fleckii* was the least (0.5%) targeted species.

Table 9: Harvested species for firewood in Masida CF

Species	Number of households' response(s)
<i>Colophospermum mopane</i>	178
<i>Terminalia sericea</i>	84
<i>Combretum collinum</i>	24
<i>Baikiaea plurijuga</i>	22
<i>Dichrostachys cinerea</i>	17
<i>Acacia erioloba</i>	15
<i>Combretum imberbe</i>	5
<i>Combretum engleri</i>	4
<i>Acacia fleckii</i>	1

The respondents revealed the number of times they visit the forest to collect firewood and the quantity collected (Table 10). The results show that 44% of the households collected firewood in 1 – 2 days, collecting 83 bundles of firewood.

Table 10: Frequencies and quantity of firewood harvested by households

Frequency	Total Households (n =185)	Quantities collected
1-2 days	82 (44%)	83 bundles
3-4 days	44 (23.8%)	84 bundles and 2 bakkies load
Once a week	44 (23.8%)	95 bundles
Once in 2 weeks	8 (4.3%)	5 bundles, 4 sledges and 3bakkies loads
Once a month	7(3.8%)	10 bundles, 6 sledges

Table 10 further shows that beneficiaries of Masida CF extract a total of 277 bundles of firewood (the assumed weight is 20kg/bundle and 5 bakkies load (it is assumed to carry 1 000 kg or 1 ton/bakkie) and 10 sledges (assumed to carry 500kg/sledge) per month for own consumption from the forest. This is equivalent to 15 540 tons (1ton = 0.001m³) or 15.540 m³ of firewood removed from forest.

(b) Firewood for commercial purpose

According to the Forest Act, 2001(Act no. 12 of 2001, as Amended in Forest Amendment Act 2005 (Act no.13 of 2005) under Forest license for Harvesting (section 22, 23, 24, 27 and 33/ regulation 8 and 12), the Community Forest Office, is given user right to use resources for commercial purposes. This study obtained data recorded on the permit system at the office, focusing mainly on the species use and quantities harvested over a ten-year period (2007 to 2017). Data from the office showed that the Management body issued harvesting permission to individuals from within or outside the area to harvest firewood for commercial purposes to different destinations. A compilation of all permits revealed that majority of harvesting permits issued for firewood from 2008 to 2016, was

6.8 tonnes of firewood for *Colophospermum mopane*, and while only 1 tonne of *Dichrostachys cinerea* was recorded in 2012 (Table 11). This gives a sum of 7.8 tons or 0.0078m³ harvested commercially.

Table 11: Species harvested for commercial firewood in Masida CF

Year	Species	Product type	Quantity
2008	<i>Colophospermum mopane</i>	Firewood	0.3tonne
	<i>Colophospermum mopane</i>	Firewood	0.3tonne
2009	<i>Colophospermum mopane</i>	Firewood	0.67tonne
	<i>Colophospermum mopane</i>	Firewood	1 tonne
	<i>Colophospermum mopane</i>	Firewood	0.05tonne
	<i>Colophospermum mopane</i>	Firewood	1 tonne
2010	<i>Colophospermum mopane</i>	Firewood	1 tonne
2012	<i>Dichrostachys cinerea</i>	Firewood	1tonne
2015	<i>Colophospermum mopane</i>	Firewood	0.5tonne
2016	<i>Colophospermum mopane</i>	Firewood	1tonne
	<i>Colophospermum mopane</i>	Firewood	1tonne

However, the record-keeping of all species permit issued was not up to standard as not all of the forest management committee, are able to fill the permit forms correctly, due to their educational level. Some permits are incomplete, thus very difficult to record.

4.3.2.2 Thatch grass

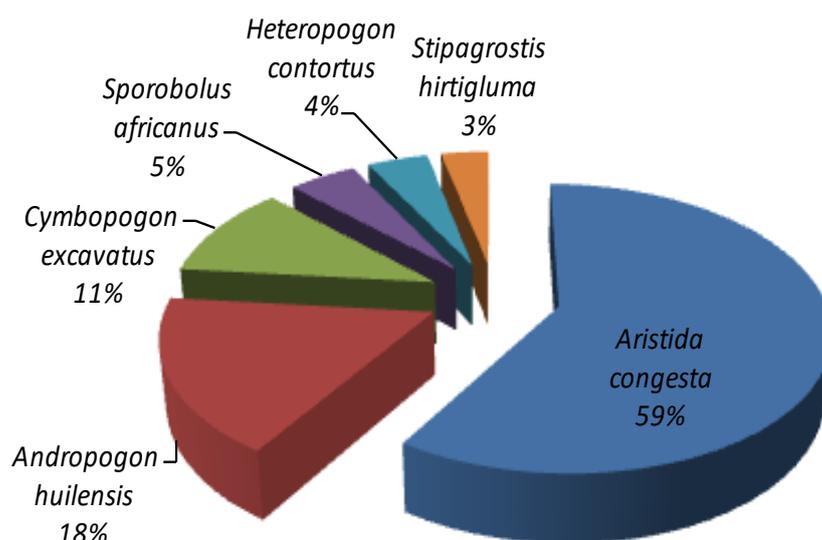
(a) Thatch grass for own consumption purpose

The study results show that 88% of the respondents indicated to use thatch grass for roofing their huts (Table 12). In the study area, more women 128 (69.2%) collects thatch grass as compared to man 57(30.8%) counterparts ($p < 0.05$). Majority of the respondents (47.6%) indicated to collect thatch grass once a year or during the onset of the dry season, while 8.1% indicated that it takes them more than five years to return to the forest to collect thatch grass once they thatch their huts.

Table 12: Frequencies and quantities of thatch grass collected in Masida CF

Frequency	Total Households	Quantities collected
Once a year	88(47.6%)	4098
2-3 years	36(19.5%)	1190
4-5 years	24(13%)	1497
More than 5 years	15(8.1)	895
Total	153	7680

When household heads were asked about the species of thatch grass used for thatching their huts, the majority of the households reported the use of *Aristida congesta* (59%) followed by *Andropogon huilensis*(18%) (Fig. 11).

**Figure 11: Thatch grass species used in Masida CF**

4.3.2.3 Wild fruits

The study results on the species of wild fruits collected by households in the study area are shown in Figure 12. Some of the wild fruits are not directly consumed after collection but need to be cooked before being eaten e.g *Guibortia coleosperma* fruits. The study reveals that *Grewia falcistipulata* (82.2%) and *Grewia retinervis* (73.5%) are the most collected while *Parinari capensis* (4%) and *Annona senegalensis* (3%) fruits were least collected. Other species mentioned by less than 5 households included *Berchemia discolor*, *Garcinea livingstoneii*, *Adansonia digitata*, *Ximenia cafra*, *Schinziophyton rautanenii* and *Ziziphus mucronata*.

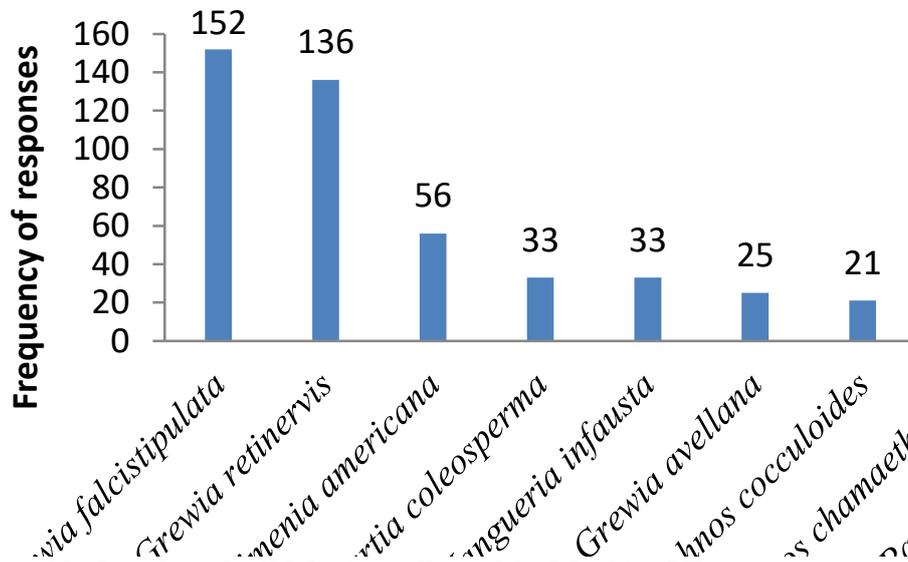


Figure 12: Species of wild fruits collected in Masida CF

Regarding gender roles in the households, the majority (65.9%) collecting wild fruits as food were females.

4.3.2.4 Poles

(a) Poles for own consumption

During the interviews, respondents listed the species targeted for different household - own consumption benefits including species used for poles to construct their houses (Table 13). *Colophospermum mopane* is the most preferred and harvested species for poles (98%) in all the villages, followed by *Terminalia sericea* (65.9%).

Table 13: Preferred species for poles in Masida CF

Species	Total Households response(s) (n = 185)
<i>Colophospermum mopane</i>	182
<i>Terminalia sericea</i>	122
<i>Dichrostachys cinerea</i>	64
<i>Acacia erioloba</i>	9
<i>Baikiaea plurijuga</i>	9
<i>Combretum collinum</i>	4
<i>Combretum imberbe</i>	2
<i>Lonchocarpus nelsii</i>	2

Regarding harvesting of poles to construct a house or to maintain the houses Table 14 shows that most households collected most poles at a frequency of 2 – 5 years.

Table 14: Frequencies and quantities of poles collected by households

Frequency	Total Households	Quantities collected
Once a year	25	4110
2-3 years	61	8200
4-5 years	74	9365
6-7 years	15	3020
Once in 10 years	10	2110
Total		26805

(b) Poles for commercial purpose

In addition to the poles used for own household consumption, Masida Community Forest Office records indicated that three species preferred for poles for commercial purposes from 2008 to 2017 was *Colophospermum mopane* with total of 11036 poles permitted and harvested out of the community forest, followed by 354 poles permits for *Terminalia sericea* from 2009 to 2015 and permits for 1100 poles of *Dichrostachys cinerea* from 2014 to 2015 (Table 15).

Table 15: Tree species harvested for poles from 2008 - 2017

Year	Species	Quantity
2008	<i>Colophospermum mopane</i>	42
2009	<i>Colophospermum mopane</i>	1 326
	<i>Terminalia sericea</i>	72
2010	<i>Colophospermum mopane</i>	120
2012	<i>Colophospermum mopane</i>	2 560
	<i>Terminalia sericea</i>	171
2013	<i>Colophospermum mopane</i>	4 182
	<i>Terminalia sericea</i>	61
2014	<i>Colophospermum mopane</i>	686
	<i>Dichrostachys cinerea</i>	100
2015	<i>Colophospermum mopane</i>	506
	<i>Terminalia sericea</i>	50
	<i>Dichrostachys cinerea</i>	1 000
2016	<i>Colophospermum mopane</i>	1 274
2017	<i>Colophospermum mopane</i>	340

4.3.2.5 Droppers

(a) Droppers for commercial purposes

The official data further show that *Colophospermum mopane* species is among the three highest preferred species for droppers followed by *Terminalia sericea* (Table 16). During 2009 to 2013, a total of 30150 droppers of *Colophospermum mopane* were harvested, while from 2013 to 2014 a total of 14980 droppers of *Terminalia sericea* was harvested.

Table 16: Species harvested for droppers from 2009 - 2014

Year	Species	Quantity
2009	<i>Colophospermum mopane</i>	500
2012	<i>Colophospermum mopane</i>	26 000
	<i>Dichrostachys cinerea</i>	400
2013	<i>Colophospermum mopane</i>	3 650
	<i>Terminalia sericea</i>	13 330
	<i>Dichrostachys cinerea</i>	500
2014	<i>Terminalia sericea</i>	1 650

4.3.2.6 Timber

(a) Timber harvested for commercial purpose

Despite the fact that the filing of permit system at Masida CF office was not up to date, there were records of different species permitted to be harvested for timber from the area from 2009 to 2014 (Table 17). These products were harvested and processed in the forest and transported out as finished and semi-finished products such as finished planks. A total of 150 planks from *Pterocarpus angolensis* were processed, while a total of 183 finished planks and 82 semi-finished cants for *Baikieae plurijuga* were permitted and transported out of Masida CF to other destinations (Table 17).

Other products recorded were tree harvesting for different purposes such as sledge and canoe carvings. As per stipulated Forest Act 2001, all the harvested resources have to be deducted from the Annual Allowable Cut, as set in the management plan and an annual

block permit that is issued by the respective Directorate of forestry office under which the community forest falls. During this study in the community forest, no block permit or management plan document was available for cross-checking the harvested species and quantities.

Table 17: Forest resources harvested for various purposes from 2009 - 2014

Year	Species	Product type	Quantity
2009	<i>Pterocarpus angolensis</i>	Planks	50
	<i>Pterocarpus angolensis</i>	Planks	100
	<i>Baikeae plurijuga</i>	Planks	23
	<i>Baikeae plurijuga</i>	Planks	30
	<i>Baikeae plurijuga</i>	Planks	100
	<i>Baikeae plurijuga</i>	Planks	30
	<i>Baikeae plurijuga</i>	Blocks/Cants	30
	<i>Baikeae plurijuga</i>	Blocks/Cants	30
	<i>Baikeae plurijuga</i>	Blocks/Cants	10
	<i>Baikeae plurijuga</i>	Canoe	1 tree
	<i>Guibortia coleosperma</i>	Canoe	1 tree
2010	<i>Baikeae plurijuga</i>	Blocks/Cants	5
2011	<i>Baikeae plurijuga</i>	Blocks/Cants	3
	<i>Baikeae plurijuga</i>	Blocks/Cants	4
2012	<i>Baikeae plurijuga</i>	Spatula	50
2013	<i>Azelia quanzensis</i>	Sledge	1
2014	<i>Baikeae plurijuga</i>	Sledge	1

4.3.2.7 Medicinal plants

Figure 13 shows the number of households and species used for medicinal purposes in the study area. During the face-to-face interviews, it was reported that the *Terminalia sericea* (28%) and *Colophospermum mopane* (25.9%) are the most species used for medicinal purposes. Other species that were revealed to be less preferred for medicinal purpose included *Boscia albintrunca* (4), *Ziziphus mucronata* (3), *Adansonia digitata* (2), *Dichrostachys cinerea*, *Pterocarpus angolensis*, *Sclerocarya birrea* and *Strychnos cocculoides* with each mentioned by one household.

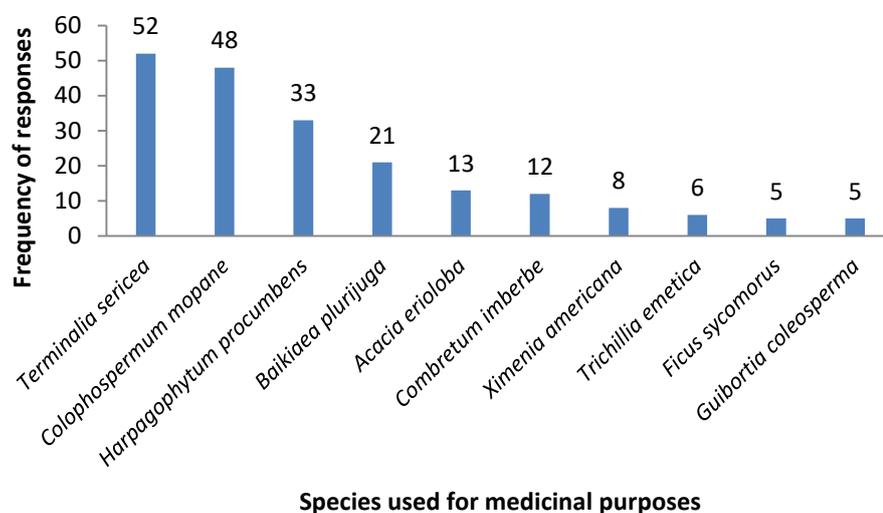


Figure 13: Medicinal plant species in Masida CF

Overall, the study results reveal that *Colophospermum mopane* species is highly preferred for various products both at household own consumption and for commercial purposes. This shows that in the study area, these species can be classified as an endangered species, as partially supported by the high use frequency and the quantity reported from household interviews as well as the actual quantities from harvesting permits. Also, *Colophospermum mopane* and *Terminalia sericea* are harvested for droppers (<10 cm diameter) to poles (up to 30 cm diameter). From the inventory conducted 2009 in the Zambezi region, it was estimated that *Colophospermum mopane* takes 88 years to reach a Dbh of 15 cm at a growth rate of 0.17cm/year while *Terminalia sericea* takes 24 years at a growth rate of 0.61 cm/year (Hackenberg, B. Personal Communication, 2009).

The findings of this study concur with the study by Ashley and LaFranchi (1997), cited by Kamwi *et al.* (2015); who reported that “rural communities in the Zambezi region use poles for household construction and firewood as the main source of energy on a daily basis.” Another study by Pokharel *et al.* (2015) also from Namibia supports the current

findings revealing that management of forests in Namibia experiences challenges in applying traditional centrally-controlled forest management approaches because local people rely heavily on forest resources for their livelihoods.

The results of the current study are also similar to the findings of other studies; including Awono and Levang (2018) in Cameroon, that revealed that community forests are exploited for various activities creating worries on sustainable management and that forests are exploited by outsiders or companies without considering local people's needs, hence degrading forest's natural potential. Likewise, Jannat *et al.* (2018) in Bangladesh revealed that forest dependency is considered problematic when the forest resources are used commercially.

Mohammed *et al.* (2010) also reported that the extent of forest resource utilization by communities can be identified through the different forest-based activities that are being carried out by the community members. Ahmad and Stacey (2016) also found that in rural households, firewood, medicine, building materials and wild fruits are common uses of forest resources. The findings on permit-issuing correspond with the findings by Vrabcová *et al.* (2019) in Namibia that illiteracy among the community forest management body is a major challenge in commercializing of forest resources.

4.4 People's Perception to Forest Dependence in Relation to the Sustainability of Forest Resources

4.4.1 People's perception on forest resources importance

During the face to face household interviews, the Likert type questions were used to assess the household forest importance and usefulness to their livelihoods. The results were subjected to the Pearson's chi-square test which showed that all these four-scaling differed

significantly ($p < 0.001$) across the six villages for household forest importance (Table 18) and helpfulness (Table 19).

The majority of the households interviewed perceive the forest as very highly important especially at Kapani; Sabelo and Kansoko villages ranking the forest importance as high (Table 18). On the other hand, two households in Taulo (1) and Sitanta (1) villages ranked forest to be of low importance and not helpful.

Table 18: People's perception on the importance of forest products

Village name	Importance of forest products to household			
	Very high	High	Medium	Low
Kapani (n = 24)	15	6	3	0
Kansoko (n = 34)	4	28	2	0
Sabelo (n = 36)	0	36	0	0
Masida (n = 17)	3	14	0	0
Taulo (n = 47)	3	37	6	1
Sitanta (n = 27)	3	17	6	1

Regarding the usefulness of the forest, most village households ranked the forest as highly useful except one household who found forest to be of no use in Taulo (Table 19).

Table 19: People's perception on helpfulness of forest products

Village name	Very helpful	Helpful	Not helpful
Kapani (n= 24)	15	9	0
Kansoko (n = 34)	4	30	0
Sabelo (n = 36)	0	36	0
Masida (n = 17)	2	15	0
Taulo (n = 47)	2	44	1
Sitanta (n = 27)	2	25	0

4.4.2 People's perception on the availability of forest resources

The study disclosed that the availability of forest resources varies. Majority (85%) of respondents reported that medicinal plants are currently the same as in earlier periods

(Table 20); thatch grasses are decreasing (74%), while firewood is slightly increasing (36%).

Table 20: Perceptions on forest resource availability in Masida CF

Name of resource	Increase (%)	Decrease (%)	Same as before (%)
Poles	35	36	19
Thatch grass	12	74	15
Fodder	32	42	32
Firewood	36	28	37
Medicinal plants	5	10	85
Wild fruits	26	32	40

This is in contrary to the study by Jannat *et al.* (2018) who reported that the all resources were decreasing due to dependency although small portions of fuel wood, poles and medicinal plants remained as before.

This result reflects the current situation of Masida CF that more people are building their roofs using thatched grass and frequent droughts make it hard for grass to reach harvestable size. Kamwi *et al.* (2015) working in the same region reported that drought spells are causing more tree species to dry out and turn into firewood thus firewood availability turns to increase. Similar findings were reported by Ahmad and Stacey (2016).

4.4.3 People's perception on forest resources collection

Respondents were asked to rate the collection of forest resources as to whether they have decreased, increased or remained the same as before. According to the respondents, forest resources collected by the communities in the area tend to vary per forest resources (Table 21). Collection of thatch grass was reported by 63% of the respondents as decreasing; in contrast, 55% of the respondents reported increasing pole harvesting; while 79% and 56% of the respondents respectively, reported collection of firewood and medicinal plants not to have changed.

Table 21: The peoples' perceptions on forest resource collection in Masida CF

Name of resource	Increase (%) (n = 185)	Decrease (%) (n = 185)	Same as before (%) (n = 185)
Poles	55	28	17
Thatch grass	26	63	11
Fodder	25	40	34
Firewood	16	5	79
Medicinal plants	4	40	56
Wild fruits	56	8	37

Above findings were supported by the Pearson chi-square test showing that collection of all five forest resources was significantly ($p < 0.001$) different across all villages; only fodder collection was insignificant. These results reveal that the collection of fodder by villagers who own cattle in the area has not changed. A similar finding was reported by Jain and Sajjad (2016) that families who own more cattle mostly depend on the forest for fodder, and further supported by Ofoegbu *et al.* (2017) that households that possess animals and have lived long in a community tend to depend more on the forest because it's relatively low cost in supporting their livelihood strategies.

4.4.4 Peoples' perceptions on the level of dependency to forest resources

The study revealed that all beneficiaries of Masida community forest tend to use forest resources for building materials such as thatch grass, poles, rafters, droppers for roofing and surrounding the courtyard (Table 22).

Table 22: People's perception on the level of forest dependence

Forest dependence	Low (%) (n = 185)	Medium (%) (n = 185)	High (%) (n = 185)	Very high (%) (n = 185)
Income	14.1	13.5	69.7	2.7
Food supply	10.8	46.5	42.7	0.0
medicinal plants	37.3	58.4	4.3	0.0
Fodder	36.2	12.4	43.8	7.6
Building materials	0.0	0.5	82.2	17.3

The Likert scale assessment on the level of dependence per benefit revealed that building materials, income and fodder benefits are scaled as high, the food supply and medicinal

plant scaled medium. The high income dependency perception on forest resources is caused by the single high income derived by beneficiaries of the community forest during a seasonal sale of *Harpagophytum procumbens* (devil's claw) facilitated by the community forest committee and is important to households who participate in harvesting and selling devil's claw. Building materials and fodder was scaled high since all of the household uses forest resources for building their dwellings whereas the high in fodder is brought by the availability of unused fodder due to limited number of livestock in the area that graze freely. However, the community forest is a source of medicine as people initially prepare different forest products concoctions as first aid before being taken to the nearby hospital that is 25 km away at Sibbinda. The Pearson chi-square test results showed that the relationship of the benefits among the villages was significantly ($p < 0.001$) different between villages in their level of dependence to forest resources.

The results of this study on people's perception shows an individual's evaluation of the changes in the stock of the resources referred to, as whether it was increasing, decreasing or the same as before. The results from the current study shows that people's perception are in agreement with the study by Chimello de Oliveira (2018) indicating that people's perceptions give a better reflection of the history of the environmental status rather than the ecological dimension of the changes. Moreover, results of this study are similar to Fernández-Llamazares *et al.* (2016) who reported that the local people's perception forms a basis for monitoring the changes in availability and utilization of common pool stock of natural resources.

4.4.5 Alternative interventions to support forest resource conservation

At the end of every interview, the respondents were asked to give their views on possible interventions that could reduce their dependence on the natural forest alone as a source of

livelihood supplier, hence promote natural resource conservation. The responses of respondents are shown in Table 23. About 56% of the respondents suggested adoption of Agroforestry followed by Brickmaking (20.4%) and micro projects (19.2%). This will enable people to use their own planted trees in household orchards as supplements of food and make bricks instead of cutting trees for building materials.

Table 23: Interventions suggested by households towards forest conservation

Appropriate interventions to conserve the forest			
Alternative measures	Code	Count	Percent of Responses (%)
Agro forestry	1	93	55.7
Brickmaking	2	34	20.4
Micro projects(Basketry, Poultry, Bakery)	3	32	19.2
Woodlot nursery	4	7	4.2
Beekeeping	5	1	0.6
Total responses		167	
Valid cases		185	

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study has shown that the household's forest dependency and forest income vary with households' characteristics and that households in the lower income category are highly forest-dependent than the high-income categories. The study has shown that forest resource collection, remittances, piecework, farming, social grants, and wages are the livelihood strategies and forest resources contribute 16% to the total annual household incomes in the study area. The study further reveals that the socio-economic factors such as age of respondents, education and hectares of land owned significantly ($p < 0.05$) influence forest dependency. Natural ablution facility, provision of free medicine, cheap acquisition of forest resources, easy accessibility to the forest, and unemployment were found to be significant factors influencing households' forest dependency in the study area.

The extraction of forest resources for both own consumption and for commercial purposes through permit system is not well documented, which may not give accurate figures on utilities of forest resources in the area. In addition, bookkeeping at the community forest office is not up to date, thus forest permission issued and quantity it contained could not be traced during the study period. Illiteracy among the community forest management body is one of the major challenges. However, certain species were highly targeted for multiple uses e.g. *Colophospermum mopane* and *Terminalia sericea*. Firewood is the most frequently collected resources and is used as a supplement in households that have access to electricity and gas, whereby it is used for heating or cooking. This study further reveals that local people's perception forms a basis of monitoring the sustainability of common

pool natural resource stock. Agroforestry, brickmaking and beekeeping are appropriate alternatives to embark upon instead of relying on forest resources alone.

5.2 Recommendations

The study has the following to recommend;

- (i) An in-depth study and forest resource inventory should be carried out to determine the intensity of resource consumption in the area.
- (ii) The in-service training in bookkeeping should be conducted to the management body of the community forest.
- (iii) Conduct awareness creation on lesser-known tree species to lessen the burden on the targeted species.
- (iv) The Community Forest management body to set up agroforestry trial orchards as an alternative to using the natural forest alone.
- (v) The development and promotion of fuel-efficient stoves to reduce the high consumption of firewood.
- (vi) Directorate of Forestry and stakeholders should provide seedlings of fast-growing species for planting in home gardens, fruit orchards or on common lands.
- (vii) Strengthen management body to reinforce the practice of early burning in the area.

REFERENCES

- Abdullah, A. N. M., Stacey, N., Garnett, S. T. and Myers, B. (2016). Economic dependence on mangrove forest resources for livelihoods in the Sundarbans, Bangladesh. *Forest Policy and Economics* 64: 15 – 24.
- Adam, Y. O. and EL Tayeb, M. A. (2014). Forest dependency and its effect on conservation in Sudan: a case of Sarf-Saaid Reserved Forest in Gadarif State. *Agriculture and Forestry* 60(3): 107–121.
- Adlina, A. H., Jawan, J. A., Sri Rahayu, I., Normala, O. and Mohd Hadzrul, M. (2013). Traditional knowledge and environmental conservation among indigenous people in Ranau, Sabah. *Global Journals Incorporated* 13(3): 4–12.
- Ahammad, R. and Stacey, N. (2016). *Forest and Agrarian Change in the Chittagong Hill Tracts Region of Bangladesh. Agrarian Change in Tropical Landscapes*. Center for International Forestry Research, Bogor, Indonesia. 233pp.
- Angelsen, A., Jagger, P., Babigumira, R., Belcher, B., Hogarth, N. J., Bauch, S. and Wunder, S. (2014). Environmental income and rural livelihoods: A global-comparative analysis. *World Development* 64: 12 – 28.
- Awono, A. and Levang, P. (2018). Contribution of environmental products to the household economy in cameroon: essential, complementary or trivial?, *Forest Research and Engineering: International Journal* 2(1): 1–14.
- Belcher, B., Achdiawan, R. and Dewi, S. (2015). Forest-based livelihoods strategies conditioned by market remoteness and forest proximity in Jharkhand, India. *World Development* 66: 269 – 279.

- Bhandari, D. and Jianhua, Z. (2017). household dependency on buffer zone community forest and its implication for management of Chitwan National Park, Nepal. *International Journal of Sciences* 3(3): 68 – 80.
- Bose, P., Arts, B. and van Dijk, H. (2012). ‘Forest governmentality’: A genealogy of subject-making of forest-dependent ‘scheduled tribes’ in India. *Land Use Policy* 29(3): 664 – 673.
- Brown, D. and Schreckenber, K. (2001). *Rural Development Forestry Network: Community Forestry Facing Up to the Challenge in Cameroon*. Overseas Development Institute, London. 14pp.
- Bwalya, S. M. (2013). Household dependence on forest income in rural Zambia. *Zambia Social Journal* 2(1): 67 – 86.
- Chimello de Oliveira, L. E. (2018). The perceptions of social-ecological changes in Tarituba, a coastal village in Southeastern Brazil. Thesis for Award of PhD Degree at University of Manitoba, Winnipeg, Brazil, 224pp.
- Dev, O. P., Yadav, N. P., Springate-Baginski, O. and Soussan, J. (2003). Impacts of community forestry on livelihoods in the middle hills of Nepal. *Journal of Forest and Livelihood* 3(1): 64 – 77.
- Endamana, D., Angu, K. A., Akwah, G. N., Shepherd, G. and Ntumwel, B. C. (2016). Contribution of non-timber forest products to cash and non-cash income of remote forest communities in Central Africa. *International Forestry Review* 18(3): 280 – 295.

- Fernández-Llamazares, Á., Díaz-Reviriego, I., Guèze, M., Cabeza, M., Pyhälä, A. and Reyes-García, V. (2016). Local perceptions as a guide for the sustainable management of natural resources: empirical evidence from a small-scale society in Bolivian Amazonia. *Ecology and Society* 21(1): 1 – 2.
- Fernández-Llamazares, Á., Méndez-López, M. E., Díaz-Reviriego, I., McBride, M. F., Pyhälä, A., Rosell-Melé, A. and Reyes-García, V. (2015). Links between media communication and local perceptions of climate change in an indigenous society. *Climatic Change* 131(2): 307 – 320.
- Field, A. (2014). *Discovering Statistics Using SPSS. and Sex and Drugs and Rock 'N' Roll*. (Third Edition), SAGE Publication Ltd., India. 857pp.
- Fikir, D., Tadesse, W. and Gure, A. (2016). Economic contribution to local livelihoods and households dependency on dry land forest products in Hammer District, Southeastern Ethiopia. *International Journal of Forestry Research* 2016(12): 1 – 11.
- Fonta, W. M. and Ayuk, E. T. (2013). Measuring the role of forest income in mitigating poverty and inequality: evidence from south-eastern Nigeria. *Forests, Trees and Livelihoods* 22(2): 86–105.
- Garekae, H., Thakadu, O. T. and Lepetu, J. (2017). Socio-economic factors influencing household forest dependency in Chobe enclave, Botswana. *Ecological Processes* 6(1): 1 – 10.
- Giess, W. (1998). A preliminary vegetation map of Namibia. *Dinteria* 4: 1–112.

Government Gazette of the Republic of Namibia (2001). Promulgation of Forest Act, 2001 (Act No. 12 of 2001). Windhoek, Namibia.

Government Gazette of the Republic of Namibia. (2005). Promulgation of Forest Act, 2005 (Act No. 13 of 2005). Windhoek, Namibia.

Hosmer, D., Lemeshow, S. and Sturdivant, R. (2013). *Applied Logistic Regression*. (3rd Ed). John Wiley and Sons, New York. 397pp.

ICF (2014). The UK's international Climate Fund. [<http://icai.independent.gov.uk/wp-content/uploads/2014/01/ICAI-Study-The-UK-International-Climate-Fund-ToRs.pdf>] site visited on 12/07/2019.

Jain, P. and Sajjad, H. (2016). Household dependency on forest resources in the Sariska Tiger Reserve (STR), India: Implications for management. *Journal of Sustainable Forestry* 35(1): 60 – 74.

Jannat, M., Hossain, M. K., Uddin, M. M., Hossain, M. A. and Kamruzzaman, M. (2018). People's dependency on forest resources and contributions of forests to the livelihoods: A case study in Chittagong Hill Tracts of Bangladesh. *International Journal of Sustainable Development and World Ecology* 25(6): 1–8.

Jones, T. B. (2015). *A Strategic Forestry Management Plan for the Mudumu Landscape. Zambezi Region*. Republic of Namibia, Namibia. 48pp.

Kajembe, G. C., Monela, G. C. and Mvena, Z. S. K. (2003). *Making Community Management Work: A Case Study of Duru-Haitemba Village Forest Reserve*,

Babati, Tanzania. Policies and Governance Structures in Woodlands of Southern Africa. Center for International Forestry Research, Bogor. 12pp.

Kamwi, J. M., Chirwa, P. W. C., Graz, F. P., Manda, S. O. M., Mosimane, A. W. and Kätsch, C. (2018). Livelihood activities and skills in rural areas of the Zambezi region, Namibia: Implications for policy and poverty reduction. *African Journal of Food, Agriculture, Nutrition and Development* 18(1): 13074 – 13094.

Kamwi, J. M., Chirwa, P. W., Manda, S. O., Graz, P. F. and Kätsch, C. (2015). Livelihoods, land use and land cover change in the Zambezi Region, Namibia. *Population and Environment* 37(2): 207 – 230.

Kothari, C. R. and Garg, G. (2014). *Research Methodology: Methods and Techniques.* New Age International (P) Limited, Publishers Nairobi. 418pp.

Krug, J. H. (2017). Adaptation of *Colophospermum mopane* to extra-seasonal drought conditions: site-vegetation relations in dry-deciduous forests of Zambezi region (Namibia). *Forest Ecosystems* 4(25): 1 – 10.

Langat, D. K., Maranga, E. K., Aboud, A. A. and Cheboiwo, J. K. (2016). Role of forest resources to local livelihoods: The Case of East Mau Forest Ecosystem, Kenya. *International Journal of Forestry Research* 11(12): 1 – 10.

Larson, A. M., Monterroso, I., Banjade, M. R. and Mwangi, E. (2017). Community rights to forests in the tropics. *Comparative Property Law: Global Perspectives* 9(12.6): 435 – 442.

- Leclerc, C., Mwongera, C. N., Camberlin, P. and Boyard-Micheau, J. (2013). Indigenous past climate knowledge as cultural built-in object and its accuracy. *Ecology and Society* 18(4).
- Lepetu, J., Alavalapati, J. and Nair, P. K. (2009). Forest dependency and its implication for protected areas management: A case study from Kasane forest reserve, Botswana. *International Journal of Environmental Research* 3(4): 525–536.
- Mahanty, S., Gronow, J., Nurse, M. and Malla, Y. (2006). Reducing poverty through community based forest management in Asia. *Journal of Forest and Livelihood* 5 (1): 78 – 89.
- Malleson, R., Asaha, S., Egot, M., Kshatriya, M., Marshall, E., Obeng-Okrah, K. and Sunderland, T. (2014). Non-timber forest products income from forest landscapes of Cameroon, Ghana and Nigeria—an incidental or integral contribution to sustaining rural livelihoods?. *International Forestry Review* 16(3): 261 – 277.
- Marshall, M. N. (1996). The key informant technique. *Family Practice* 13(1): 92 – 97.
- Mbongo, W., Benkenstein, A. and Hengari, S. (2014). *Community Forests in Namibia: Ensuring Sustainable Local-level Forest Management*. Policy Briefing No. 119. governance if African’s Resources Programme, Namibia. 4pp.
- Mccarthy, A., Hepburn, C., Scott, N., Schweikert, K., Turner, R. and Moller, H. (2014). Local people see and care most? Severe depletion of inshore fisheries and its consequences for Māori communities in New Zealand. *Aquatic Conservation: Marine and Freshwater Ecosystems* 24(3): 369 – 390.

- Mendelsohn, J., Jarvis, A., Roberts, C. and Robertson, T. (2002). Atlas of Namibia: A portrait of the land and its people. Cape Town, South Africa. [<https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-3113.2004.08001111>] site visited on 10/03/2019.
- Mendelsohn, M. and Roberts, C. (1997). *An Environmental Profile and Atlas of Caprivi*. Directorate of Environmental Affairs, Windhoek. 50pp.
- Miah, M. D. (2014). Trade-offs between Forest Conservation and Livelihoods of the forest-dependent people in the Chittagong Hill tracts: REDD+ Strategy Development in Bangladesh. The Rufford Small grants fountain, London. [[https://www.researchgate.net/.../Trade-offs-between-forest-conserv](https://www.researchgate.net/publication/260111111)] site visited on 12/04/2019.
- Misbahuzzaman, K. and Smith-Hall, C. (2015). Role of forest income in rural household livelihoods: the case of village common forest communities in the Chittagong Hill Tracts, Bangladesh. *Small-Scale Forest* 14(3): 315 – 330.
- Mogotsi, I., Lendelvo, S., Angula, M. and Nakanyala, J. (2016). Forest resource management and utilisation through a gendered lens in Namibia. *Environment and Natural Resources Research* 6(4): 79 – 90.
- Mohammed, Y. S., Bashir, N. and Mustafa, M. W. (2015). Overuse of wood-based bioenergy in selected sub-Saharan Africa countries: review of unconstructive challenges and suggestions. *Journal of Cleaner Production* 96: 501 – 519.
- Muhammed, N., Oesten, G., Von Detten, R., Masum, M. F. H. and Chakma, S. (2010). *Livelihood Pattern and Forest Dependence of the Major Tribes in Rangamati, Bangladesh*. Shinsu University International Symposium, Japan. 58pp.

- Mujawamariya, G. and Karimov, A. A. (2014). Importance of socioeconomic factors in the collection of NTFPs: The case of gum Arabic in Kenya. *Forest Policy Economics* 42: 24 – 29.
- Mukete, B., Yujun, S., Etongo, D. and Ndiaye Georges, N. (2018). Household characteristics and forest resources dependence in the Rumpi Hills of Cameroon. *Applied Ecology and Environmental Research* 16(3): 2755 – 2777.
- Munanura, I. E., Backman, K. F., Moore, D. D., Hallo, J. C. and Powell, R. B. (2014). Household poverty dimensions influencing forest dependence at Volcanoes National Park, Rwanda: An application of the sustainable livelihoods framework. *Natural Resources* 5: 1031 – 1047.
- Mwera, D. K., Nyangena, W. and Gathiaka, K. (2017). Contribution of forest resources to household income and level of dependence by different income groups. *American Journal of Economics* 1(1): 66 – 78.
- Nelson, J., Muhammed, N. and Rashid, R. A. (2015). Communities forest dependency and its effects towards the forest resources and wildlife abundances in Sarawak, Malaysia. *International Journal of Sustainable Development and World Ecology* 22(5): 401–412.
- Newton, P., Miller, D. C., Byenkya, M. A. A. and Agrawal, A. (2016). Who are forest-dependent people? A taxonomy to aid livelihood and land-use decision-making in forested regions. *Land Use Policy* 57: 388 – 395.
- NNRC (2002). Namibia's natural resource sector. A contribution to Vision 2030. National planning commission. Windhoek. [www.the-eis.com/.../Namibias%20natural

%20re source%20sector%] site visited on 08/04/2019.

NPC (2001). Second national development plan. National Planning Commission.

Windhoek. [https://www.npc.gov.na/?page_id=206] site visited on 12/04/2019.

NRC (2000). Agriculture and land resources. Directorate of environmental affairs,

Windhoek. [www.the-eis.com/.../Farming%20systems%20in%20Namibia%20P] site visited on 12/04/2019.

Nyumba, T. O., Wilson, K., Derrick, C. J. and Mukherjee, N. (2018). The use of focus group discussion methodology: Insights from two decades of application in conservation. *Methods in Ecology and Evolution* 9(1): 20 – 32.

Odera, J. (2004). Lessons learnt on community forest management in Africa. *A Report Prepared For The Project 'Lessons Learnt on Sustainable Forest Management in Africa': Royal Swedish Academy of Agriculture and Forestry, African Forest Research Network*. Food and Agriculture Organization of the United Nations, Rome, Italy. 74pp.

Odunwole, S., Ben, O. O., Oluwayomi, A. and Joseph, O. (2015). Implications of fuelwood demand on sustainable forest conservation of the Sub-Sahara Africa. *International Journal of Scientific and Technology Research* 4(8): 74 – 80.

Ofoegbu, C., Chirwa, P. W., Francis, J. and Babalola, F. D. (2017). Socio-economic factors influencing household dependence on forests and its implication for forest-based climate change interventions. *Southern Forests* 79(2): 109 –116.

Ojea E., Loureiro, M. L., Alló, M. and Barrio, M. (2016). Ecosystem services and REDD: estimating the benefits of non-carbon services in worldwide forests. *World Development* 78: 246 – 261.

- Oldekop, J. A., Bebbington, A. J., Truelove, N. K., Holmes, G., Villamarín, S. and Preziosi, R. F. (2012). Environmental impacts and scarcity perception influence local institutions in indigenous Amazonian Kichwa communities. *Human Ecology* 40(1): 101 – 115.
- Pandit, R. and Bevilacqua, E. (2011). Forest users and environmental impacts of community forestry in the hills of Nepal. *Forest Policy and Economics* 13(5): 345–352.
- Parviainen, T. (2012). *Role of Community Forestry in Rural Livelihood and Poverty Alleviation in Ohangwena and Caprivi Regions in Namibia*. University of Helsinki. 170pp.
- Pokharel, R. K., Neupane, P. R., Tiwari, K. R. and Köhl, M. (2015). Assessing the sustainability in community-based forestry: A case from Nepal. *Forest Policy and Economics* 58: 75 – 84.
- Rahman, M. M., Mahmud, M. A. A. and Shahidullah, M. (2017). Socioeconomics of biodiversity conservation in the protected areas: a case study in Bangladesh. *International Journal Sustainable Development and World Ecology* 24(1): 65 – 72.
- Rai, R. K., Neupane, P. and Dhakal, A. (2016). Is the contribution of community forest users financially efficient? A household level benefit-cost analysis of community forest management in Nepal. *International Journal of the Commons* 10(1): 142–157.
- Riehl, B., Zerriffi, H. and Naidoo, R. (2015). Effects of community-based natural resource management on household welfare in Namibia. *PLoS One* 10(5): 1 – 23.

- Riseth, J. Å., Tømmervik, H., Helander-Renvall, E., Labba, N., Johansson, C., Malnes, E. and Schanche, A. (2011). Sámi traditional ecological knowledge as a guide to science: snow, ice and reindeer pasture facing climate change. *Polar Record* 47(3): 202 – 217.
- Schaafsma, M., Morse-Jones, S., Posen, P., Swetnam, R. D., Balmford, A., Bateman, I. J. and Geoffrey, V. (2014). The importance of local forest benefits: economic valuation of non-timber forest products in the Eastern Arc Mountains in Tanzania. *Global Environmental Change* 24: 295 – 305.
- Schusser, C. (2013). Who determines biodiversity? An analysis of actors' power and interests in community forestry in Namibia. *Forest Policy and Economics* 36: 42 – 51.
- Shackleton, C. M., Shackleton, S. E., Buiten, E. and Bird, N. (2007). The importance of dry woodlands and forests in rural livelihoods and poverty alleviation in South Africa. *Forest Policy and Economics* 9(5): 558 – 577.
- Steele, M. Z., Shackleton, C. M., Shaanker, R. U., Ganeshiah, K. N. and Radloff, S. (2015). The influence of livelihood dependency, local ecological knowledge and market proximity on the ecological impacts of harvesting non-timber forest products. *Forest Policy and Economics* 50: 285 – 291.
- Suleiman, M. S., Wasonga, V. O., Mbau, J. S., Suleiman, A. and Elhadi, Y. A. (2017). Non-timber forest products and their contribution to households' income around Falgore Game Reserve in Kano, Nigeria. *Ecological Processes* 6(1): 1 – 14.

- Sunderland, T., Achdiawan, R., Angelsen, A., Babigumira, R., Ickowitz, A., Paumgarten, F., Shively, G. (2014). Challenging perceptions about men, women, and forest product use: a global comparative study. *World Development* 64: 56 – 66
- Teshome, B. Kassa, H., Mohammed, Z. and Padoch, C. (2015). Contribution of dry forest products to household income and determinants of forest income levels in the Northwestern and Southern Lowlands of Ethiopia. *Natural Resources* 6(5): 331–338.
- Thoms, C. A. (2008). Community control of resources and the challenge of improving local livelihoods: A critical examination of community forestry in Nepal. *Geoforum* 39(3): 1452 – 1465.
- Thondhlana, G. and Muchapondwa, E. (2014). Dependence on environmental resources and implications for household welfare: evidence from the Kalahari drylands, South Africa. *Journal of Ecological Economics* 108: 59 – 67.
- Tieguhong, J. C. and Nkamgnia, E. M. (2012). Household dependence on forests around lobeke National Park, Cameroon. *International Forestry Review* 14(2): 196 – 212.
- Timko, J. A. and Kozak, R. A. (2014). Using a gender perspective to explore forest dependence in rural HIV/AIDS-affected Malawian households. *Population and Environment* 35(4): 441 – 454.
- Timko, J. A., Waeber, P. O. and Kozak, R. A. (2010). The socio-economic contribution of non-timber forest products to rural livelihoods in Sub-Saharan Africa: Knowledge gaps and new directions. *International Forestry Review* 12(3): 284 – 29.

- UNECE (2014). We are all forest dependent people. United Nations Economic Commission for Europe [<http://www.unece.org/index.php?id=3564>] site visited on 20/06/2019.
- Van Laerhoven, F. (2010). Governing community forests and the challenge of solving two-level collective action dilemmas-A large-N perspective. *Global Environmental Change* 20(3): 539 – 546.
- Vedeld, P., Angelsen, A., Bojö, J., Sjaastad, E. and Berg, K. G. (2007). Forest environmental incomes and the rural poor. *Forest Policy Economics* 9(7): 869 – 879.
- Vigne, P. (2000). Forestry Sector Issues and Options Paper. *Natural Resources Cluster Workshop*, May 9, 2000 DEA/DANCED, Windhoek.
- Vrabcová, P., Nikodemus, A. and Hájek, M. (2019). Utilization of Forest Resources and Socio-Economic Development in Uukolonkadhi Community Forest of Namibia. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis* 67(1): 197 – 206.
- Wily, L. A. (2002). The political economy of community forestry in Africa – getting the power relations right. *Forests, Trees and People* 46: 4 – 12.
- Yeh, E. T. (2016). How can experience of local residents be “knowledge”? ‘Challenges in interdisciplinary climate change research. *Area* 48(1): 34 – 40.

APPENDICES

Appendix 1: Community forest benefit distribution plan

.....Community Forest Benefit Distribution Plan		
Benefit	Who benefits	Method/Rules
10% of surplus income	Traditional Authorities (TA)	In return the TA supports the aims and objectives of the Community Forest
Development Fund	All members	Community decides on what should be funded at the AGM. Proposals to be submitted to the management authority at least 1 month before the AGM.
25 % of Surplus income	FMC	The Management Authority to cater for running costs and Honorariums taken quarterly

Appendix 2: Household questionnaire

Questionnaire for Household survey (Semi - structured)

Questionnaire No:.....Interview date.....

Constituency Region.....

Enumerator's name

Name of village

Household coordinates: S.....E.....

Respondent: Head of household Representative

Name of Respondent.....Relation to Head.....

Section A: Household demographics

1. Gender of the Respondent

1. Male	2. Female
---------	-----------

2. Age of the Respondent (years)

1. 18 – 28 (2000 - 1990)	2. 29 – 39 (1989 -1979)	3. 40 – 50 (1978 – 1968)	4. 51 – 60 (1967 -1958)	5. 61+ Before 1957
-----------------------------	----------------------------	-----------------------------	----------------------------	-----------------------

3. Ethnicity:.....

4. Number of years being a resident of this village

1. 0 - 10 years (2008 -2018)	2. 10 – 20 years (1998 – 2008)	3. 20+ years (Before 1998)
---------------------------------	-----------------------------------	-------------------------------

5. Size of the Household (Number of people in the household)

Males	Females	Age	Occupation
		≥18	
		19 – 39	
		40 – 60	
		61+	

6. Level of Formal Education of Respondent

1.None	2. Primary	3. Secondary	4.Tertiary
--------	------------	--------------	------------

7. Occupation of the Respondent

1. Unemployed	2. Farmer	3. Pensioner	4. Civil servant	5. Private company	6. Business enterprises...
---------------	-----------	--------------	------------------	--------------------	----------------------------

Others (specify).....

8. Marital status of Respondent

1. Single	2. Married	3. Divorced	4. Separated	5. Widowed	6. Cohabitant
-----------	------------	-------------	--------------	------------	---------------

9. Sources of Household income

1. Salary	2. Livestock farming	3. Crop Farming	4. Old age grant	5. Forest products	6. Business
-----------	----------------------	-----------------	------------------	--------------------	-------------

Others (specify).....

10. Monthly Income level of household (N\$)

1. Below 1500	2. 1501 - 3000	3. 3001 - 5000	4. 5001 - 10000	5. Above 10000
---------------	----------------	----------------	-----------------	----------------

11. Household major source of income.....

12. Livestock size:

1. Cattle.....	2. Goats.....	3. Sheep.....	4. Others...
----------------	---------------	---------------	--------------

13. Agricultural land ownedhectares

14. Skills possess by household head that brings in income

.....

B. Household benefits from forest and dependence on forest

15. Do you use any of the forest resources to meet your household needs?

- (i) Yes
- (ii) No

16. What are the benefits that you obtain from the forest for your household needs?

- (a) Food

--
- (b) Medicinal purposes

--
- (c) Fodder/grazing for livestock

--
- (d) Source of income

--
- (e) Building materials

--

Others specify.....

17. Among those benefits in 16 above, what are the most important ones; rank by importance to your household?

Forest Benefit(s)	Ranking
Food	
Medicinal purpose	
Fodder	
Income to household	
Building materials	

Others

18. Who collects the forest resources from the forest in your household?

Gender of Collector	Product/Resource(s) Collected

19. Can you list the types of forest products you get from forest and their uses in your household?

Forest product (s)	Species (Local name)	Use	Frequency	Quantity
Poles				
Timber				
Wild Fruits				
Thatch grass				
Firewood				
Medicinal plants				
Others.....				

20. How far is the forest from where you collect the resources from the house?

- (i) 1 km
- (ii) 2 km
- (iii) 3 km

21. Which mode of transport do you use to transport your products from forest?

.....

22. Have you planted any trees in your farm?

- (i) Yes
- (ii) No

23 What are the reasons that make you choose to use forest resources in your household?

- (i) Forest is easily accessed
 - (ii) Forest product acquisition is cheaper, they regenerate naturally
 - (iii) Cannot afford to pay other alternatives e.g electricity and gas
 - (iv) Unemployed, no reliable source of income
 - (v) Supplements crop field during drought season poor harvest
- Others (Specify).....

C. Extent and consequences of forest dependence on forest resources

22. Which forest products are mostly used for your house hold requirements?

.....

.....

25 What do you use as energy for cooking?

- (a) Firewood
- (b) Gas
- (c) Electricity

26 Amongst the resources that you collect, state the purposes it is used in your household?

Collected resources	Household use	Sale	Both purposes
Poles			
Timber			
Wild Fruits			
Thatch grass			
Firewood			
Medicinal plants			

27 Have you observed any scarcity of forest products that you usually collect?

- (i) Yes
- (ii) No

28 If Yes, What do you think could be the cause of scarcity of these products?

.....

.....

29 If No sale go to question 34, if Sale continue with question 29. What do you look at when you set the price of the products?

.....

.....

Who are the customers and where do you sell the products?

.....

.....

30 When selling, which products is mostly sold or of high demand?

Forest product (s)	Ranking
Poles	
Timber	
Wild Fruits	
Thatch grass	
Firewood	
Medicinal plants	
Others.....	

31 Has the number of Customers changed over years?

- (i) Yes
- (ii) No

32 What problems do you experience in selling forest products?

.....

33 What role do you play in controlling and ensuring that the resources in the area are managed sustainably?

- (i) Tell others of the importance of forest
- (ii) Patrol and report any illegal harvesting
- (iii) Nothing

34 Are you aware of any existing customary/traditional control measure or any other measure regarding forest products and its management?

- (i) Yes
- (ii) No

D. Perceptions on dependency on resources in relation to sustainability

35 How do you rate the importance of forest products/services to your household subsistence needs?

- (i) Very high
- (ii) High
- (iii) Medium
- (iv) Low

36 For the time that you have been staying in this area how has the forest been of help to your household needs?

- (i) Very helpful
- (ii) Helpful
- (iii) Not helpful

37 If helpful, In which ways have the forest been so helpful to your household?

.....

38 What is the trend in the availability of forest resources in your area?

Name of resources	Increasing	Decreasing	Same as before
Poles			
Timber			
Thatch grass			
Fodder for livestock			

Firewood			
Medicinal plants			
Wild Fruits			
Others			

39 What is the trend in the collections of forest resources in your area?

Name of resources	Increasing	Decreasing	Same as before
Poles			
Timber			
Thatch grass			
Fodder for livestock			
Firewood			
Medicinal plants			
Fruits			
Others			

40 Perceptions on dependence on the forest

State the level of dependence on forest for	Very High	High	Medium	Low
Income				
Supply of Food				
Medicinal plants				
Fodder for my livestock				
Building material				

41 In your opinion, what role does the forest play in your household?

.....

42 In your opinion, what do you think should be done by community as an alternative(s) for them not to depend only in natural forest resources?

.....

Thank You for Your Time!

Appendix 3: Focus group discussion checklist

Focus Group Discussion Checklist

Date of the Meeting:.....

Place:.....

Number of Participants:.....

Village(s) represented:.....

1. How is the land zoned in your area (Agricultural, grazing, settlement and forested area)?
2. How frequent do you extend your crop fields (Years)?
3. What agricultural cropping system do you practice in your area?
4. What agricultural crops are mostly cultivated within your area?
5. Among the cultivated crops, which crop(s) are mostly sold for income?
6. What plant species are mostly planted in your homestead/courtyard or farm?
7. What are the existing customary/traditional control measures regarding forest products and its management?
8. Can you list the medicinal plant species available in your area and their specific uses?
9. Can you list the forest products species mostly used for household requirements?
10. What are the institutional structures/organizations that guide the people on the sustainable use of forest resources in your area?
11. What are the forest related projects/activities that can serve as an alternative to households' dependence on natural forest resource utilization?
12. Do you have any general comment on use of forest products as a mean of improving people's livelihoods?
13. Any other comments on sustainable utilization of forest resources in this area?

Thank You for Your Time!

Appendix 4: Checklist for key informant interviews (traditional leader)

Date of the interview:.....

Years being a resident in the area:.....**Sex**.....

Village of residence in the area:.....

Community Position/Committee representing:.....**Age**.....

1. What role do you play in the management of the Community Forest of Masida?
2. Are there any policies in the traditional authority act governing the use of forest resources in Community forest?
3. Is there any land use zones in your area with respects to Settlements, Agricultural fields and forest area?
4. Since establishment of a community forest, how have the forest resources contributed to changing people's livelihood?
5. What could be the factors that influence Households to depend on Forest in your area?
6. How did the dependency on forest impacted on the forest resources in your area?
7. Comparing to the time you settled here up to now and forecasting on the years to come, how do you see the resources availability in your area?
8. In your opinion, how is the contribution of forest comparing to other source of livelihoods of household like Agriculture?
9. Any general comment on the management of forest resources in your area?

Thank You Very Much for Your Cooperation!!!

Appendix 5: Checklist for key informant interviews (community forestry officer)

Date of the interview:.....

Years being a resident in the area:.....**Sex:**.....

Village of residence in the area:.....

Position in the Committee:.....**Age:**.....

1. What is the state of community people settlements in Masida Community Forest (CF)?
2. What is the overall contribution of forest resources in Masida CF?
3. Have there been any demands for extension of forest area boundaries?
4. How has the population change affected the availability and utilization of resources?
5. Which amongst the forest resources is in high demand by the community in the area and how is the availability of it?
6. Are the communities acquiring permission of forest resource only for own consumption or for commercial purposes as well?
7. How frequent do the communities from this area visit your office for forest resource use permission?
8. Who amongst the community are the ones regularly coming for forest resources use permission?
9. How is forest resource utilization regulated in relation to agricultural cultivation?
10. How is your permit system monitored? Who controls your books after you have issued permissions?
11. To which institutions/ organizations do you report about your activities at the office?
How frequent do you do this?
12. How is the general demand of forest resources and the annual allowable cut(supply)?
13. How frequent do you carry out forest inventory? Who facilitates this activities?
14. Do you receive or attend any in service training about the daily work you carry out at your office?

Thank You Very Much for Your Cooperation!!!

Appendix 6: Checklist for key informant interviews (conservancy officer)

Date of the interview:.....

Years being a resident in the area:.....**Sex**.....

Village of residence in the area:.....

Position in the Committee:.....**Age**.....

1. Is there any distinction between the boundary of Sobbe Conservancy and Masida Community Forest (CF)?
2. Is there any platform where the Conservancy committee and Community Forest committee comes together and plan for your daily activities?
3. Do you have any joint activities such as Patrols in the forest together with Community forest committee members?
4. To whom do you report your activities of the Conservancy such as your work plans, achievements, benefit sharing etc.?
5. What could you tell as reasons that keep households of Masida to depend on forest?
6. How would you rate the utilization of forest resources of the area is it sustainable or is being exploited?
7. Is there an integration of conservancy and community Forest in this area?
8. Any comment on the management of forest resources of Masida Community forest?

Thank You Very Much for Your Cooperation!!!

Appendix 7: Checklist for key informant interviews (constituency development committee)

Date of the interview:.....

Years being a resident in the area:.....**Sex:**.....

Village of residence in the area:.....

Position in the Committee:.....**Age:**.....

1. What developmental activities have taken place in Masida area over the past 5 years?
2. How did these developments influence the people's mindset on depending on forest resources for their daily activities?
3. When did the Child social grant came into effect in Masida area?
4. What other developmental activities/ infrastructure is earmarked for Masida villages in the near future?
5. What forest related project would you recommend that will act as an alternative to people not to use natural forest resources alone?
6. How would you rate the Contribution of Community forest initiatives to the conservation of resources in Masida area?
7. Any general comment on the utilization of forest resources by the people of Masida community forest?

Thank You Very Much for Your Time Aailed to this Interview!!!

Appendix 8: Checklist for key informant interviews (forestry government official)

Date of the interview:.....

Years being in the Service:.....**Sex**.....

Office location:.....

Position or Rank :.....**Age**.....

1. Can you give a brief overview of community forest status in the region?
2. How are the resources in the declared community forest area regulated, in terms of policies?
3. What role does the Directorate of forestry play in a Community forest after the declaration of the area?
4. How is the utilization of forest resources in the community forest monitored? To ensure the sustainability of resources?
5. How does the permit system in the declared community forest differ from the permit system in a general forest in a communal land?
6. How often do the Forest management body reports to the Directorate of forestry and Is there any standard reporting format provided to them?
7. How is the benefit derived from the community forest shared?
8. Is there any training offered to the Management Body of the Community forest? In terms of Bookkeeping, Customer service etc? If any, how often is this conducted and by who?
9. What is the Directorate of Forestry's plan of actions in the area for the development of the community forest in general and to beneficiaries specifically?
10. Any comment on the status of resource utilization in Masida Community forest since its declaration and the capability of the Forest Management Committee?

Thank You Very Much for Your Cooperation and Time Availed to this Interview!

Appendix 9: Checklist for key informant interviews (Linyanti constituency office)

Date of the interview:.....

Years being in the Service:.....**Sex**.....

Office location:.....

Position or Rank :.....**Age**.....

1. Do you have any major developmental activities planned in the area of Masida? Infrastructures such as roads, buildings (Clinics and Schools).
2. From the time of the establishment of community forest e.g Masida CF have you observed any impact it has brought in terms of improving the standard of living of its residents?
3. How do you see the utilization of forest resources in the areas declared as Community forest and areas in general forest of the communal land?
4. Which forest related projects would you recommend to be carried out in Masida community forest given that the water tanks has been installed in every village?
5. Is the any platform in place where your office meets with the management body of the community forest to deliberate on the planning of developmental activities?
6. Any comment on the management of forest resources and the distribution of the benefit sharing by Forest Management Committee?
7. Can you give a general overview of the activities at your respective office earmarked for Community Forests in general in your Constituency?

Thank You Very Much for Your Cooperation and Time Availed to this Interview!

Appendix 10: Checklist for key informant interviews (DAPEES government official)

Date of the interview:.....

Years being in the Service:.....**Sex:**.....

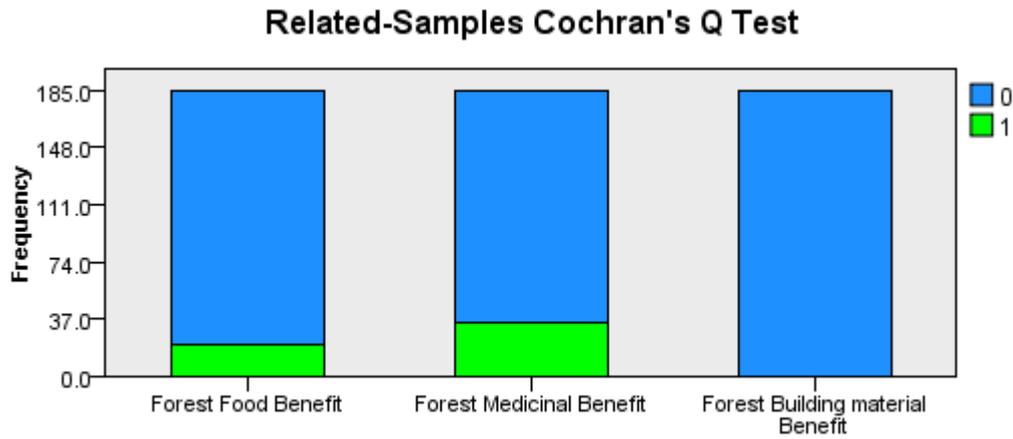
Office location:.....

Position or Rank :.....**Age:**.....

1. Can you give a brief overview of the activities of Directorate of Agricultural Production Extensions and Engineering Services in Masida Community forest/ area?
2. Where do the farmers of Masida mostly depend for their Household subsistence requirements? What could be the reason for this?
3. How would you classify farmers of Masida area, are they Commercial crop farming or subsistence crop farming and only sell the surplus? What is the average price per kilogram of crops they sell?
4. How are the farmer's fields in Masida? Are they extending their fields every year or after some years?
5. How would you rate the dependence of farmers, Do they use much of their land for agriculture or they reserve it for Forest conservation?
6. How is the interaction between farmers clearing for Agricultural field clearing and forest conservation over the past years, which one has increased?
7. What are the requirements for a farmer's field before your office assist him or her with tractor ploughing? Can a tractor plough where farmers have cultivated crops in between trees or he/she has to clear out all the trees in the crop fields?
8. In your views and what you have observed, how is the utilization of forest resources in Masida areas in relation to sustainability of forests resources?

Thank You Very Much for Your Cooperation and Time Availed to this Interview!

Appendix 12: Cochran's Q test statistics of mean ranks



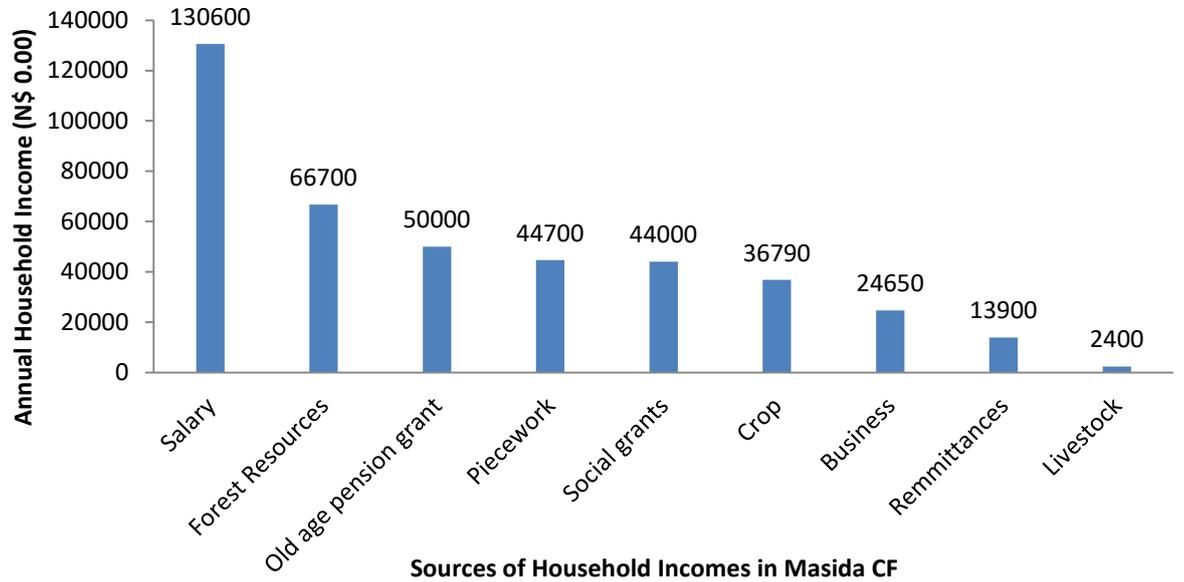
Total N	185
Test Statistic	38.542
Degrees of Freedom	2
Asymptotic Sig. (2-sided test)	.000

Appendix 13: The description of pairwise comparisons of benefits in Masida CF

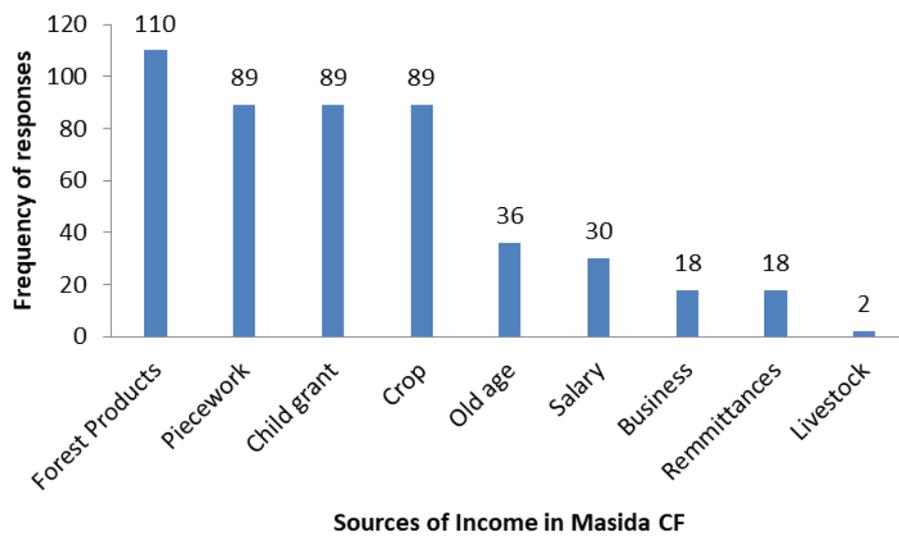
Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
Forest Medicinal Benefit-Forest Food Benefit	.081	.031	2.652	.008	.024
Forest Medicinal Benefit-Forest Building material Benefit	-.189	.031	-6.187	.000	.000
Forest Food Benefit-Forest Building material Benefit	-.108	.031	-3.536	.000	.001

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is .05.

Appendix 14: Sources of income in monetary term in Masida CF



Appendix 15: Sources of income by response in Masida CF communities



Appendix 16: ANOVA of the various income sources in Masida CF

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	143 203 0477.838	2	716 015 238.919	366.898	.000
Within Groups	6 492 774 012.973	3 327	1 951 540.130		
Total	7 924 804 490.811	3 329			

Appendix 17: Household income categories of Masida CF communities

Name of Villages	Level of household Income categories			Total
	1-1500 (Poor)	1501-3000 (Moderate)	>3000 (Rich)	
Kapani	15	5	4	24
Kansoko	26	4	4	34
Sabelo	30	4	2	36
Masida	13	4	0	17
Taulo	36	7	4	47
Sitanta	10	13	4	27
Total	130	37	18	185

X² value of 24.3 p value of 0.007

Likelihood ratio test: 24.1

Appendix 18: Model coefficient, Summary and Hosmer & Lemeshow test

Omnibus test of model coefficient			
	Chi-square	df	Sig.
	48.132	26	0.005
Block	48.132	26	0.005
Model	48.132	26	0.005

Model summary		
-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
206.768 ^a	0.229	0.306

Hosmer and Lemeshow Test

Chi-square	df	Sig.
8.387	8	0.397

Appendix 19: Percentage of accurate classifications

Percentage of Accurate Classification Without Variables

Observed		Predicted		Percentage Correct
		Household dependency status		
		low dependency	high dependency	
Household dependency status	low dependency	101	0	100.0
	high dependency	84	0	0.0
Overall Percentage				54.6

Percentage of Accurate Classification With Variables

Observed		Predicted		Percentage Correct
		Household dependency status		
		low dependency	high dependency	
Household dependency status	low dependency	78	23	77.2
	high dependency	32	52	61.9
Overall Percentage				70.3

Appendix 20: Factors influencing household dependence on Forest

Socioeconomic factor	Response	Proportion of respondents in the Villages (%)					
		Kapani n = 24	Kansoko n = 34	Sabelo n = 36	Masida n = 17	Taulo n= 47	Sitanta n= 27
Forest easily accessed (3)	No	20.8	44.1	27.8	29.4	12.8	0.0
	Yes	79.2	55.9	72.2	70.6	87.2	100.0
Forest resources cheap to acquire (4)	No	29.2	35.3	33.3	11.8	19.1	11.1
	Yes	70.8	64.7	66.7	88.2	80.6	88.9
Cannot afford to pay alternatives (e.g. electricity, gas) (6)	No	70.8	88.2	83.3	100.0	31.9	29.6
	Yes	29.2	11.8	16.7	0.0	68.1	70.4
Unemployment (5)	No	29,2	17.6	16.7	17.6	38.3	59.3
	Yes	70,8	82.4	83.3	82.4	61.2	40.7
Forest resource provide free medicine (2)	No	37.5	2.9	22.2	11.8	19.1	22.2
	Yes	62.5	97.1	77.8	88.2	80.9	77.8
Natural Ablution facility (1)	No	25.0	14.7	16.7	17.6	17.0	37.0
	Yes	75.0	85.3	83.3	82.4	83.0	63.0