FACTORS AFFECTING HOUSEHOLD PARTICIPATION IN NON-TIMBER FOREST PRODUCTS MARKET IN EASTERN UGANDA

BY

MOUBARAKATOU TASSOU

A thesis submitted to the Department of Agricultural Economics in Partial Fulfilment of the requirements for the award of a Master of Science Degree in Agricultural and Applied Economics, University of Nairobi

July 2017

DECLARATION

I declare that this thesis is my original work and has not been submitted for the award of a degree in any other university.

Signature: ……. Date: ……..
Moubarakatou Tassou
Reg: A56/75579/2014

This thesis has been submitted for examination with our approval as supervisors:

Signature: ……. Date: ……
Dr. Cecilia Ritho
Department of Agricultural Economics, University of Nairobi

Signature: …… Date: …….
Dr. Amos Gyau
World Agroforestry Centre

DEDICATION

This thesis is dedicated to my family whose love and support has continually inspired my academic life.

ACKNOWLEDGEMENTS

I am grateful to World Agroforestry Center (ICRAF) for funding this research under the project "Value chain innovation platforms for food security". I am highly indebted to my supervisors Dr. Cecilia Ritho and Dr. Amos Gyau for their invaluable guidance, advice, constructive criticism and encouragement. My special gratitude goes to Dr. Judith Oduol and Dr Patrick Irungu for their guidance.

My exceptional appreciation goes to the African Economic Research Consortium (AERC) for facilitating my third semester studies at the University of Pretoria. I also thank the Intra ACP-UE Arise program for sponsoring my master studies at the University of Nairobi. I am grateful to the CMAAE program and lecturers who equipped me with important skills that contributed immensely to the success of this research. I appreciate households in Kapchorwa and Manafwa districts who took part in the survey for their time and patience. I also thank the enumerators involved in data collection for their committed effort to collect reliable data during fieldwork. Lastly I thank my colleagues whose moral and material support during course work was timely. All these efforts bore fruit through God's abundant love, grace and mercy.

ABSTRACT

It is recognized that non-timber forest products can contribute to poverty alleviation in areas with high poverty rate like Eastern Uganda. These products are particularly vital for the rural poor who collect them for diverse needs and functions. Therefore the Ugandan Government has recently focused on developing markets for non-timber forest products (NTFPs). This is also due to the surging demand for NTFPs, driven by increased consumer's awareness of their medicinal, nutritional and economic value. In Uganda the markets of NTFPs are not yet as developed as that of staple food. Furthermore, there is little information about factors that influence household decision to collect or produce NTFPs as well as their decision to sell them in Uganda. The identification of these factors will help the Uganda Government in designing effective programs to boost households' income in the short term and enable the sustainable use of forest resources in a way that they will be available for use by the future generation. Using data from a sample of 633 households selected through multistage sampling procedure, this study assesses factors affecting households' decision to collect or produce NTFPs using a Probit model and identifies factors affecting households' choice of a source of NTFPs using a Probit model. The study also analyses the determinants of households' decision to sell NTFPs by use of a Probit model. The study found that the household characteristics (age, household size and wealth status) and other characteristics (agro-ecological zones and access to agricultural and market information) significantly affect household decision to participate in NTFPs or not as collector or producer. Household and farm characteristics (farm size, age, presence of trees on farm and occupation of the head of household) and other characteristics (agro-ecological zones and access to agricultural and market information) had a significant effect on household decision to collect NTFPs from the forest instead of producing them on farm. In addition, household and farm characteristics (education of the head of household, gender, presence of trees on farm and wealth status) and agro-ecological zones significantly affect household decision to sell NTFPs. Therefore the study recommends as follows: stakeholders should promote sound extension services on appropriate

agroforestry practices in the lowland communities. This is considering the land poor households who rarely plant trees on their farm. Poor households should be encouraged to invest more in NTFPs extraction and selling in order to take advantage of the growing market for products with high premium price. There is also a need for concerted effort among policy makers, non-governmental organizations and other stakeholders towards improving women participation in harvesting and marketing of NTFPs in the study area.

TABLE OF CONTENTS

DECLARATION i

DEDICATION ii

ACKNOWLEDGEMENTS iii

ABSTRACT iv

TABLE OF CONTENTS vi

LIST OF TABLES ix

LIST OF FIGURES x

ACRONYMS AND ABBREVIATIONS xi

CHAPTER 1: INTRODUCTION 1

1.1 Background 1

1.2 Statement of the research problem 4

1.3 Objectives and hypotheses 6

1.4 Justification 7

1.5 Organisation of the Study 8

CHAPTER 2: LITERATURE REVIEW 9

2.1 Definition and classification of non-timber forest products 9

2.2 Contribution of Forest to Household Livelihoods 9

2.2.1 Contribution of Forest to Livelihood Assets 10

2.2.2 Contribution of Forest to Livelihood Capabilities 11

2.2.3 Contribution of Forest to Livelihood Activities 11

2.3 Adoption of agroforestry practices by households in Sub-Sahara Africa 14

2.4 Harvesting technologies for non-timber forest products 16

2.5 Factors affecting households decision to participate or not in non-timber forest products as producer or collector 17

2.6 Market for Non-Timber Forest Products 22

2.7 Factors Affecting Households Participation in Non-timber forest products Markets as seller 23
CHAPTER 3: METHODOLOGY 30
3.1 Conceptual Framework 30
3.2 Theoretical Framework 31
3.3 Empirical Methods used in the Three Hurdle Decision Making Process 34
3.4 Empirical studies that used Probit model 35
3.5 Estimating Equations 36
3.6 Variables hypothesized to influence households in the three decision making process 38
3.7 Study Areas 40
3.8 Sampling Design and Data Collection 43
3.8.1 Sampling Design 43
3.8.2 Data collection procedure 45
3.8.3 Data analysis 45
CHAPTER 4: RESULTS AND DISCUSSION 48
4.1 Socio-Economic Characteristics that affect Collection or Production of NTFPs by Households 48
4.1.1 Household and Farm Characteristics 48
4.1.2 Main occupation of the respondents 50
4.1.3 Sources of non-timber forest products 50
4.1.4 Non-timber forest products collected from the forest or produced on farm 51
4.2 Household Socioeconomic Characteristics that affect market participation 52
4.2.1 Households Characteristics 52
4.2.2 Other Characteristics 53
4.2.3 Distribution of non-timber forest products sold by households 57
4.3 Factors affecting households' decision to participate in NTFPs or not as collector or producer 58
4.4 Factors affecting households decision to produce NTFPs on farm or to collect them form the forest 60

4.5 Factors affecting households decision to participate in non-timber forest products market 64
CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS 67
5.1 Summary 67
5.2 Conclusion 68
5.3 Recommendations 72
6.0: REFERENCES 74
7.0: APPENDICES 91
Appendix 1: Results of the multicollinearity tests 91
Appendix 2: Survey questionnaire 1

LIST OF TABLES

Table 3.1: Variables hypothesized to influence households' decision to participate in NTFPs or not as collector or producer 38

Table 3.2: Variables hypothesized to influence households' decision to grow NTFPs on farm or to collect NTFPs from the forest 39

Table 3.3: Variables hypothesized to influence households' decision to sell NTFPs 40

Table 4.1 Socioeconomics characteristics of respondents 49

Table 4.2: Sources of non-timber forest products 51

Table 4.3: Non-timber forest products collected grouped by site of collection 52

Table 4.4: Household characteristics 53

Table 4.5: Comparing group membership, wealth status, infrastructure, access to information and credit among households 56

Table 4.6: Non-timber forest products sold by source of collection 58

Table 4.7: Result of the Probit model for the determinants of households decision to collect or produce non-timber forest products 59

Table 4.8: Result of the Probit model for the determinants of households decision to produce NTFPs on farm or to collect from the forest 61

Table 4.9: Results of the Probit model for the factors affecting households' decision to participate in non-timber forest products market 65

LIST OF FIGURES

Figure 3. 1: Conceptual framework for the linkage between socioeconomics characteristics of households and their decisions in the three hurdles 32

Figure 3. 2: Map of the study area 42

ACRONYMS AND ABBREVIATIONS

CARPE: Central African Regional Program for the Environment

FAO: Food and Agriculture Organization

FOSA: Forestry Outlook Studies in Africa

IFAD: International Fund for Agricultural Development

IFPRI: International Food Policy Research Institute

IUCN: International Union for Conservation of Nature

MEAAI: Ministry of Economic Affairs, Agriculture and Innovation

MoFPED: Ministry of Finance, Planning and Economic Development

NAAD: National Agricultural Advisory Services

NaFORRI: National Forestry Resources Research Institute

NDPII: Second National Development Plan

NEMA: National Environment Management Authority

NTFPs: Non-Timber Forest Products

UBOS: Uganda Bureau of Statistics

UMCA: University of Missouri Center for Agroforestry

UNEP: United Nations Environment Program

US$: United States of America Dollars

CHAPTER 1: INTRODUCTION

1.1 Background

Sustaining forests is important to food security of the poor because they rely on its products (Pimentel *et al.,* 1997). In developing countries about 220 million people are food insecure (IFAD, 2015). In Uganda about 9 million people suffer from food insecurity and even those who have food, don't eat in a balanced manner (FAO, 2015). These people tend to rely on a range of strategies to cope with periods of food insecurity (Shumsky *et al.,* 2014). The strategies include measures such as reducing food intake or selling livestock for income. Non-timber forest products (NTFPs) are defined as any forest-derived tradable products apart from timber and have been identified as an important way for households in developing countries to adapt to food insecurity situations (Neumann and Hirsch, 2000).

Non-timber forest products include products such as bark, roots, tubers, leaves, fruits, flowers, seeds, resins, honey, mushrooms, and fuelwood (Sunderland *et al.,* 2003). It is estimated that about 60 percent of the population in Sub-Sahara Africa live and work near forested land (Mulenga *et al.,* 2011). They rely on NTFPs in order to satisfy their basic needs such as income, food, medicine, wood, fodder for animals, shade and soil fertilization (Belem *et al.,* 2007). For example fuelwood is collected for subsistence and income generation while wild fruits and leaves are also collected because they are the major source of micronutrients for rural households (Sunderland *et al.,* 2013). Hence NTFPs is important to rural households in developing countries

because they contribute to their nutrition and provides income which may be used to buy food for the family (Shackleton and Shackleton, 2004).

Population growth has increased the demand for forest products leading to severe pressure on forest products by people living around forested areas (Rademaekers *et al.,* 2010). For example in Sub-Sahara Africa, fuelwood and charcoal remain the main source of fuel for populations in rural and urban areas (MEAAI, 2010). In developing countries about 15 million people earn their income from forest-related activities such as fuelwood and charcoal sales, commercial hunting, and handicraft production (Kaimowitz, 2003).

Agroforestry is a practice that combines trees or shrubs with crops or livestock, it has been encouraged to curb deforestation (UMCA, 2015). It has the advantages to increase social, economic and environmental benefits for smallholder farmers (Lenkey, 1996). Agroforestry produces non-timber forest products for commercial purposes. For example, Jamnadass *et al.*, (2011) reported that in Kenya and Malawi, respectively 90 percent and 50 percent of households practicing agroforestry grew fruit trees such as Avocado (*Persea americana*), Mango (*Mangifera indica*), Papaya (*Carica papaya*) and Orange (*Citrus sinensis*). In Nigeria NTFPs such as nuts, mushrooms, wild fruit, herbs, spices, honey and bamboo are part of the diet of many rural dwellers especially during the period of food scarcity (Jimoh, 2006). According to Fentanun and Hager (2009) NTFPs are consumed by many households as food supplements in Ethiopia.

Non-timber forest products enable the sustainable use of forest resources; using resources in a way that they will be available for use by the future generation. Unlike timber, NTFPs are by products that depend on availability of forests and hence its conservation by users. NTFPs are collected by rural households for diverse products and functions, they are particularly vital for the rural poor, who are mainly women and youth (Kamara, 1986). Furthermore, Shackleton *et al.,* (2011) concluded that women are most of the time responsible for non-timber forests products (NTFPs)

related activities; for income, fuel and craft materials (Neumann and Hirsch, 2000). Therefore, promotion of NTFPs is an avenue for women empowerment and poverty reduction at large (Shillington, 2002).

Uganda's population is estimated at 30.7 million and 50 percent of these are women (UBOS, 2009). Like most developing countries, agriculture is the backbone of Uganda's economy. It is practiced on 40 percent of her land (Okorio, 2006), sustaining 3 million smallholder farmers and it contributes to 22 percent of the country's Gross Domestic Product (GDP) in 2014 (FAO, 2003; UBOS, 2014). The main food crops are bananas, cereals and root crops whereas the major cash crops for the economy are: coffee, cotton, tea, tobacco, sugar cane and cocoa. Food crops production and forestry contribute respectively to 12 percent and 4 percent of total GDP in 2014 (UBOS, 2014).

In Uganda, forests are made up of tropical high forests and woodlands and they cover about 2.6 million hectares (UBOS, 2014). About nine percent of the total land area is established as a permanent forest estate which is aimed at protecting the environment and providing forests products and services to the society. It consists of central forest reserves, local forest reserves and forested areas in national parks. Increased population pressure has led to depletion of forest resources. Therefore, people are encouraged by forest conservation agencies like CIFOR and ICRAF to collect non-timber forest products as compared to timber products. Agroforestry practices are also promoted in Uganda according to the National Forestry Policy in 2001 (Kaggwa *et al.,* 2009). According to a baseline survey conducted in Uganda by the Farm Income Enhancement and Forest Conservation project in 2007, about 76 percent of the households in the

rural areas practiced agroforestry. Uganda has pursued policies aimed at promoting market liberalization since 1990. Commercialization of NTFPs also generates about US$ 33 million per year (IFPRI, 2002). However, the country is disadvantaged as far as international trade of NTFPs is concerned. For example, the bulk of non-timber forest products are exported in semi-processed forms reducing opportunity for job creation and value addition (Kanabahita, 2001).

In Uganda, natural resources are a source of livelihood to rural smallholder farmers (NEMA, 2001). The country is endowed with a variety of NTFPs that can be commercialized to improve livelihoods through poverty reduction. The market for NTFPs in Uganda is growing with the surging population and better awareness of their nutritional and economic values (Kaboggoza, 2011). By taking advantages of this opportunity rural populations are likely to diversify their source of income through sale of NTFPs. Furthermore, marketing of NTFPs has been recognized in Uganda's national strategic and operational framework for poverty eradication as a way of reducing poverty through increased household incomes (MoFPED, 2014). Such interventions are best suited for areas with the highest rate of poverty like Kapchorwa and Manafwa districts (UNEP, 2008). This justify why the government is interested in promoting the sale of NTFPs. The term "non-timber forest products" in this study is taken in a broad sense and entails products derived from trees which may be found in the forest or farm.

1.2 Statement of the research problem

In Uganda, rural households depend on non-timber forest products collected from the forest or produced on farm for their nutritional needs (Agea *et al.*, 2011). Their diets are mainly made up of staple grains and the main source of vitamins are NTFPs. Trees provide products such as oil seeds, edible leaves, and fruits rich in important vitamins (Hoskins 1990; Ogden 1990). Non-timber forest

products do not only contribute directly to nutrition and health; they also contribute to increase household purchasing power. For instance, sale of non-timber forest products contributes to 27 percent of household cash incomes in rural areas in Uganda (Bush and Nampindo, 2004).

In the 1990s, about 56 percent of the population in Uganda were living below the poverty line (MoFPED, 2014). In 2014, Uganda achieved the first target of the Millennium Development Goals (MDG) by reducing the proportion of people living in extreme poverty by a substantial margin. While Uganda national poverty level has declined, there are some disparities across regions. The eastern region where Kapchorwa and Manafwa districts are located continues to lag behind with poverty levels higher than the national average (MoFPED, 2014).

The Eastern part of Uganda is classified by IFPRI in 2002 to be part of the region within which sale of NTFPs can contribute to poverty reduction. Therefore, the Ugandan Government is committed to promote NTFPs value chains, in line with the Sustainable Development Goals (SDGs) aim of ending poverty. Several interventions have been planned such as development of markets for forest products and services, promotion of forestry in urban development planning and scaling up of agroforestry-based alternative livelihood system (NDPII, 2015). In order to achieve these objectives, there is need to ensure that households have access to tradable quantity of NTFPs through appropriate sources. However, there are limited studies on factors that determine household decision to collect or produce NTFPs.

The Eastern part of Uganda is adjacent to Mount Elgon National park from where households can collect non-timber forest products. Households have also witnessed the implementation of projects that promote agroforestry practices in the area. For example, the project entitled ‘trees for food

security' aimed to promote tree planting in Kapchorwa and Manafwa districts was implemented by Uganda National Forestry Resources Research Institute (NaFORRI) and World Agroforestry Centre (ICRAF). As a result, households could also produce NTFPs on farm. However, the NTFPs market is not as organized as that of staple foods and very few members of the community are engaged in the selling of NTFPs (Wilson, 2015). According to Sebatta *et al.,* (2014) research done on farmer market participation in Uganda have mainly covered the staples commodities particularly maize even though NTFPs can contribute to household income generation in the study area (IUCN, 2008). Therefore, there is need to study households' socioeconomic factors that affect their participation in non-timber forest products market given that this gap in knowledge prevented the Government from considering NTFPs as an avenue for poverty alleviation.

1.3 Objectives and hypotheses

Household's decision to sell non-timber forest products is contingent on their decision to collect them; therefore the overall objective of this study is to assess the factors that affect household decision to participate in non-timber forest products market as sellers by collecting them from the forest or producing them on farms in Eastern Uganda.

Specific objectives were to:

1. To identify the factors that affects households decision to participate or not in NTFPs as collector or producer
2. To determine the factors that influence households decision to produce NTFPs on farm or to collect them from the forest
3. To examine the key factors that influence decision of the households to participate or not in non-timber forest products market as a seller.

This study hypothesizes that:

1. Socioeconomic and physical factors (gender, age, agro-ecological zones, wealth status and land size) do not significantly affect household's decision to participate or not to participate in the collection or production of non-timber forest products.
2. Socioeconomic factors (age of the household head, farm size, presence of trees on farm and access to agricultural and market information) do not significantly influence household's decision to choose forest as a source of non-timber forest products over farm.
3. Socioeconomic factors (gender of the household head, access to agricultural and market information, distance to market, sources of NTFPs) have no influence on household decision to participate in non-timber forest products market as seller.

1.4 Justification

This study provides information about the socioeconomic factors that contribute to literature on households' decisions to collect NTFPs from the forest or to produce them on farm. This study is a baseline study that will give useful information to international organizations aimed to promote long term conservation of the Mont Elgon National park. The identification of the significant factors that affect households' decision to sell non-timber forest products will help the Uganda Government in designing effective programs to boost households' income in the short term and the country's economy in the long term through collection and sale of NTFPs. Moreover, smallholders and development organizations alike can clearly understand the important factors for farmers' decision to participate in non-timber forest products market.

1.5 Organisation of the Study

The rest of the thesis is organized as follows: Chapter 2 reviews past studies and discusses the literature on agroforestry practices' adoption by rural households and determinants of their market participation. Chapter 3 presents the methodology which includes the conceptual framework, empirical methods, the study area, data collection procedure and research design. Chapter 4 presents the results and discussion while chapter 5 presents the summary, conclusion and recommendations of the study.

CHAPTER 2: LITERATURE REVIEW

Introduction

This chapter provides a discussion based on the available literature on NTFPs and their contribution to household livelihood. The review emphasizes those studies carried on household adoption of agroforestry practices as well as factors influencing household decisions to collect and sell agricultural products. The existing gap in knowledge concerning determinants of household decision to sell NTFPs is also highlighted.

2.1 Definition and classification of non-timber forest products

According to FAO (2006), deforestation is the deliberate removal of forest cover for agriculture or urban development. The pressure on forest has increased during the last decade due the growing population in Sub-Sahara Africa hence inducing climate change, soil resource losses and decrease of biodiversity (Chakravarty *et al.*, 2012). Therefore there is a need to come up with a strategy that will allow forest dependent people to continue collecting products and at the same time help in reducing the pressure on the forest. The term "non-timber forest products" came up because forest conservation agencies are shifting the attention of population near forest areas from timber towards more environment friendly uses of forest. According to FAO (1992) non-timber forest products are very diverse and can be classified into different categories such as extractive, edible, pharmaceutical plant, bee products as well as handicrafts and biofuels.

2.2 Contribution of Forest to Household Livelihoods

Livelihood has been defined by the British Department for International Development (DFID) as the set of the capabilities, assets, and activities that are needed to make a living (Krantz, 2001).

Forest contributes to a household livelihood through its different components that are capabilities, assets and activities. These components are made up of capital such as natural, social, economic and human capital. The contribution of forest to these components of livelihood is made through sustainable use of forest resources which will take place if the communities living in forested areas are given the right to manage the forest (Dev *et al.*, 2003) as explained in the subsections below.

2.2.1 Contribution of Forest to Livelihood Assets

Livelihood assets include natural, social and economic capital. Natural capital incorporates land, water, common-property resources, flora or fauna from which households derive resources and services (Krantz, 2001). Forest is a natural capital that provides resources such as NTFPs and timber. Community management of forest will improve the condition and sustainable use of the forest resources, hence improving its natural capital. This is possible through diligent protection of forests from forest fire, illegal tree felling and unregulated extraction of forest products.

Social capital are networks, social relations, affiliations and associations upon which households rely for collective action (FAO, 2000). Community management of forest can contribute to creation of forest user groups, networks and institutions for collective selling of forest resources, capacity building and local development activities. This improves the social cohesion in the community. In South Africa for example a network of 30, 000 NTFPs collectors was created in 2006, which make possible the delivery of high-quality products to global markets on time (IFAD, 2008). The benefits of creation of social capital depends upon participation of households in the activities of the groups or networks.

Economic assets include cash, micro-credit, basic infrastructure, production equipment or technologies (Krantz, 2001). Through community management of the forest, development activities that improve the level of infrastructure of the community can take place. Dev *et al.,* (2003) found that in the Middle Hills of Nepal, community management led to the development of the infrastructure. The main examples are: trail making, construction of community halls and village electrification. Community management of forest can also provide cash to its members. This is generally possible if the members have access to marketable NTFPs and a nearby market (IFAD, 2008).

2.2.2 Contribution of Forest to Livelihood Capabilities

Capabilities or human capital include education, skills and psychological orientation (Krantz, 2001). Community forestry can contribute to improving human capital in various ways. In Nepal for instance, forest user groups in the Middle hills provide support to schools by paying teachers' salaries and funding school building construction. Moreover the Nepal UK Community Forestry Project was also providing training to women in the forest user groups to increase their social role in conservation of forest resources (Dev *et al.,* 2003). In Burkina Faso, the United Nations Development Fund for Women provided improved technologies and marketing assistance to groups of women that collect and process shea nuts (IFAD, 2008).

2.2.3 Contribution of Forest to Livelihood Activities

Generally, communities adjacent to forests have the opportunity to engage in forest related activities such as hunting, collection and selling of NTFPs. These activities contribute to income generation, food security and health improvement of the households as explained below (Dovie *et al.,* 2001).

- **Sources of employment and cash income**

Activities related to NTFPs provide employment for rural households in many countries. In South Africa, women earn an average of US$ 2,000 per year from trading bark material from a tree called cape Onion wood (*Cassipourea flanaganii*) (Wynberg, 2004). Sale of bamboo shoot, rattan and medicinal plants creates employment to a large number of educated youth. These products are used as fresh vegetables and are also sold in local markets. Mushrooms are also harvested for subsistence and commercial use (Agustino *et al.*, 2011). In developing countries NTFPs contribute significantly to economic growth (Chikamai and Tchatat, 2004). Dabiré (2003) found that NTFPs contribute to 14 percent GDP in Senegal with an annual income ranging from US$ 194 to US$ 1,114.

In the forest zones many poor households have been domesticating indigenous fruit trees as a means of income generation. In Cameroon about 70 percent of African pears (*Dacryodes edulis*) produced are sold, providing households with a gross annual income of US$ 160 (Schreckenberg *et al.*, 2006). For example, in Ghana FAO (1996) found that 72 percent of the households interviewed identified income generated from NTFPs activities as being important in meeting their nutrition and healthcare needs.

- **Food security**

Ahenkan and Boon (2011) reported that trees contribute to food security in many ways across the world. They can provide a direct source of food as well as essential nutrients that increase the nutritional impact of other foods. They also help in filling food gaps by providing food during seasonal shortages. In developing countries, NTFPs contribute to the food security of nearly 80 percent of the population (FAO, 2003). In Sub-Saharan Africa where crops' yields decline due to climate change, NTFPs are consumed by the population during seasonal shortages, hence

contributing to the food security of about 12 million people (Moseley, 2012). In Uganda NTFPs are consumed by a least 76 percent of the population (Kaggwa *et al.,* 2009). A study on NTFPs contribution to food security in Cross River State in Nigeria revealed that NTFPs contribute to the food security of 70 percent of the population (Offiong and Ifa 2013). In that region the leaves of the forest trees like African nut tree (*Myrianthus arboreus*) and Silk-cotton (*Ceiba pentandra*) are highly valued because they are the main source of vegetable at the end of the dry season. In Swaziland, Ogle and Grivetti (1985) found that more than 200 species of the wild plants were consumed. In Machakos district of Kenya vegetables from forests are delicacies during the rainy season. Fruits are mostly seasonal and consumed mostly by children. In Zambia wild vegetable is used as ingredients in 42 percent of the meals served in Mukupu village. For example, in the Ferlo region of Senegal, 150 wild plants including *Adansonia digitata, Balanites aegyptiaca* have been recorded to be consumed by the local communities (Agustino *et al.,* 2011).

- **Health improvement**

In Sub-Saharan Africa, forests and trees are important to local communities because they supply medicinal plants that are important for their health (Chege, 1994). Households in forested areas use NTFPs as supplement in their diet and hence their health is improved through the prevention of diseases. Fruits, leaves, nuts, tubers, roots and honey are rich in vitamins (A, B, C, D), minerals, (calcium, magnesium, potassium, iron) carbohydrates (fructose, soluble sugars) and protein which are indispensable for vulnerable groups such as children and older people. Fruits from tree species such as Baobab (*Adansonia digitata*), Tamarind (*Tamarindus indica*), Blackjack (*Bidens pilosa*) and Vitex (*Vitex doniana*) are sources of food and vitamins for most rural communities (Achigan-Dako *et al*., 2010).

Violet tree (*Securidaca longepedunculata*) is a multipurpose plant found in Africa. In East Africa the dried bark and root of this plant are used to treat nervous system disorders. The dried leaves are used for wounds and sores, coughs, venereal diseases, and snakebites in Nigeria. Another multipurpose medicinal plant is Prunus (*Prunus Africana*). It is found in the afro-montane forests of Cameroon, Uganda and Kenya. It is traditionally used to treat malaria, chest pains and heartburn. Therefore, forests would provide the only medicines available to about 90% of the developing world (Cunningham and Mbenkum, 1993).

2.3 Adoption of agroforestry practices by households in Sub-Sahara Africa

Agroforestry is "*the incorporation of commercial tree growing and management by farmers into farming systems for the production of both wood and non-wood products, increasing agricultural productivity and encouraging sustainable natural resource management"* (NSW, 2003, p. 2). The five recognized agroforestry practices are upland forest buffers (combination of trees, shrubs and grasses established in distinct zones), windbreaks, alley cropping, silvo-pasture (combination of trees, forage and livestock managed as a single integrated system) and forest farming. Among those practices alley farming and forest farming are the most important in providing non-timber forest products to adopters (UMCA, 2015).

Alley farming

Alley farming is a combination of trees planted in single or multiple rows with agricultural crops cultivated in the wide alleys. The trees may include species that can provide non-timber forest products for sale (UMCA, 2015). Farmers' adoption of this practice is affected by different factors that are worth reviewing. For example, in Cameroon a study on determinants of farmers' adoption

of alley farming showed that it is commonly adopted by male household heads that have access to extension services and are members of farmer groups (Adesina *et al.,* 2000). Moreover they found that the adoption increased in areas where there is a high fuelwood scarcity but decreased in the highly populated areas. A similar study in Nigeria by Adesina and Chianu, (2002) revealed that income generated from NTFPs selling as well as farmer characteristics such as gender and age were significant in explaining farmers' adoption of alley farming.

Krause *et al.,* (2007) also analyzed smallholder farmers' decisions to integrate woody plants on farm in Ethiopia. The study reveals that resource-based factors like farm size and land tenure were the major determinants. Farmers' perception of alley farming was also found to affect farmers' decision to adopt it. In West Africa the reason for the low adoption of alley farming was that farmers perceive it as difficult to undertake (Douthwaite *et al.,* 2002).

Forest farming

Forest farming is the management of shade in forests for the cultivation of trees that can provide marketable NTFPs (UMCA, 2015). This agroforestry practice improves forest composition while enhancing farmers' income opportunities through NTFPs selling. Socioeconomic factors of farmers such as farm size, land tenure, marital status and household size were found to affect their decision to adopt forest farming. For instance, Thangata *et al.,* (2002) studied household decision to practice forest farming in Malawi and found that their decision is mainly driven by the availability of land and labour. In Tanzania factors such as marital status, household size, tenure security and credit access were found to significantly affect the adoption of agroforestry practices (Bullock *et al.,* 2013).

The fact that forest farming can also provide direct economic benefits through sale of NTFPs is crucial for its adoption. For example, in Rwanda a study on determinants of tree planting on farm revealed that farmers' adoption of forest farming was driven mainly by the following factors: availability of food, firewood and total income from tree products selling (Ndayambaje *et al.*, 2012). Similarly, environmental values and perceptions regarding the extent to which forest farming can contribute to forest conservation were found to affect the probability of farmers' participation in forestry in Ethiopia (Mekoya *et al.,* 2008). These studies lead to the conclusion that alley farming and forest farming can contribute to production of NTFPs and income diversification. The factors that determine household adoption of alley farming and forest farming include socioeconomic and environmental factors as well as the perception of the household about those practices. Therefore policies aimed at promoting agroforestry need to be guided by a better understanding of the motivations of adopters.

2.4 Harvesting technologies for non-timber forest products

Harvesting techniques of NTFPs including pre-harvest and post-harvest treatment are different from those of timber. According to Agustino *et al.,* (2011) the difference is related to the equipment, pre-harvest preparations and post-harvest treatment used (Agustino *et al.,* 2011). The process of harvesting NTFPs does not involve a whole tree as it is the case for timber; hence it is less harmful to the forest. It also differs depending on the type of NTFPs involved. For example, technics such as root digging and debarking are used to harvest some medicinal plants, which is not the case while harvesting nuts or fruit. The procedures of harvesting NTFPs other than honey are not well elaborated because volumes harvested are usually small. Therefore, there is need to develop elaborate harvesting procedures in order to prevent post-harvest losses.

2.5 Factors affecting households decision to participate or not in non-timber forest products as producer or collector

Socioeconomics characteristics of the household were found by several authors to affect their decision to participate or not in NTFPs as collector or producer. These factors are also the factors likely to influence their decision to produce NTFPs on farm or to collect them from the forest. Therefore the conclusions made are valid for the two objectives.

Gender of head of household

Campbell (1991) found that in Ethiopia men like taking risk and hence are more likely to go to the forest and collect NTFPs compared to women. In contrast, Opaluwa *et al.,* (2011) found that in Nigeria women were more likely to collect NTFPs as compared to men. Therefore in this study gender is hypothesized to positively or negatively affect household decision to participate in NTFPs as collector or producer as well as their decision to choose the forest as their main source of NTFPs in Uganda.

Age of head of household

The age of the head of household may positively or negatively influence household decision to collect NTFPs. Collection of NTFPs is labour intensive, hence young people may be more dependent on forest products than elderly people (Mamo *et al.,* 2007). McElwee (2008) also analyzed the socio-economic factors that affect household's decision to collect forest products. They found that the elderly people are less likely to collect NTFPs from the forest, hence they rely more on their farm because they may not have the strength to carry out forest-related activities. However, Rodrigez (2009) found that adult household heads were more likely to collect NTFPs in

India. Many other researchers; (Hedge *et al.,* 1996; Hedge and Enters, 2000; Shone and Caviglia-Harris 2006) have found a positive association between age and decision to collect NTFPs. Therefore in this study age is hypothesized to positively or negatively affect household decision to participate in NTFPs as collector or producer as well as their decision to choose the forest as their main source of NTFPs.

Occupation of head of household

Main occupation of the head of households is the type of work they do irrespective of the place or education level. In Uganda nearly 64 percent of the working populations were engaged in subsistence agriculture in the year 2014, according to the Uganda Bureau of Statistics. This variable is expected to positively affect the households' decision to participate in NTFPs as collector or producer as well as their decision to choose the forest as their main source of NTFPs.

Household size

Household size affects significantly household decision to collect NTFPs. The larger the household size, the more non-timber forest products they need like fuelwood for cooking. Therefore, households look for a way to secure a source of NTFPs relying on either the forest or own farm. This suggests that larger households have a greater demand for NTFPs, hence are more likely to collect NTFPs (Adikhari, 2014). Similarly, a study conducted by Rodrigez (2007) in India on the determinants of NTFPs collection revealed that the presence of an additional individual in the household increases the household probability of collecting NTFPs. Household members can also provide labour that may help in collecting NTFPs. Therefore the larger the household size, the more labour they have to collect NTFPs. Size of household is then hypothesized to positively

influence the decision to participate in NTFPs as collector or producer as well as their decision to choose forest as their main source of NTFPs.

Farm size

In Uganda, the average size of farmland owned by a rural household is 1.1 ha (UBOS, 2010). Household farm size is related to their decision to grow trees on their farm. When farm size is large, farmers are more likely to own a woodlot. The larger the area they allocate to agroforestry the more will be the quantity of NTFPs collected. Thus farm size is hypothesized to be positively linked to the household's decision to participate in NTFPs as collector or produce as well as their decision to choose the forest as their main source of NTFPs.

Level of education of head of household

Level of education is an important indicator of the society's stock of human capital and refers to the highest level of education that an individual has completed (UBOS, 2014). In every socioeconomic studies education is included to measure the level of socioeconomic development in the area. Education has a significant negative influence on household decision to collect non-timber forest products. Adhikari *et al.,* (2004) studied the relationship between household characteristics and collection of NTFPs in Nepal and found that a higher level of education provides opportunities for better jobs and reduces the households dependency on NTFPs, hence they are less interested in collecting NTFPs. Therefore in this study, education is hypothesized to negatively affect household decision to participate in NTFPs as collector or producer as well their decision to choose the forest as their main source of NTFPs.

Access to agricultural and market information

Household access to market information such as prices and availability of buyers affects households' decision to collect non-timber forest products. According to Angelsen and Kaimowitz (1999), greater access to prices and buyers information often accelerates NTFPs extractions and induces people to earn more income by selling the NTFPs in the market. Therefore in this study access to agricultural and market information is expected to positively affect household's decision to participate in NTFPs as collector or producer as well as their decision to choose the forest as their main source of NTFPs.

Household wealth status

Household income level has a significant effect on the decision to collect non-timber forest products. On one hand, higher income households might not be interested in collecting or selling NTFPs compared to lower income households because they can afford to purchase NTFPs from local markets (Ndayambaje *et al.*, 2012; Angelsen and Kaimowitz, 1999). Therefore poor households are more likely to collect NTFPs. Moreover the better-off households collect lower amount of NTFPs especially firewood because they can afford substitutes like gas for cooking. On the other hand, higher income household may be attracted by prices of forest products; hence they might be interested in NTFPs collection (Springate-Baginski *et al.*,1999). Material used for wall construction can be used to capture the state of wealth of the household. In rural areas in Uganda, walls are constructed with permanent materials like cement, burnt bricks and stones or with temporary materials like mud, dirt, zinc and iron. Households who have their walls built with permanent materials are considered to be wealthier than others. Therefore in this study wealth status is hypothesized to positively or negatively affect household's decision to participate in

NTFPs as collector or producer as well as their decision to choose the forest as their main source of NTFPs.

Distance to source of non-timber forest products

Distance from homestead to the source of non-timber forest products has negative and significant relationship with non-timber forest product collection. A study conducted by Opeluwa *et al.,* (2011) on determinants of NTFPs collection and utilization in Nigeria revealed that the distance separating the households to the source of NTFPs negatively affected their decision to collect NTFPs. It suggested that households residing close to the source of NTFPs are more likely to collect NTFPs or to acquire higher amount of NTFPs. This result contrasts the findings by Adhikari *et al.,* (2004) who found that distance to the forests positively affect household decision to collect NTPFs like firewood in Nepal indicating that as distance to the source of collection increases household still collect firewood because it is not easily substituted by other source of energy in that area. According to Ndayambaje *et al.*, (2012) agro-ecological zones can be used as a proxy to assess distance to the forest. In Eastern Uganda there are three agro-ecological zones which are high, middle and low agro-ecological zones. Households in high and middle agro-ecological zones are closer to the forested areas; hence they have better access to the resources that it provides (Paumgarten, 2007). It is expected that they are more involved in NTFPs collection. Based on these findings, it is hypothesized that householdds in high and middle lands are more likely to participate in NTFPs as collector or producer and to choose the forest as their main source of NTFPs.

2.6 Market for Non-Timber Forest Products

Geographically, NTFPs are sold in the village markets as well as at the national and international markets. In developing and developed countries, there are large domestic markets for NTFPs. NTFPs like edible nuts and resin are commonly sold in the producing countries and special types of honey need specific niches (Agustino *et al.*, 2011). However, industrialized countries in Europe, Japan and North America absorb the bulk of most of the internationally traded NTFPs. With regard to end-use, non-timber forest products are sold in raw or primary processed forms in several markets. The main end-use sectors served by NTFPs in raw form include cattle feeds, food industry and pharmaceutical industry. Pharmaceutical industries in Europe and America are increasingly importing NTFPs for their medicinal properties. For example *Prunus African* was worth US$ 200 million to pharmaceutical industries in 1999 (CARPE, 2001). In Namibia, annual export of medicinal plant was worth US$ 2 million in 1998 (Agustino *et al.*, 2011).

From the gatherers point of view collectors of NTFPs include the middlemen and national organizations who sell their products directly to consumers in village or town markets (Achigan-Dako *et al.*, 2010). These reviewed studies demonstrate the importance of non-timber forest products from different sources in contributing to rural households' food security as well as their economic returns. It also shows the potential of NTFPs in contributing to international trade, hence Uganda Government can take advantage of the market opportunities by developing the value chains of NTFPs.

2.7 Factors Affecting Households Participation in Non-timber forest products Markets as seller

There is scarce literature on household participation in NTFPs markets but it is likely that factors affecting household decision to sell agricultural products are also the factors likely to affect household decision to sell NTFPs. Several factors have been identified as affecting market participation of smallholder farmers. These factors include socioeconomic factors (age, gender, education of the household head, household size and land size) and institutional factors (road infrastructure, distance to market and access to information).

Gender of the head of household

The gender of the household head affects the decision to participate in the market. Male headed household are more likely to sell farm products because they own more productive resources than the female headed households (Jagwe *et al.,* 2010). Furthermore, Demeke et *al.,* (2014) found that female headed households are more likely to be resource constrained and it affects negatively their market participation decision in Central Ethiopia. Similarly Hlongwane *et al.,* (2014) investigated factors affecting market participation of the small-scale maize farmers in South Africa and found that female headed households are less likely to sell maize because of the high transaction cost of searching for buyers as opposed to the male headed households. Gender also plays an important role in NTFPs selling. According to Tugume *et al.,* (2015) women are mostly involved in collection of wild food and medicinal plants for home use due to low volumes collected while men are involved in more labour intensive activities involving commercial extraction of firewood and rattam which offer high values. For example, Mulenga *et al.,* (2014) found that in Zambia male-headed households are more likely to participate in NTFPs markets and depend more on NTFPs

income than households headed by women. Therefore this study expects gender to influence household decision to commercialize NTFPs.

Age of the head of household

Several studies show that age of the household head may negatively or positively affect market participation. According to Adegbola and Gardebroek (2007) older farmers may easily decide to participate in the market than the young farmers because they are likely to have bigger land size that allow them to have more surplus. Another study was conducted on factors influencing household participation in maize market in Ghana and revealed that older farmers were more likely to sell maize compared to younger ones (Musah *et al.,* 2014). However, young household heads who are risk takers may also be more likely to participate in product markets (Zegeye *et al.,* 2001). Also, Chalwe (2011) found that in Zambia younger people participate more in beans selling than older people. Similarly, Sigei *et al.,* (2014) found that older household heads were less likely to sell pineapple in Kenya. Effect of age on NTFPs commercialization is expected to be indeterminate. It can either be positive or negative. On one hand collection of NTFPs products demand a lot of physical strength which excludes older people. Similarly older people are more knowledgeable about NTFPs with medicinal value hence they are more incline in commercialization of medicinal NTFPs. A study by Tugume *et al.,* 2015 shares similar insights when it found that older people with more knowledge on medicinal NTFPs in Central Uganda were involved in commercialization as traditional healers.

Education of head of household

According to Enete and Igbokwe (2009) household heads with higher education level have access to better remuneration activities as compared to collection or selling of NTFPs. Piya *et al.,* (2015)

found that better educated household heads depend lesser on NTFPs as a source of income in Nepal. However income obtained from other economic activities could be used by the educated household with higher education level, to engage in commercial exploitation of forest products which require capital thus justifying the positive relationship (Tugume *et al.,* 2015). Therefore it is expected that education is hypothesized to positively or negatively affect households' decision to sell NTFPs.

Land size

Land size has significant effect on farmers' decision to sell their products. According to Key *et al.*, (2000) land size is positively related to farmers' decision to sell their agricultural products because they can produce more output with large land size. In Bangladesh and Ethiopia farm size was found to positively affect the probability of being a commercial farmer (Osmani and Hossain, 2015; Demeke *et al.*, 2014). In Kenya, Olwande and Mathenge (2012) investigated factors affecting participation of rural households in the market and found that larger per capita land size is significantly associated with a higher probability of participating in fruits market. Contrary to this observation farm size is expected to negatively affect selling of NTFPs since Tugume *et al.*, (2015) found that households with big land sizes are less likely to sell NFTPs as compared to those with less land size because the ones with large land can engage in agriculture which provides alternative sources of income than NTFPs. Therefore for this study it is also expected that farm size is negatively related to households' decision to sell NTFPs.

Household size

The household size can negatively or positively affects household market participation decision. A positive influence could be because larger household provide cheaper labour for collection of

more surpluses of NTFPs that can be sold (Alene *et al.,* 2008). For instance, Tugume *et al.,* (2015) analyzed the socio-economic predictors of dependence on NTFPs in Uganda and found that household size is positively related to farmer decision to sell NTFPs. However, larger family size may also require larger amounts of NTFPs for households' consumption which in turn reduces the marketable surplus (Gebregziabher 2010). Therefore household size is expected to negatively or positively affect farmers' decision to sell NTFPs.

Distance from homestead to the market

Distance from homestead to the nearest market influence negatively households' participation in the market as it indicates the extent to which road infrastructure is developed in the area of study (Chilundika, 2011). For example, Hlongwane *et al.,* (2014) in their study on household participation in agricultural products market, found that distance to the market negatively affects farmer decision to sell their agricultural products because it increases the transportation cost. Distance from homestead to the market was also found by several authors (Sebatta *et al.,* 2014, Glover *et al.,* 2013, Omiti *et al.,* 2009) to have a negative effect on market participation. This might also be the case for NTFPs since Paumgarten (2006) and Timko *et al.,* (2010) also found that household proximity to the market is important in selling NTFPs because it reduces the transportation cost. Therefore distance from homestead to nearest market is expected to negatively affect household's decision to sell NTFPs.

Access to agricultural and market information

Households need to have access to information about the market such as prices, demand, supply and expectations; before they take the decision to sell what they produced or collected. They may

also be reluctant to collect or produce NTFPs on farm if they know that prices of the products fluctuate widely. Market information has been found to positively affect market participation for NTFPs (Kar and Jacobson, 2012) suggesting that poor access to market information results in high transaction costs such as transportation and communication cost. This is because NTFPs sellers have to use other means that is calling their counterpart or incurring transport costs to the market to get the information. Therefore access to market information is also hypothesized to positively affect household's decision to sell NTFPs.

Group membership

Some authors found that membership to farmer groups influence the probability of market participation. According to Mbowa *et al.,* (2012), groups are usually formed to facilitate access to better agricultural technologies and transportation of goods to markets. In that case it positively impacts on market participation (Olwande and Mathenge, 2012). Similarly, Sebatta *et al.,* (2014) analyzed the factors that influence smallholder farmers' decision to participate in potato market in Uganda and found households belonging to farmer groups were more likely to sell potato because the group helps them to get information on the prices of potato on different markets and increase their bargaining power. Membership in a group would enable NTFPs sellers to have better access to loans, training and processing technologies from government or international organizations and to supply global market (IFAD, 2008). For example, Harsch (2001) found that in Burkina Faso, 100 groups of shea butter sellers received training from a cosmetic company. The company also pay for the product in advance thus promoting greater economic security. Therefore, membership to farmer groups is hypothesized to positively affect household decision to sell NTFPs.

Access to credit

Access to credit positively affects market participation because credit is a production-enhancing input which boosts productivity and consequently increases the level of marketable surplus, hence encouraging farmers to sell their products. Hlongwane *et al.,* (2014) in South Africa and Musah *et al.,* (2014) in Ghana found that households who have access to credit were more likely to sell maize in South Africa and Ghana respectively. Similarly, Franzel *et al.,* (2007) found that lack of capital, especially during the rainy season is a constraint for effective trade in NTFPs as collectors who have access to credit have the ability to afford transportation means, market information hence they are more likely to sell NTFPs as compared to those without credit. For these reasons it is also suggested that access to credit is positively related to households' decision to sell NTFPs.

Wealth status

Wealth can have a positive or negative effect on household market participation. Wealth status is a proxy for household income therefore higher income households might not be interested in selling NTFPs compared to lower income households because they do not collect or produce NTFPs, instead they purchase NTFPs from the local markets (Ndayambaje *et al.,* 2012). Mulenga *et al.,* (2013) also found that poorer households are relatively more dependent on income from the extraction and sale of NTFPs than wealthier households in Zambia. However, Kepe (2002) found that in Zimbabwe wealthier households are more involved in NTFPs selling because they are attracted by the prices of the products. Therefore, wealth status is expected to positively or negatively affect households' decision to sell NTFPs.

Distance from homestead to forest

According to Timko *et al.,* (2010) household decision to sell NTFPs is influenced by where they are physically situated in relation to forests. Dash *et al.,* (2016) found that in India, living far from the forest is clearly associated with low commercialization. Kamanga *et al.,* (2009) also found that in Malawi households close to forests had higher forest incomes than those who are far from forests, suggesting that households close to forests were more likely to sell NTFPs. While agro-ecological zones help to capture variation across different regions particularly in terms of climatic risk, according to Ndayambaje *et al.,* (2012) it can be used as a proxy to assess distance to the forest. In Eastern Uganda there are three agro-ecological zones which are high, middle and low agro-ecological zones. Households in high and middle agro-ecological zones are closer to the forested areas; hence they have better access to the resources that it provides (Paumgarten, 2007). Therefore it is expected that household living in high and middle lands are more likely to sell NTFPs.

In summary these studies broadly covered socioeconomics factors that explain collection of NTFPs as well as market participation of smallholder farmers. It was found that little attention has been given to factors affecting household decision to sell non-timber forest products. Therefore the current study will contribute to the growing literature on market participation studies on NTFPs. It will also identify areas of policy interventions that need to be emphasized in order to achieve high participation of household in selling of non-timber forest products.

CHAPTER 3: METHODOLOGY

Introduction

This chapter begins with the conceptual framework of how the study sought to address the identified research gap. The theoretical framework under which the study is grounded is also discussed. The chapter further presents the sampling procedure, sample size determination, data collection and description of the study area.

3.1 Conceptual Framework

The conceptual framework for the assessment of factors affecting households' participation in non-timber forest products market is presented in figure 1. The figure underscores important linkages in three levels of decision making processes and stresses the variables that are likely to have the take home message. The incentives suggested in level 1 are the basis for household decision making process and they are perceived differently by household based on their socioeconomic characteristics. All together they shape household decision making process in level 3.

At level 1 household decision is visualized to be influenced by incentives such as household access to market information such as prices and demand, proximity to market and agro-ecological zones (proximity to the forest). These factors are likely to have a negative or positive influence on household in the decision making process. They can also be perceived as incentives or disincentives depending on households' socioeconomic characteristics such as age, land size, gender of the household head and land ownership. It is hypothesized that different decisions are likely to be made and implemented based on varying conditions of these factors as shown in level 3. Three stages of decisions are identified in this study. The decision process leading to household

behavior in this study can be visualized as a triple hurdle where the first hurdle is for the household to decide whether to participate in NTFPs as producer or collector or not to participate. The second hurdle is for the household to choose to produce NTFPs on farm or to collect them from the forest. The third hurdle is to decide on whether to sell NTFPs or not.

3.2 Theoretical Framework

Households' decision making process can be explained by the utility maximization theory whose basis is rooted in random utility theory (McFadden, 1974). Utility maximization theory assumes that households evaluate each opportunity that comes to them with complete knowledge of alternatives and choose the opportunity that maximize the utility. According to this theory, choice that households make among a set of options depends on the utility of each alternative relative to the utilities of all alternatives (Clifton and Handy, 2001). In another words, given two options that is selling NTFPs or not for example, household *i* confronted with a choice between the two options will assign to each alternative a perceived utility. Hence household *i* will choose the option that maximizes the utility after comparing the expected utility of participation in NTFPs selling with non participation. If a household chooses to participate in NTFPs selling, that means it yield a highest utility.

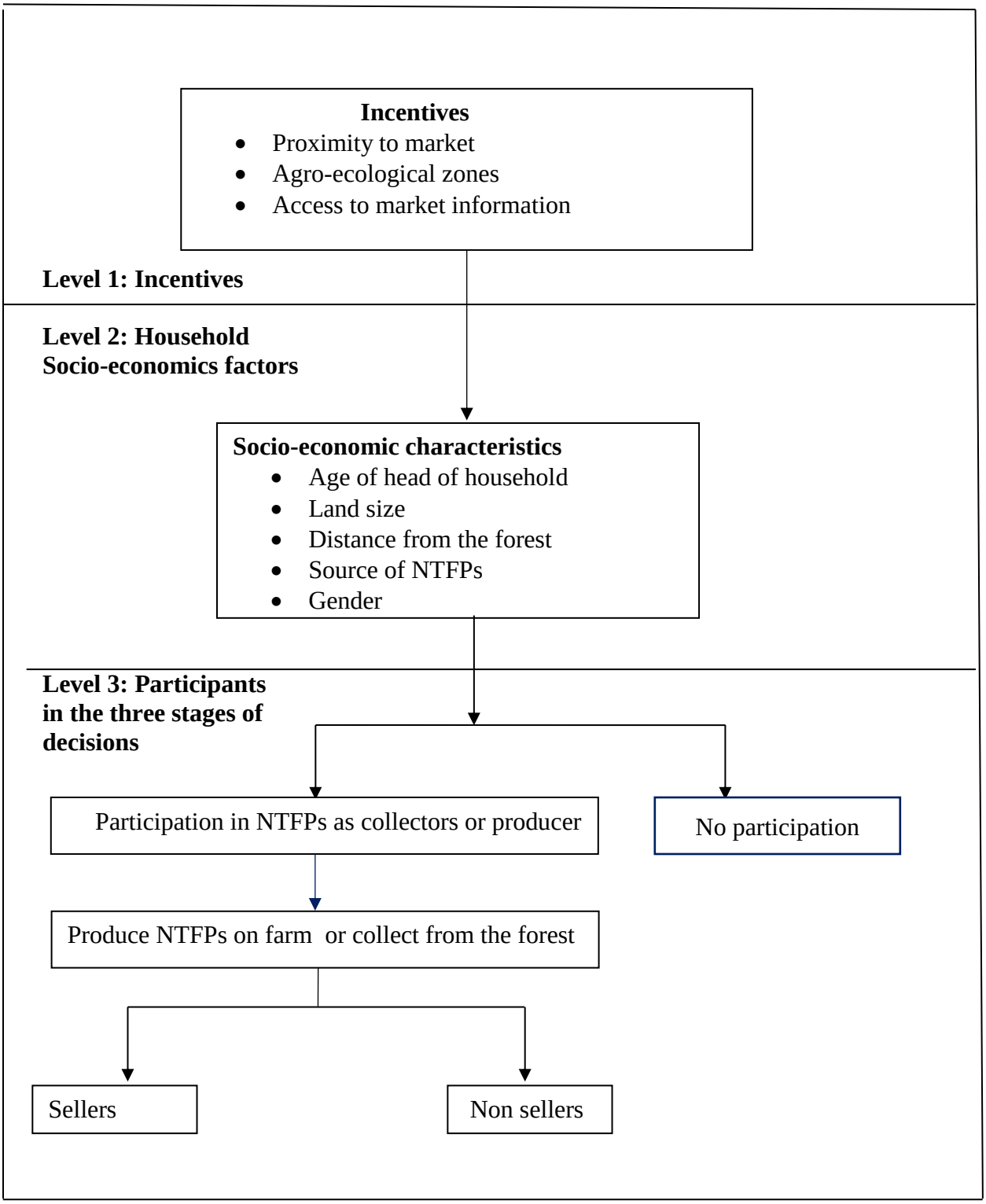

Figure 3. 1: Conceptual framework for the linkage between socioeconomics characteristics of households and their decisions in the three hurdles

Assuming:

(i) a set of alternatives *B*, presented to the household *i*. For the first objective the alternatives are to participate in NTFPs as producer or collector or not to participate. For the second objective the alternatives are to produce NTFPs on farm or to collect them from the forest and finally households have to decide on whether to sell NTFPs or not.

(ii) a set of household socioeconomic characteristics X_{ij}

(iii) a family of choice probabilities $\{P_{ij}(B), j \in B\}$, where $P_{ij}(B)$ is the probability of choosing alternative *j* inside *B.* According to Dagsvik (2004), the utility maximization theory implies that probability of choosing alternative *j* inside *B* depends on the maximum utility it provides expressed as in equation 1:

$$P_{ij}(B) = Prob\,(Y_i = j) = Prob\,(U_{ij} = \max_{k \in B} U_{ik}) \quad (1)$$

Where Y_i is the outcome of the decision and also represents the utility U_{ij} assigned by the household *i* to alternative *j*. In equation 1, the utility U_{ij} is a latent construct that is in the mind of the household and cannot be observed directly or measured (McFadden, 1974). That utility assigned by the household *i* to alternative *j* is not known with certainty by an external observer. According to Gujarati (2003), the utility U_{ij} can be expressed as a linear combination of the systematic utility V_{ij} that household *i* gets from the choice of alternative *j* and the random factors ε_{ij} expressed as in equation 2. The random component (ε) arises both because of the randomness in the households' preferences and because the attributes do not cover all of their preferences.

$$U_{ij} = V_{ij} + \varepsilon_{IJ} \quad (2)$$

Where:

$$V_{ij} = \beta_{ij} X_{ij} = \beta_{ij}\, F\,(X_{ij}) \quad (3)$$

β_{ij} = unobserved parameters

X_{ij} = vector of explanatory variables

Therefore by replacing equation 3 in equation 2, it results to equation (4) which implies that the utility a household derives from a choice depends on its characteristics X_{ij} and those of the alternative choices (Rungie *et al.*, 2012).

$$U_{ij} = \beta_{ij} X_{ij} + \varepsilon_{IJ} \quad (4)$$

According to Vojacek and Pecakova (2010), if the household chooses the alternative which brings the greatest utility then the probability of the choice of the alternative *j* over alternative *j'* is derived from equation (5) and is expressed as:

$$\begin{aligned} Prob\ (Y_I = j) &= \mathrm{P}\left(U_{ij} > U_{ij'}\right) \\ &= \mathrm{P}\left(V_{ij} + \varepsilon_{ij} > V_{ij'} + \varepsilon_{ij'}\right) \\ &= \mathrm{P}\left(\varepsilon_{ij} - \varepsilon_{ij'}) > (\beta_{ij'} - \beta_{IJ})\, F(X_{ij}, X_{ij'}\right) \\ &= F(\beta_i\, X_i) \end{aligned} \quad (5)$$

3.3 Empirical Methods used in the Three Hurdle Decision Making Process

Different approaches have been used to evaluate factors that explain household decision making process based on the utility maximization theory. In this study households have to make decision in two steps. The first step is to decide whether to collect non-timber forest products or not and the second step is to decide whether to sell or not after having collected NTFPs. Participation decision taken as dependent variable can be modelled with discrete choice models. According to Gujarati (2003) the most commonly used approaches to estimate such models are Linear Probability Model, Logit and Probit model. In all these cases the households are categorized as being either participants or non-participants. The dependent variable takes the value of 1 for participants and 0

for non-participants. Linear Probability Model is the regression approach used to analyse a binary choice when the dependent variable is discrete. With the Linear Probability Model, an event will occur given X_i explanatory variables and this probability is linearly related to the independent variables. LPM is plagued by several problems such as non-normality and heteroscedasticity of the errors terms as well as the possibility of the probability that an alternative *j* selected is greater than 1.

For these reasons Probit and Logit models are preferred because the conditional probabilities are nonlinearly related to the independent variables and have the characteristic to not exceed 0 and 1 asymptotically. Logit model is based on cumulative logistic probability distribution while Probit model is based on cumulative normal probability distribution (Greene, 2008). Logit model encompasses some limitations. It does not assume normality, linearity and homogeneity of variance for the independent variables. These assumptions are important because Logit model cannot represent the variation of the random taste (Train, 2003). Probit model deals with this problem, hence it was preferred for this study.

3.4 Empirical studies that used Probit model

Analysts have used Probit model alone or in two stage models to explain households decision making process. For example, Oladejo *et al.,* (2011) have used Probit model to analyse women participation in agricultural production in Egbedore Local Government Area of Osun State in Nigeria. Specifically, the study examined the influence of selected socio-economic characteristics of women and access to economic resources on their participation in agricultural production. Two stage models such as double-hurdle, Heckman and Tobit allows analysts to study determinants of market participation using Probit model at the first stage. Bellemare and Barrett (2006) in their

study on determinants of livestock market participation in Kenya used an ordered Tobit model. In the first stage of their analysis they used an ordered Probit regression in order to take into account buyers, sellers and autarkic separately. More recently Musah *et al.,* (2014) in their study on determinants of farmers' participation in maize market in western Ghana used the double-hurdle model for a sample of maize producers to evaluate determinants of market participation using a Probit model in the first stage. Sebatta *et al.,* (2014) also used Heckman model to analyze factors that influence smallholder farmers' decision to participate in the potato market in eastern Uganda. They used Probit model in the first stage to determine factors affecting households participation in the potato market.

3.5 Estimating Equations

This section defines variables mentioned in equation 5 that are used to estimate equations for this study:

Y_i = dependent variable for the participation decisions

j = alternative decisions

The decisions to participate in NTFPs or not as collector or producer is then stated as:

$$j = \begin{cases} 1\ if\ household\ participates\ in\ NTFPs\ as\ collector\ or\ producer \\ 0\ otherwise \end{cases}$$

The decisions to produce NTFPs on farm or to collect from the forest is then stated as:

$$j = \begin{cases} 1\ if\ household\ collects\ NTFPs\ from\ the\ forest \\ 0\ if\ household\ produces\ NTFPs\ on\ farm \end{cases}$$

The decision to sell NTFPs or not is stated as:

$$j = \begin{cases} 1\ if\ household\ sells\ NTFPs \\ 0\ otherwise \end{cases}$$

X_i = the vector of the independent variables for each objective as defined in tables 3.1, 3.2 and 3.3 below.

β_i = vector of coefficients to be estimated

ε = the normally distributed error term.

Given the above, the probability that a household belongs to a group j is function of the independent variables X_i and the normally distributed error terms ε, hence following Greene (2008) equation (5) is rewritten as:

$$Prob\ (Y_i = 1) = U_{ij} = F(\beta_i X_i) \qquad j = 0\ and\ 1 \tag{6}$$

According to Jones (2009) Probit model assumes that *F* represents the cumulative distribution function (Φ) of a standard normal variable. The cumulative distribution function (Φ) is then expressed as follow:

$$Prob\ (Y_i = 1) = \Phi\ (\beta_i X_i) = \int_{-\infty}^{X_i} 2\pi^{-o.5} \exp\left(-\frac{X_i^2}{2}\right) dX_i \tag{7}$$

The inverse of equation (7) gives the linear form of the Probit model also estimated in studies by Oladejo *et al.,* (2011) and Sebatta *et al.,* (2014). It is stated as:

$$\Phi^{-1}(p_{ij}) = Y_i^* = \beta_i X_i + \varepsilon \tag{8}$$

The parameter estimates of the Probit model provide only the direction of the effect of the independent variables on the dependent variable but they do not represent either the actual magnitude of change (Demeke *et al.,* 2014). The magnitudes of the coefficients of the Probit model can be obtained by computing partial effects of the explanatory variables that is differentiating equation (8) with respect to each explanatory variable.

3.6 Variables hypothesized to influence households in the three decision making process

The tables below describe the independent variables hypothesized to influence households decision to participate in NTFPs or not as collector or producer (Table 3.1), their decision to produce NTFPs on farm or to collect them from the forest (Table 3.2) and their decision to sell NTFPs or not (Table 3.3).

Table 3.1: Variables hypothesized to influence households' decision to participate in NTFPs or not as collector or producer

Variable definition	Variable measurement unit	Expected sign
Dependent variable		
Participation in collection or production of NTFPs	1= household collected or produced NTFPS , 0= otherwise	
Independent variables		
Age of the household head	Numbers of years	+ or -
Education of the household head	Numbers of years spent at school	+ or -
Occupation of the household head	1=Farming and 0 for off farm activities	+
The household head is male	1=yes and 0 otherwise	+
Household size	Total members in the households	+ or -
Advanced material for building house as a proxy for wealth	1=cement, burnt bricks or stones and 0 otherwise	-
Farm size	Hectare (Ha)	+
Household has access to agricultural and market information	1=yes and 0 otherwise	+
Agro-ecological zones as a proxy for distance from forest	1= high land, 2=middle land and 3= low land	+

Table 3.2: Variables hypothesized to influence households' decision to grow NTFPs on farm or to collect NTFPs from the forest

Variable definition	Variable measurement unit	Expected sign
Dependent variable		
Produce NTFPs on farm or collect NTFPs from the forest	1= forest , 0= farm	
Independent variables		
Age of the household head	Numbers of years	+ or -
Education of the household head	Numbers of years spent at school	+ or -
Occupation of the household head	1=Farming and 0 for off farm activities	+
The household head is male	1=yes and 0 otherwise	+
Household size	Total members in the households	+ or -
Advanced material for building house as a proxy for wealth	1=cement, burnt bricks or stones and 0 otherwise	-
Farm size	Hectare (Ha)	+
Household has access to agricultural and market information	1=yes and 0 otherwise	+
Agro-ecological zones as a proxy for distance from forest	1= high land, 2=middle land and 3= low land	+
Presence of tress on farm	1=yes and 0 otherwise	+ or -

Table 3.3: Variables hypothesized to influence households' decision to sell NTFPs

Variable definition	Variable measurement unit	Expected sign
Dependent variable		
Households sold NTFPs between March 2015 and February 2016	1 = yes, 0 = otherwise	
Independent variables		
Age of the household head	Number of years	+ or -
Education of the household head	Numbers of years spent at school	+ or -
Occupation of the household head	1=Farming and 0 for off farm activities	+
The household head is male	1=yes and 0 otherwise	+
Household size	Total members in the households	-
Group membership	1=yes and 0 otherwise	+
Household has access to agricultural and market information	1=yes and 0 otherwise	+
Household has access to credit	1=yes and 0 otherwise	+
Agro-ecological zones as a proxy for distance from forest	1= high land, 2=middle land and 3= low land	+
Presence of trees on farm	1=yes and 0 otherwise	+
Road condition	1= good and 0= not so good	+
Source of NTFPs	1= forest and 0= farm	+ or -
Distance to nearest market for NTFPs	Continuous (kilometres)	-

3.7 Study Areas

The data for this study was collected in two districts in Eastern Uganda: Kapchorwa and Manafwa districts. Kapchorwa district is situated on the slopes of Mt Elgon in the Eastern region of Uganda (Figure 3.2). Therefore, it is characterized by a mountainous terrain. The district is bordered by

Kween district in the Northeast and Eastern part, Sironko district in the Southern part and Bulambuli district in the West and Northeast parts. A third of the area is public land that comprises Mt. Elgon National Park (NEMA, 2008). Manafwa district lies on the South-Western slopes of Mount Elgon and is bordered by Kenya to the East. The nearby town of Mbale serves as the administrative and trading hub of the sub-region. Kapchorwa and Manafwa districts population were estimated respectively at 104,580 and 352,864 respectively in 2014 (UBOS, 2014).

Agriculture is the primary economic activity in Kapchorwa and Manafwa districts. The area receives high rainfall and is characterized mainly by volcanic soil which is favourable for growing crops. The main crops are: maize, banana, beans, cassava, millet, cabbage, onions, tomatoes, sweet potatoes, sorghum, potatoes, soya beans and groundnuts. Many farmers keep livestock such as pigs, goats, chicken, and dairy cows, therefore animal manure is important for soil fertility. The main trees on farm are coffee, avocado, mango, passion fruit, jack fruit, orange, guava, and papaya (IUCN, 2008). Tree planting interventions in the area lead farmers to plant trees on farm. Some common tree species include natal fig (*ficus natalensis),* red gum (*eucalyptus grandis*), grevillea (*grevillea robusta*) and silk trees (*albiza coriaria*) (Wilson, 2015). The proximity of the districts to Mt Elgon national park suggests that forest resource utilization by the local communities is not new. The most commonly collected forest products are firewood, crop stakes and vegetables like mushrooms, bamboo shoots (Scott, 1994).

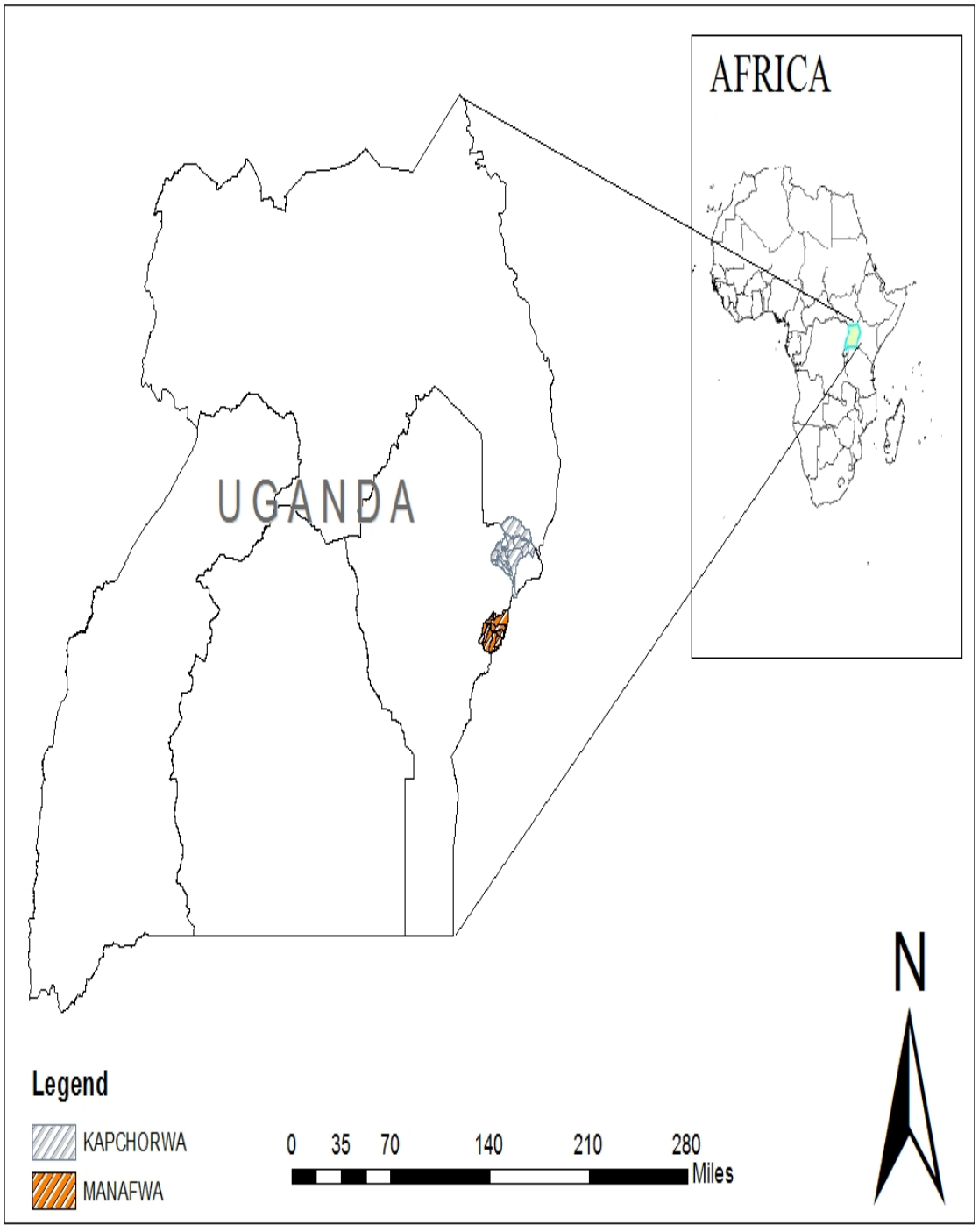

Figure 3.2: Map of the study area
Source: Google Earth

3.8 Sampling Design and Data Collection

3.8.1 Sampling Design

The sampling frame in this study is the household. Multistage sampling procedure was used to sample households in Kapchorwa and Manafwa districts. First, one sub county was randomly selected from each agro-ecological zones (the high land, middle land and low land) in each district. Random sampling was preferred because it allows statistical inferences. In Manafwa district the sub counties selected were Mukoto, Namabya and Butiru sub counties. In Kapchorwa district the sub counties selected are Tegeres, Kapsesombe and Kabeywa sub counties. Households in high and middle lands were expected to participate more in NTFPs collection. Projects promoting agroforestry focus more on the low land, hence households in this area were expected to produce NTFPs on farm. Therefore, the sub counties were chosen to ensure a representation of NTFPs collectors from the forest and producers on farm. Second, six villages were randomly selected from sub counties of Manafwa district and ten villages from sub counties of Kapchorwa district because of the small population size of the district. Finally, the lists of households in each village were provided by the chairman of each village. Simple random sampling was used to select households from the villages. The name of the household heads in each sub county was numbered and the table of random numbers was used to select those that appeared in the sample.

The sample size was determined using Cochran (1963) formula and following studies by Lehmann *et al.,* (2013) and Singh *et al.,* (2014) as shown below:

$$n_f = \frac{Z^2 pq}{d^2} \qquad (9)$$

Where:

n_f = the desired sample size when the population is more than 10 000. Kapchorwa and Manafwa districts population were estimated respectively at 104,580 and 352,864 in 2014 (UBOS, 2014).

p = proportion in the target population estimated to participate in NTFPs as collectors producers or sellers NTFPs

d = the level of statistical significance

q = 1 - p

Fisher *et al.,* (1983) recommend to use p = 50 percent when the standard deviation of the sample is not known like it is the case for this study and hence p = 50 percent was used for this study. It implies that the z-statistics is 1.96 and the desired level of statistical significance is 5 percent. The minimum sample size according to equation *(6)* was:

$$n_f = \frac{1.96^2 * 0.5 * 0.5}{0.05^2} = 384$$

Although calculated sample size was 384, the project financing this thesis covered a scope beyond this study and aimed for a bigger sample. Since the study covered two districts 350 households were surveyed in each district making 700 households. However, data from 67 households was finally dropped due to missing information from data collection. Therefore, the total sample size for this study came to 633 households with 321 households and 312 households in Kapchorwa and Manafwa districts respectively. Overall, about 42 percent of households sampled were located in the high land areas, approximately 35 percent and 22 percent were based in the medium and lowland agro-ecological zones respectively. Households located in the high land are nearer to the forest than households located in the middle and low land, the latter are the furthest from the forest.

3.8.2 Data collection procedure

Data collection was funded by World Agroforestry Center (ICRAF) through the project "Value chain innovation platforms for food security". A household survey was conducted to collect primary data between May and June 2016 in Kapchorwa and Manafwa districts. Cross sectional data was collected to identify factors that affect household participation in collection or production of NTFPs as well as factors that affect their decision sell their products. The factors considered include head of household's age, farm size, household size, gender, access to market information, distance of household's dwelling to the market, type of land tenure and source of NTFPs.

Ten enumerators were selected based on their level of education and trained for data collection. Enumerators with undergraduate degree in agriculture, experience with administration of questionnaires and ability to communicate in local languages were selected. The training involved explaining the objectives of the study, the meaning and implication of each question, interviewing skills, time management during interviews, recording of answers and ethical issues related to surveys. A total of 20 farmers were used to pre-test the questionnaires

3.8.3 Data analysis

The data collected was assessed to ensure that they were no missing information. Households with missing information were removed from the sample. To ensure that the assumptions of the econometric models are met heteroscedasticity and multicollinearity were tested for.

Test for Heteroscedasticity

Heteroscedasticity exists when the assumption that the variance of the error term is constant across the observation is violated (Greene, 2008). In this case standard errors are large leading to small t-

value. Test for the presence of heteroscedasticity was done by use of the Breusch-Pagan and Cook-Weisberg test. The specification tests of the null hypothesis, that the error term variances are not constant across the observations. The test was implemented using hettest command in STATA software version 13. The results of the heteroscedasticity test for household decision to participate in NTFPs or not as collector or producer are given below:

Chi^2 (1) = 3.37

Prob > Chi^2 = 0.06

Similarly, the results of the heteroscedasticity test for household decision to produce NTFPs on farm or to collect NTFPs from the forest are given below:

Chi^2 (1) = 9.32

Prob > Chi^2 = 0.00

For household decision to sell NTFPs the results are shown below:

Chi^2 (1) = 10.29

Prob > Chi^2 = 0.00

The chi-square value of 3.37 was small and was not statistically significant at 1 percent consequently the null hypothesis of constant variance of the error terms across observations was not rejected meaning that heteroscedasticity was not a problem. The chi-square values of 9.32 and 10.29 were large and were statistically significant at 1 percent consequently the null hypothesis of constant variance of the error terms across observations was rejected meaning that heteroscedasticity was a problem, therefore robust Probit model was used.

Test for Multicollinearity

Multicollinearity refers to the presence of linear relationships among the explanatory variables used in a model. In the presence of multicollinearity the model yields wrong signs of coefficients, high standard errors of coefficients and high R^2 value even when individual parameter estimates are not significant (Gujarati, 2003). The variance inflation factor (VIF) for each variable was assessed to check for multicollinearity using STATA software version 13. If the VIF of a variable exceeds 10, that variable is said to be highly collinear and can be excluded from the model. The results of the multicollinearity tests are presented in the appendix 1. The test showed that none of the variables of the three Probit models had a VIF greater than 10 indicating that there was no serious problem of multicollinearity among the explanatory variables. After all these tests; descriptive statistics and Probit models were used to achieve the specific objectives of the study using STATA software version 13.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics that affect Collection or Production of NTFPs by Households

4.1.1 Household and Farm Characteristics

About 59 percent of the respondents collect or produce NTFPs while 41 percent did not collect or produce (Table 4.1). The overall average age of the respondents was 44 years. A study on determinants of market participation for potato's farmers in Eastern Uganda by Sebatta *et al.,* (2014) revealed that the average age in a sample of 200 potatoes farmers was about 40 years which is similar to the result of this study. The mean age of NTFPS collectors was found to be 44 years and that of non-collectors was also 44 years meaning that the mean age between collectors of NTFPs and non-collectors were equal. The average number of years of schooling for the household heads was seven years, showing that majority of the households had acquired primary education. The average number of years of schooling of NTFPs collectors was found to be 7 years and that of non-collectors was also 7 years meaning that both collectors and non-collectors had equal level of education. This finding implies that both collectors and non-collectors in the study area are relatively young and have an acceptable level of human capital.

The average family has four members while the highest membership was 12 people for some households. Similarly the average family within collectors and non-collectors has four members. About eighty-eight percent of the households surveyed are headed by men while 20 percent are female headed. This is in line with the gender distribution in Uganda where about 77 percent of households are male-headed and 30 percent are female-headed (UBOS, 2016). About 90 percent of NTFPs collectors are headed by men while 10 percent are female headed. The explanation for

this is that women are less likely to take the risk of going to the forest as compared to men (Campbell, 1991).

Table 4.1 Socioeconomics characteristics of respondents

Variables	Collectors and producers (n = 372)	Non collectors (n = 261)	Total (N=633)
	Means		
Age (years)	44.5	44.3	44.4
Education (number of years)	6.9	6.7	6.8
Household size (number of persons)	4.5	4.1	4.3
Land size (acres)	2	1.9	1.9
	Percentages of farmers		
Gender of the household head			
Male	89.8	84.7	87.6
Main occupation			
Farming	82.1	80.6	81.9
Owns land			
Yes	98.7	96.2	97.4
Land tenure			
Customary	46.1	54.4	50.6
Access to credit			
Yes	8.4	7.2	7.9

Source: Survey data, 2016

About ninety-eight percent of households surveyed own land. This is consistent with the findings that in Uganda 85 percent of households in Eastern Uganda own land (UBOS, 2016). The majority of both NTFPs collectors (99%) and non-collectors (96%) owned land. The type of land tenure is half customary and half freehold hence half of the household surveyed did not possess the desired collateral by financial institutions. This justifies why only eight percent of the households surveyed have at least once gotten credit from either formal or informal financial institutions. The average land size in the total sample is about 2 acres. Similarly the average land size for NTFPs collectors

and non-collectors is also 2 acres. This means that farms in the study area are small confirming that farmers are subsistence farmers.

4.1.2 Main occupation of the respondents

About eighty-two percent of the households in the sample are involved in agricultural activities (Table 4.1). The majority of NTFPs collectors or producers (82%) and non-collectors (81%) are involved in farming activities. This is consistent with the national statistics of Uganda whereby in 2014, ninety percent of rural households were involved in agriculture (UBOS, 2016). Furthermore farmers have up to 11 crops on their farm. However, the majority of farmers have a minimum of 5 crops on their farms namely maize, beans, cooking banana, Irish potatoes and coffee. Maize was found to be the main cash crop, followed by coffee and cooking banana. The preference for maize may be due to dietary habit. Households who keep livestock have up to 8 types of livestock. The most commonly kept animals were dairy cattle and poultry. These results give evidence that farmers in the area of study rely more on incomes generated from crops and livestock selling.

4.1.3 Sources of non-timber forest products

The different sources of non-timber forest products are described in Table 4.2. Non-timber forest products that are sold in the market come from the forest and the farm. In terms of the quantity of NTFPs harvested, about 36 percent of the households rely mainly on the forest while 23 percent rely mainly on their farm and 41 percent do not collect or produce. Non-timber forest products collected on farm are produced through agroforestry practices. The main agroforestry practices adopted by the households are alley farming and farm forestry.

Table 4.2: Sources of non-timber forest products

Variable		Frequency	Percentage
Household produced and collected NTFPs from farm		372	58.7
	Forest	227	35.8
	Farm	145	22.9
Household did not collect or produce NTFPs		261	41.2

Source: Survey data, 2016

The average number of trees species on farm is two. Nevertheless, some have up to eleven trees species on their farm. A variety of trees species were planted and the main trees species on farm are *Eucalyptus sp, Persea Americana (*avocado trees*) and Chordia Africana*. This may be explained by the fact that International Union for Conservation of Nature (IUCN) has promoted the adoption of those trees species among others. But that does not seem to be a limitation in Uganda. Another reason that may explain the presence of trees on farm is that majority of the households has coffee intercropped with trees for different reasons including the need of for shed for coffee and windbreak.

4.1.4 Non-timber forest products collected from the forest or produced on farm

A number of non-timber forest products were collected from the forest and produced on farm (Table 4.3). A household could collect many NTFPs but Table 4.3 presents the main NTFPs collected by the households. Households harvest NTFPs such as firewood, fruits, bamboo shoot and honey from the farm. From the forest, the NTFPs collected include firewood, fruits, bamboo shoot, honey, herbs, beeswax, propolis, spices, mushroom and materials for basketry. More varieties of NTFPs are collected from the forest than the farm. The most important product collected from the forest and the farm is firewood. However, households prefer collecting firewood

from the forest to producing from their own farm. This finding is attributed to the households' free access to the forestland.

Table 4.3: Non-timber forest products collected grouped by site of collection

	On farm produced NTFPs (n=145)	Forest collected NTFPs (n=227)
	Percentages of households	
Firewood	56	51.6
Fruits	30.9	11.2
Bamboo shoot	2.4	7.5
Honey	8.3	9.9
Herbs	0.6	3.7
Beeswax	0	2.3
Propolis	0	0.3
Spices	0	1.5
Mushrooms	0.6	5.2
Materials for basketry	1.2	6.8

Source: Survey data, 2016

4.2 Household Socioeconomic Characteristics that affect market participation

4.2.1 Households Characteristics

About 40 percent of NTFPs collectors or producers sold their products during the study period (March 2015 and February 2016) (Table 4.4). The table shows that the mean age of NTFPs sellers was about 45 years while that for non-sellers was about 44 years. The results of the *t* test show that the age of the household head was not significantly different, indicating that the mean age between NTFPs sellers and non-sellers were almost equal. In terms of education of the household head, the results indicate that the average number of years of schooling for the market participants and non-participant was approximately 7 years. The two tailed *t* test results showed that education of the

household head was not significantly different, showing that market participants and non-market participants have almost the same level of education.

Table 4.4: Household characteristics

	Market participants (N=147)	Non participants (N=225)	Total collectors or producers (372)		
		Means		*t* -ratio	Sig
Age (years)	44.9	44.2	44.55	-0.42	0.67
Education (years)	6.7	7.1	6.9	1.09	0.27
		Percentage		*z* -ratio	Sig
Gender					
Male	91.8	88.4	90.1	-1.05	0.29

Source: Survey data, 2016

The results in table 4.4 show that among the households who collected or produced NTFPs, about 90 percent were male and 10 percent were female. Moreover among market participants about 92 percent were male and 8 percent were female. Among non-market participants, about 88 percent were male and 12 percent were female. The results of the proportion test (z) show the proportion of gender of the household head was not significantly different indicating that the proportion of male who sold NTFPs is equal to the proportion of male who did not sell NTFPs.

4.2.2 Other Characteristics

In terms of distance to nearest selling point, the results in Table 4.5 indicate that the mean distance to reach the market for the market participants and non-participants was approximately 7 kilometres. The *t* test results show that distance to nearest market was not significantly different

meaning the mean distance that separate NTFPs sellers and non-sellers to the market were almost equal.

Approximately 33 percent of households who collected or produced NTFPs reported that they have ever been a member of a farmer group. This can be explained by the fact that the groups do not always meet their expectations. This result is almost similar to the finding of the Uganda census of agriculture in 2009 where 17 percent of households in Eastern Uganda were reported to belong to groups. According to Davis *et al.,* (2010) the low membership in farmer groups in African countries may be explained by the lack of information and the low budgetary allocations to farmer institution development. Approximately 69 percent of households who were able to join groups were motivated by the fact that it helps them to increase their income. Therefore, fixed transaction costs faced by farmers are reduced. The majority of the groups are composed of men and women of different ages. It has been reported that the main services that the majority of groups offer is savings services. The results of the *z* test presented in table 4.5 shows that there was no difference between market participants and non-participants in terms group membership of the household head. It suggests that the proportion of NTFPs sellers who belong to groups is almost equal to the proportion on non-sellers who also belong to groups.

About twenty-eight percent of the NTFPs collectors had access to agricultural and market information mainly through radio, government extension agents and others farmers. Advice is received about crop production, natural resources management and market opportunities of NTFPs such as potential buyers and best prices for their products. In most of the cases the extension agents visit the households. In 2009, 19 percent of agricultural households surveyed reported that they had been visited at least once by extension agents (UBOS, 2011). One possible reason for that

might be the failure of the national programme entitled ‘operation wealth creation’ to take over the advisory services as planned. Instead it leaned toward input distribution. The program was established in 2002 and its objective is to facilitate socioeconomic transformation of household by raising their incomes to eradicate poverty. The results of the *z* test further show that, access to credit and agricultural information did not vary significantly between market participants and non-participants. This means that equal proportion have access to credit and agricultural information from the two groups.

About thirty-five percent of the NTFPs collectors or producers in the sample used permanent construction materials such as cement, burnt bricks and stones while others used mud, dirt, zinc and iron to build their wall (Table 4.5). Similarly, the Uganda national population and housing census reported that about 35 percent of rural households have built their walls with permanent materials (UBOS, 2016). This variable is a proxy for the standard of living of the households and the result gives evidence that majority of households have low standard of living. This result suggests that more developmental actions are required in the area of study. The results of the *z* test show that wealth status did not vary significantly between market participants and non-participants. This means that equal proportion of households were rich and poor (as shown by quality of construction materials) from the two groups.

Table 4.5: Comparing group membership, wealth status, infrastructure, access to information and credit among households

	Market participants (n=147)	Non participants (n=225)	Total collectors or producers (n=372)		
		Mean		*t* -ratio	Sig
Distance to nearest market (kilometres)	7.2	7	7.1	-0.49	0.62
		Percentages of households		*z* -ratio	Sig
Group membership					
Yes	36.7	28.5	32.6	-1.68	0.10
Access to market information					
Yes	29.3	26.6	27.9	-0.54	0.58
Access to credit					
Yes	10.8	7.6	9.2	-1.18	0.27
Permanent materials for wall construction					
Yes	37.4	32	34.7	-1.08	0.28
Road condition					
Not so good	99	99	99	-0.22	0.82
Source of NTFPs					
Forest	64.6	58.3	60.7	-1.37	0.17
				χ^2	
Agro-ecological zones					
High land	55.7	48	51.1	13.52***	0.00
Middle land	41.5	37.8	39.24		
Low land	2.7	14.2	9.7		

NTFPs: Non-timber forest products

*** Significant at 1 percent

Source: Survey data, 2016

About 56 percent, 42 percent and 3 percent of the market participants live in the highland, medium and lowland agro-ecological zones respectively (Table 4.5). About 48 percent, 38 percent and 14 percent of the non-participants live in the highland, medium and lowland agro-ecological zones

respectively. The results of the *z* test show that the proportion of households living in the different agro-ecological zones varied significantly between market participants and non-participants at one percent. It suggests that the majority of the households living in lowland do not sell NTFPs. Agro-ecological zones is also a proxy to access the distance to source of NTFPs meaning that households in lowland do not sell NTFPs because they are far from the main source of NTFPs which is forest. Table 4.5 also shows that among the market participants, almost 65 percent collected NTFPs from the forest while 35 percent collected them from the farm. Among the non-participants about 59 percent collected their products from the forest while 42 percent produced them on the farm. The results of the *z* test further show that the choice of source of NTFPs did not vary significantly between market participants and non-participants. This means that equal proportions choose forest and farm as source of NTFPs from the two groups.

4.2.3 Distribution of non-timber forest products sold by households

Among the 147 households that sold NTFPs, about 48 percent (70 households) sold NTFPs harvested on farm while 52 percent (77 households) sold NTFPs collected from forest (Table 4.6). A Household could sell many NTFPs but Table 4.6 presents the main NTFPs sold by the households. The results show that main NTFPs sold by households include firewood, fruits, bamboo shoot, honey, herbs produced on the farm and materials for basketry collected from the forest. Among those products firewood, fruits and honey are sold by most of the households. Barany (2003) also found that firewood is highly demanded because it is the main source of cooking energy used to convert food supplies into adequate diets in rural areas. Non-timber forest products are sold directly to individuals.

Table 4.6: Non-timber forest products sold by source of collection

	Households sold NTFPs produced on farm (n = 70)	Households sold NTFPs collected from the forest (n =77)
	Percentages of households	
Firewood	40.4	59.7
Fruits	39.7	19.4
Bamboo shoot	7.1	7.7
Honey	12.8	10.6
Materials for basketry		2.6

Source: survey data, 2016

4.3 Factors affecting households' decision to participate in NTFPs or not as collector or producer

Probit model was used to identify factors that affect the household decision to participate in NTFPs or not to participate as collector or producer (Table 4.7). The Probit regression fit the data well since the Wald Chi Square of 127.58 was significant at 1 percent and the log-likelihood had the right negative sign.

Wealth status of the head of household, access to agricultural and market information, as well as agro-ecological zones influence the households' decision to collect NTFPs. Older household heads are less likely to collect or produce NTFPs as compared to the younger household heads. For a unit increase in the age of the household head, the probability of collecting or producing non-timber forest products reduces by 4 percent. This may be due to the fact that younger household heads are motivated to collect NTFPs because it is source of income. Similarly McElwee (2008) also analyzed the socio-economic factors that affect forest use and found that the elderly people are less likely to collect or produce NTFPs because they may not have the strength to carry out forest-related activities.

Table 4.7: Result of the Probit model for the determinants of households decision to collect or produce non-timber forest products

Dependent variable: household participate or not in NTFPs as collector or producer during the study period (1= yes, 0= no)			
Variable description	Coefficient	Standard error	Marginal effect
Household head age (years)	-0.015*	0.001	-0.04
Household head education (years)	-0.03	0.005	-0.005
Household head occupation (1= farmer, 2= off farm)	0.245	0.050	0.013
Gender of household head (1= male, 0= female)	0.33	0.061	0.107
Household size (number)	0.094	0.009	0.312
Advanced material for wall construction (1= yes, 0= no)	-0.451**	0.053	-0.087
Farm size (acres)	0.092	0.013	0.006
Access to agricultural and market information (1= yes, 0= no)	0.24***	0.048	0.17
Middle land (1= yes, 0= no)	2.862***	0.075	0.383
High land (1= yes, 0= no)	3.217***	0.058	0.429
Constant	-1.246	0.335	
Wald Chi Square: 127.58 Log-likelihood: -348.18 Agro-ecological zones (base: Low land) NTFPs: Non-timber forest products * Significant at 10 percent ** significant at 5 percent *** significant at 1 percent			

Source: Survey data, 2016

Wealth status (materials used for wall construction) negatively affect households' decision to collect or produce NTFPs. Being wealthy reduces the probability of collecting or producing NTFPs by almost 9 percent. Sikei *et al.,* (2008) found that with improved economic wellbeing, households can afford to buy NTFPs from the market. Therefore the poor households in the communities are more likely to be involved in the economic activities related to NTPFs for their livelihood improvement (Fisher, 2004). Access to market information increased the household heads

probability of collecting or producing NTFPs by 17 percent. This may be because greater access to market information often accelerates collection or production of NTFPs that can be sold by households (Angelsen and Kaimowitz, 1999).

For a unit increase in the household size the probability of collecting or producing non-timber forest products increased by 30 percent. This may be because bigger households can be associated with the availability of labour for NTFPs collection or production. Similarly, a study conducted by Rodrigez (2007) on the determinants of NTFPs collection revealed that the presence of an additional individual in the household will increase household probability to collect NTFPs in India.

Agro-ecological zones positively affect a household's decision to collect or produce NTFPs. Residing in highland and middle land increases the probability of collecting or producing non-timber forest products by 43 percent and 38 percent respectively. Households based in high and middle agro-ecological zones are more likely to collect or produce NTFPs as compared to households in the lowland maybe because they are closer to the source of NTFPs as found by Opaluwa *et al.,* (2011) in Nigeria.

4.4 Factors affecting households decision to produce NTFPs on farm or to collect them form the forest

Probit model was used to identify factors that affect household head's decision to produce NTFPs on farm or to collect NTFPs from the forest; choice of the source non-timber forest products (Table 4.8). The robust Probit regression fit the data well since the Wald Chi Square of 96.54 was significant at 1 percent and the log-likelihood had the right negative sign.

Table 4.8: Result of the Probit model for the determinants of households decision to produce NTFPs on farm or to collect from the forest

Dependent variable: Household choose a source of NTFPs (1= produce on farm, 0= collect from the forest)			
Variable description	Coefficient	Robust standard error	Marginal effect
Household head age (years)	-0.015***	0.001	-0.004
Household head education (years)	-0.03	0.005	-0.006
Household head occupation (1= farmer, 2= off farm)	0.245*	0.050	0.094
Gender of household head (1= male, 0= female)	0.33	0.061	0.049
Household size (number)	0.094	0.009	0.023
Advanced material for wall construction (1= yes, 0= no)	-0.451	0.053	-0.087
Farm size (acres)	-0.092**	0.013	-0.033
Access to agricultural and market information (1= yes, 0= no)	-0.24***	0.048	-0.231
Access to credit (1= yes, 0= no)	-0.351	0.068	-0.053
Middle land (1= yes, 0= no)	2.862***	0.075	0.663
High land (1= yes, 0= no)	3.217***	0.058	0.731
Presence of trees on farm (1= yes, 0= no)	0.806**	0.053	0.081
Agro-ecological zones (base: Low land)			
Constant	-1.14	0.453	
Wald Chi Square: 96.54 Log-likelihood: -248.23			
NTFPs: Non timber forest products			
* Significant at 10 percent ** significant at 5 percent *** significant at 1 percent			

Source: Survey data, 2016

Household size, land size, age and occupation of the household head, presence of trees on farm and agro-ecological zones do influence the household choice of the source of non-timber forest products. For a unit increase in the age of the household head, the probability of collecting non-timber forest products from the forest reduces by 0.4 percent. This may be due to the fact that younger household heads have insecure tenure arrangements compared to older household heads, hence they have to rely on the forest. Moreover, in Uganda older household heads have large farms as compared to the younger household heads. Ndayambaje *et al.*, (2012) also found that in Rwanda that, age of the household head is strongly related to farm size. Therefore younger households who have small land size are less likely to plant trees on farm, and they are more likely to collect NTFPs from the forest.

For a unit increases in the land size the probability of collecting NTFPs from the forest over producing on farm will reduce by three percent. This may be because households adopt agroforestry practices when the size of their land is increases. Mukuralinda *et al.*, (1999) also found that small farm size is one the factors that limit farmers to plant trees or the intensity of tree planting. Therefore, when the size of land increases the reliance on forest may likely reduce.

Farmers are more likely to choose the forest as the source NTFPs over farm as compared to the household heads who are not involved in farming activities. Calculated marginal effects indicate that the state of being a full time farmer increases the probability of collecting non-timber forest products from the forest over producing them on farm by nine percent. This might be due to the fact that farmers are constrained by the size of their land to plant trees on farm hence they collect NTFPs from the forest because it is free.

Access to both agricultural and market information reduces the probability of collecting NTFPs from the forest over producing on farm by 23 percent. This may be explained by the fact that in the study area government extension agents in collaboration with private donors promote agroforestry practices in which 42 percent of the respondents are involved and hence they can produce NTFPs on their farm.

Having trees on farm increases the probability of collecting NTFPs from the forest over producing them from the farm by eight percent. This finding can be explained by the fact that household who have trees on farm also collect NTFPs from the forest in order to supplement the NTFPs produced on the farm. This result is in line with the descriptive statistics which reveal that most of the household heads that have trees on farm are still collecting NTFPs from the forest. This might be because access to the forest is free. Similarly, according to FAO (1985) as long as NTFPs can be collected from the forests without paying for it, farmers will not be motivated to harvest NTFPs from the farm. Another possible reason could be that households could be having young trees, which may not be ready for harvesting; hence they have to rely on the forest or the market.

Being a resident of high and middle lands, increase the probability of collecting non-timber forest products from the forest as compared to producing from the farm by 73 percent and 66 percent respectively. Households based in the high and middle agro-ecological zones are more likely to choose the forest as the source of NTFPs over farm as compared to households in the low agro-ecological zone. These results can be explained by the fact that households in middle and high lands are closer to the forest than those in the low land. Fisher *et al.,* (2005) and Vikram (2006)

also found that there is an inverse relationship between decision to choose a source of NTFPs and distance to the source of non-timber forest products.

4.5 Factors affecting households decision to participate in non-timber forest products market

About 40 percent of the households who collected NTFPs were selling NTFPs during the last agricultural year. Robust Probit regression was estimated and it fit the data well since the Wald Chi Square of 42.80 was significant at 1 percent and the log-likelihood had the right negative sign.

The result of the Probit model shows that presence of trees on farm, wealth status and agro-ecological zones like high and middle lands are significant at one percent, while head of household education and gender are significant at 10 percent. All those variables have the expected signs. However, some variables that are expected to be significant are not significant. A unit increases in the year of education reduces the probability of selling NTFPs by one percent. The possible explanation might be that households with a higher level of education are more likely to get white collar jobs. This observation is similar to findings by Musah *et al., (2014),* who argued that heads of households who spent more time at school are less likely to participate in maize market in Ghana. However, the results of this study contradicts the expectation of Randela *et al.,* (2008) who found that highly educated household heads were more likely to participate in the market since they are empowered with better production and managerial skills.

Table 4.9: Results of the Probit model for the factors affecting households' decision to participate in non-timber forest products market

Dependent variable: household participate in NTFPs market (1= yes, 0= no)			
Variable description	Coefficient	Robust standard errors	Marginal effect
Education of the household head (years)	-0.033*	0.007	-0.012
Age of the household head age (years)	0.01	0.027	0.023
Gender of the household head gender (1=male, 0=female)	0.376*	0.081	0.134
Household size (number)	-0.008	0.011	-0.003
Household membership in group (1= yes, 0= no)	0.130	0.060	0.049
Road condition (1=good, 0= otherwise)	0.371	0.256	0.13
Advanced material (1= yes, 0= no)	-0.4***	0.057	-0.153
Access to agricultural and market information (1= yes, 0= no)	0.187	0.064	0.071
Access to credit (1= yes, 0= no)	0.048	0.097	0.018
Middle land (1=yes, 0= otherwise)	1.087***	0.113	0.406
High land (1=yes, 0= otherwise)	1.121***	0.108	0.405
Source of NTFPs (1= farm, 0 = forest)	-0.108	0.063	-0.041
Presence of trees on farm	0.407***	0.057	0.148
Distance from homestead to market (kilometres)	0.004	0.004	0.001
Agro-ecological zones (base: Low land)			
Constant	-1.135	0.224	
Wald Chi Square: 42.8			
Log likelihood: -228.21			
NTFPs: Non-timber forest products			
* Significant at 10 percent ** significant at 5 percent *** significant at 1 percent			

Source: Survey data, 2016

Male headed households had 13 percent higher probability of selling NTFPs. In most cases, it is the males in a family who make the decisions on whether to sell most of the agricultural commodities and this seems to be the case even for NTFPs in the study area. This means that females are less likely to participate in the process of selling NTFPs. Related to that Sebatta *et al.,* (2014) and Demeke *et al.,* (2014) showed that women rarely had similar access to assets and markets as men, which led to different levels of participation in the markets. But male headed households were found to be less involved in maize market in Western Ghana (Musah *et al.,* 2014).

Being rich as shown by quality of construction materials; reduces the household probability to sell NTFPs by 15 percent. Similar result was found by Ndayambaje *et al.,* (2012) in Rwanda. However this result contradicts the finding of Kepe (2000), who found that in Zimbabwe wealthier households were more likely to sell NTFPs. Having trees on farm increases the probability of selling NTFPs by almost 15 percent. This suggests that trees on farm positively influences the decision to sell NTFPs. Ndayambaje *et al.,* (2012), found that selling of tree products could have a strong impact on the presence of trees on farms showing that the relation between the two variables are vice versa. Being a resident of high and medium agro-ecological zones increases the probability of selling NTFPs by 40 percent each. The possible explanation for this is that households in high and middle lands also collect NTFPs from farm apart from collecting them from the forest and therefore are likely to have more surplus than households in the lowland.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

In Uganda, rural households depend for their diverse needs on non-timber forest products collected from the forest, farm or bought from the market. Non-timber forest products (NTFPs) are forest-derived tradable products and they play an important role in improving household nutritional and economic status. Since the Eastern region continues to register poverty levels above the national average, it is likely that NTFPs selling can be one source of income which can help to reduce the level of poverty and improve the livelihood of the households in the study area. For this reason, one of the objectives of the Uganda Government is to develop markets for non-timber forest products (NDPII, 2015). However the majority of studies done on farmers' market participation in Uganda have concentrated on grain staple especially maize. Little attention has been given to NTFPs even though it is generally recognized that they contribute to household income generation in the study area (IUCN, 2008).

To increase the contribution of NTFPs to household livelihood, it is important to study the factors that affect households' decision to participate in NTFPs or not as collector and producer, their decision to produce NTFPs on farm or to collect them from the forest and their decision to participate in non-timber forest products market as seller or not. This is important given that this gap in knowledge prevented the Government from considering NTFPs as an avenue for poverty alleviation.

Since household's decision to sell non-timber forest products is contingent on their decision to collect NTFPs, the overall objective of this study was to assess the factors that affect household decision to participate in non-timber forest products market as sellers by collecting them from the

forest or producing them on farm in Eastern Uganda. The specific objectives were to identify the key factors that affect households' decision to collect NTFPs, to determine the factors that influence their choice of the source of NTFPs and to examine the key factors that influence their decision to participate in non-timber forest products market as sellers.

To achieve these objectives, primary data on socio-economic characteristics of rural households were collected in Kapchowa and Manafwa districts using a semi-structured questionnaire. The districts were selected because of their proximity to Mount Elgon national park and the diversity of tree planting projects in the area. A sample of 633 households was randomly selected through multistage sampling procedure. First, one sub-county was identified from each agro-ecological zones (high, middle and low land) in each district. Second, six villages were selected in every sub-county of Manafwa district and ten villages in every sub-county of Kapchorwa district because of the small population size of villages in that district. Finally, the lists of households in each village were provided by the chairman of each village and simple random sampling was used to select households from the villages. Descriptive statistics and Probit model was used to achieve the three objectives

5.2 Conclusion

Characteristics of households in the area of study

About 42, 35 and 22 percent of the households interviewed were located in the high land, middle land and low land respectively. About 59 percent of the households surveyed collected NTFPs from the forest or produced them on farm. Non-timber forest products collected from the forest or produced on farm include firewood, fruits, bamboo shoot, herbs, medicinal plants, beeswax, honey, propolis, spices, mushroom and materials for basketry. Of the 372 households that collected

or produced NTFPs, about 61 percent collected them from the forest while 39 percent produced them on farm. Moreover about 40 percent of NTFPs collectors or producers sold their products between March 2015 and February 2016. Non-timber forest products sold include firewood, fruits, honey and bamboo shoot.

The study found that only twenty percent of the households surveyed had land title implying that majority of households did not possess the desired collateral by financial institutions. This could explain why only eight percent of the households had access to financial services. Only twenty-three percent of the households had access to both extension services and market information in terms of the prices of NTFPs. Therefore effort should be made to avail technical knowledge to households especially on NTFPs harvesting technology and market opportunities using existing farmer groups. The mean distance to reach the market for crops and non-timber forest products was seven kilometres. Furthermore, majority of the households (70 percent) reported that the road conditions were bad. This means that households are constrained by long distances to urban market outlets as well as poor roads infrastructure.

Determinants of households decision to collect or produce NTFPs

The results of the Probit model showed negative significant influence of age and wealth status of the household heads on their decision to participate in NTFPs as collector or producer. Most importantly younger household heads are more likely to collect or produce NTFPs as compared to the older ones. It is concluded that younger household heads are motivated to collect or produce NTFPs because it is cheap source of income. Similarly, households considered to be richer (as assessed by type of construction material of wall of their houses) are less likely to collect or

produce NTFPs. It is then concluded that NTFPs are important for poor and young households in the area of study and they can improve their incomes through NTFPs selling.

The study also found positive and significant effect of access to market information and agro-ecological zones on the households' decision to participate in NTFPs as collector or producer. As expected households in the middle and highland are more likely to collect or produce NTFPs. This suggests that households' proximity to the collection site especially the forest is an important factor in the decision to collect or produce NTFPs. Household heads that have access to market information are more likely to collect or produce NTFPs as compared to households without. Therefore improving household access to market information will increase households' participation in NTFPs collection or production.

Factors affecting households' decision to produce NTFPs on farm or to collect them from the forest

This study confirms that farm size and access to extension services negatively affects the household heads' decision to choose the forest as the source of NTFPs over farm. Household heads with big land size prefer to produce NTFPs on farm than to collect them from the forest. It suggests a positive contribution of land size to households' decision to plant tree on their farm. Moreover, household heads that have access to extension services are less likely to collect NTFPs from the forest as compared to households without access to extension services. Therefore an improvement in the household access to extension services will increase households' participation in NTFPs production on farm.

The study found that occupation of the household heads, presence of trees on farm and living in high and midlands positively affect the household heads' decision to choose the forest as the source of NTFPs over farm. Farmers prefer to collect NTFPs from the forest than to produce them on farm. As expected, households that are closer to the forest prefer to collect NTFPs from forest even though they have trees on farm. It is then concluded that household who collect NTFPs from the forest and also produce them on farm are like to have more surplus of NTFPs that can be marketed.

Factors affecting household decision to participate in non-timber forest products market or not

The findings show significant effect of factors mainly, presence of trees on farm, agro-ecological zones, gender, education and wealth status of the household head on households' decision to sell NTFPs. Male headed households are more likely to sell NTFPs. As it is the case for most of the agricultural products, the decision to sell or not to sell non-timber forest products is done by male household heads. Less educated households are more likely to sell non-timber forest products too.

Household heads that have trees on farm are more likely to sell NTFPs compared to those who do not have. It is concluded that the presence of trees on farm increases the households' decision to sell NTFPs. Location of the household head is positively associated with the probability of selling NTFPs. Households based in the high and middle land are more likely to sell NTFPs because they have forest as a secondary source of NTFPs and therefore are more likely to have marketable surplus relative to household heads in the lowland.

5.3 Recommendations

The recommendation emerging from this study can be summarized as follows:

There is need for public enlightenment and awareness campaign on appropriate and sustainable forest extraction methods taking into consideration youth headed households from high and middle lands communities who largely depend on NTFPs from forestlands. This is important in order to sustain collection of non-timber forest products in the long term.

The management authorities of the Mount Elgon National park should redesign their resource user right policy by finding ways of limiting the number of NTFPs collection hours per week. That would help in the long run in encouraging the households to also produce more NTFPs from their farm or to start planting trees on their farm in order to supplement the quantity of NTFPs collected from the forest.

Extension services should promote tree species that are compatible with crops to maximize returns from small land sizes and encourage farmers with small land sizes to plant trees especially in high and middle land. This would result in mutual beneficial situation of enhancing their market participation for NTFPs and environmental conservation. Poor households should be encouraged to invest more in NTFPs extraction and selling in order to take advantage of the growing market for those products with high premium price. There is a need for concerted effort among policy makers, non-governmental organizations and other stakeholders towards improving female participation in NTFPs harvesting and marketing in the study area. This is necessary due to their low participation in NTFPs collection and selling.

Lastly, establishment of market outlets for NTFPs especially in lowland communities is highly recommended. This would largely increase the participation of more local people in non-timber forest products in the study area. As long as policies to improve commercialization of trees products is designed and implemented, trees planting on farm will increase, hence generating more surplus for the local markets. Government agencies should undertake market and marketing research to collect information that the households can use to plan marketing activities and develop delivery channels. Moreover, the development of appropriate technology to process raw NTFPs should also be encouraged. As topic for further research, the link between the development of NTFPs value chain and its impact on the livelihoods of farmers in Eastern Uganda needs to be explored beyond the current study.

6.0: REFERENCES

Achigan-Dako, E. G., Pasquini, M. W., Assogba Komlan, F., N'Danikou, S., Dansi, A., and Ambrose-Oji, B. (2010). Traditional Vegetables in Benin. Institut National des Recherches Agricoles du Bénin. Imprimeries du CENAP, Cotonou, 285 pp.

ActionAid (2012). *Women's rights in agriculture, Uganda*.

Adegbola, P., and Gardebroek, C. (2007). The Effect of Information Sources on Technology Adoption and Modification Decisions. *Journal of Agricultural Economics, 37 (1): 55 – 65.*

Adesina, A. A., and Chianu, J. (2002). Determinants of farmers' adoption and adaptation of alley farming technology in Nigeria. *Agroforestry systems*, 55 (2), 99–112.

Adesina, A. A., Mbila, D., Nkamleu, G. B., and Endamana, D. (2000). Econometric analysis of the determinants of adoption of alley farming by farmers in the forest zone of southwest Cameroon. *Agriculture ecosystems & environment*, 80 (3), 255–265.

Adhikari, B., Di Falco, S., and Lovett, J.C. (2004). House-hold Characteristics and Forest Dependency: Evidence from Common Property Forest Management in Nepal. *Ecological Economics 48: 245-257.*

Agea, J. G., Okia, C. A., Abohassan, R. A. A., Kimondo, J. M., Obua, J., Hall, J. and Teklehaimanot, Z. (2011). Wild and semi wild food plants of Bunyoro Kitara Kindom of Uganda: Growth Forms, Collection Niches, parts Consumed, Consumption patterns, Main gatherers and consumers. *Environmental Resources Journals*, 5(2): 74-86.

Agustino, S., Mataya, B., Senelwa, K., and Achigan-Dako, G. E. (2011). Non-wood forest products and services for socio-economic development. A Compendium for Technical and Professional Forestry Education. *The African Forest Forum, Nairobi, Kenya. 219 pp.*

Ahaibwe, G., Mbowa, S., and Lwanga, M. M. (2013). *Youth Engagement in Agriculture in*

Uganda : Challenges and Prospects. Kampala, Uganda.

Ahenkan, A. and Bonn, E. (2011). Improving Nutrition and Health through Non-timber Forest Products in Ghana

Alene, A. D., Manyong, V. M., Omanya, G., Mignouma, H. D., Bokanga, M., and Odhiambo, G. (2008). Smallholder Market Participation under Transactions Costs: Maize Supply and Fertilizer Demand in Kenya. *Journal of Food Policy, 33*

Alinyo, F., and Leahy, T. (2012). Designing Food Security Projects in Kapchorwa and Bukwo districts, Uganda. *Development in Practice,* 22(3), 334–346.

Angelsen, A., and Kaimowitz, D. (1999). Rethinking the Causes of Deforestation: Lessons from Economic Models. *The World Bank Research Observer 14: 3-98.*

Astewel, T. (2010). Analysis of Rice Profitability and Market chain: The Case of Fogera Woreda, South Gondar Zone, Amhara National Regional State, Ethiopia. An Msc. Thesis Presented to School of Graduate Studies of Haramaya University.

Barany, M. E. (2003). Non-timber forest products in the livelihood and coping strategies of households and communities affected by HIV/AIDS. Virginia Polytechnic Institute and State University.

Belem, B., Nacoulma, B., Gbangou, R., Kambou, S., Hansen, H. H., Gausset, Q., …and Boussim, I. J. (2007). Use of non wood forest products by local people bordering the“ Parc National Kaboré Tambi”, Burkina Faso. *Journal for Transdisciplinary Environmental Studies*, *6*(1), 18 pp.

Bellemare, M. F., and Barrett, C.B. (2006). “An Ordered Tobit Model of Market Participation: Evidence from Kenya and Ethiopia.” *American Journal of Agricultural Economics,* 88(20) : 324-337.

Bett, C. (2004). Farm level adoption decisions of soil and water management technologies in semi-arid Eastern Kenya. In *48th Annual Conference of the Australium Agricultural and Resource Economics Society*.

Bush, G., and Nampindo, S. (2004). The Value of Uganda's Forests: A Livelihoods and Ecosystems Approach. National Forestry Authority, Kampala.

Butler, E., & Kebba, A. (2014). *Youth and Agriculture in Uganda*. Washington, DC, USA.

Byers, A. L., Allore, H., Gill, T. M., and Peduzzi, P. N. (2003). Application of negative binomial modeling for discrete outcomes: A case study in aging research. *Journal of Clinical Epidemiology*, 56 (6), 559–564.

Campbell, J. (1991). Land or peasant? The dilemma confronting Ethiopian resource conservation. *Afr. Aff. 90, 5–21.*

CARPE (2001). Non-timber forest products: economics and conservation potential. Congo Basin. *Central African Regional Program for the Environment Information Series 10*. 4 p.

Chakravarty, S., Gosh, S. K., Surech, C. P., Dey, A. H., and Shukla, G. (2012). Deforestation: Causes, Effects and Control Strategies. *Global Perspective on Sustainable Forest Management*, p. 12.

Chalwe, S. (2011). Factors Influencing Bean Producers' Choice of Marketing Channels in Zambia. An Msc. Thesis Presented to the School of Graduate Studies of Zambia University.

Chandrasekharan, C. (1993). Issues involved in the sustainable development of Non-Wood Forest Products. Proceedings for the Expert consultation on NWFPs for English speaking African Countries, Arusha, Tanzania.

Chege, N. (1994). Africa's non-timber forest economy. *World Watch 7 (4):19-24.*

Chikamai, B., and Tchatat, M. (2004). Forest Management for Non-Wood Products and Services

in Africa. *A Report prepared for the Project: Lessons Learnt on Sustainable Forest Management in Africa. AFORNET, Nairobi.*

Chilundika, N. (2011). Market participation of bean smallholder farmers in Zambia: a gender based approach. A Research Report presented to the Department of Agricultural Economics and Extension Education of the University of Zambia.

Clifton, K. J., and Handy, S. L. (2001). Qualitative Methods In Travel Behavior Research.

Cochran, W. G. (1963). Sampling Techniques, 2nd Ed., New York: John Wiley and Sons, Inc.

Cunningham, A. B., and Mbenkum, F. T. (1993). Sustainability of harvesting Prunus africana bark in Cameroon: A medicinal plant in international trade. *People and Plants Working Paper.* Paris, UESCO.

Dabiré, A. B. (2003). Note analytique sur le Processus d'amélioration de la gouvernance et de l'application des lois dans le secteur forestier en Afrique. IUCN.

Dagsvik, J. K. (2004). Random Utility Models for Discrete Choice Behavior. Statistics Norway, Research Department. Oslo, Norway.

Dash, M., Behera, B. and Rahut, D. B. (2016). Determinants of household collection of non-timber forest products (NTFPs) and alternative livelihood activities in Similipal Tiger Reserve, India.

Forest Policy and Economics, vol. 73, pp 215-228

Davis, K., Nkonya, E., Kato, E., Mekonnen, D. A., Odendo, M., Miiro, R., and Nkuba, J. (2010). Impact of Farmer Field Schools on Agricultural Productivity and Poverty in Uganda. *IFPRI Discussion Paper 00992 June 2010.*

Demeke, L. B., and Haji, J. (2014). Econometric analysis of factors affecting market participation of smallholder farming in Central Ethiopia. *Journal of Agricultural Extension and Rural*

Development, 2(6), 94–104.

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 vol. 3(1)*

Douthwaite, B., Manyong, V. M., Keatinge, J. D. H., and Chianu, J. (2002). The adoption of alley farming and Mucuna: lessons for research, development and extension. *Agroforestry systems, 56 (3), 193–202.*

Dovie, D. B. K., Shackleton, C. M., and Witkowski, E. T. F. (2001). Valuing non-timber forest products - indicator for interplay between poverty, livelihoods and the environment. Proceedings: Open Meeting of the Global Environmental Change Research Community, Rio de Janeiro, October 6-8, 2001.

Enete, A.A., and Igbokwe, E.M. (2009). Cassava Market Participation Decision of Producing Households in Africa. *Tropicultura, **27**, 129-136.*

FAO (1985). Tree growing by rural people. Food and Agricultural Organization, Rome, Italy

FAO (1992). More than wood. Special options on multiple use of forests. *Forestry Topics Report No. 4.* FAO, Rome Italy.

FAO (1996). Domestication and commercialisation of non-timber forest products in agroforestry systems Non -Wood Forest Products 9. Food and Agricultural Organization, Rome, Italy.

FAO (2000). Forest, food security and sustainable livelihoods. Food and Agricultural Organization, Rome, Italy.

FAO (2003). Harvesting of the non-wood forest products. Rome: Food and Agriculture Organization of the United Nations.

FAO (2006) Global forest resources assessment. Progress towards sustainable forest management.

Food and Agriculture Organization of the United Nations Forestry Paper 147. Rome, Italy.

FAO (2015). Uganda country fact sheet on food and agriculture policy trends. Food and Agricultural Organization, Rome, Italy.

Feder, G., Just, R., and Zilberman, D. (1985). Adoption of Agricultural Innovations in Developing Countries: Economic Development and Cultural Change. *The University of Chicago Press, 33: 255-298.*

Fentanun, M.I., and Hager, H. (2009). Exploiting locally available resources for food and nutritional security enhancement: Wild fruit diversity, potential and state of exploitation in the Amahara Region of Ethiopia. *Food Security, 1: 207-219.*

Fisher, M., Shively, G.E., and Buccola, S. (2005). Activity choice, labor allocation and forest use in Malawi. *Land Econ 81(4): 503–517.*

Franzel, S., Wambugu, C., Nanok, T., Kavana, P., Njau, T., Aithal, A., Muriuki, J., Kitalyi, A. (2007). Production and marketing of leaf meal from fodder shrubs in Tanga, Tanzania: a pro-poor enterprise for improving livestock productivity. ICRAF Working Paper no. 50. Nairobi: World Agroforestry Centre.

Gebregziabher, D. (2010). Market chain analysis of poultry: The case of Alamata and Atsbi-Wonberta Woredas of Tigray region [on line]. Available at www.ipmsethiopia.org/content/.../FinalTHesis%20_DawitGebregziabher.pdf

Glover, E. K., Ahmed, H. B., and Glover, M. K. (2013). Analysis of Socio-Economic Conditions Influencing Adoption of Agroforestry Practices. *International Journal of Agriculture and Forestry, 3(4), 178–184.* http://doi.org/10.5923/j.ijaf.20130304.09.

Greene, W. (2008). Econometric Analysis; 6th edition. *Pearson International Edition, NJ, Prentice Hall.*

Gujarati (2003). Basic Econometrics. Fouth Edition. *Tata McGraw-Hill Publishing Company Limited, New Delhi.*

Haglund, E., Ndjunga, J., Snook, L., and Pasternak, D. (2011) Dry land tree management for improved household livelihoods: Farmer managed natural regeneration in Niger. *J Environ Manag 92: 1696–1705.*

Harsch, E. 2001. Making trade work for poor women. *Africa Recovery, vol. 15(4)*

Hedge, R., and Enters, T. (2000). Forest products and household economy: a case study from Mudumalai Wildlife Sanctuary, Southern India. *Environmental Conservation 27, 250–259.*

Hedge, R., Suryaprakash, S., Achoth, L., and Brawa, K.S. (1996). Extraction of non-timber forest products in the forest of Biligiri Rangan Hills, India. 1. Contribution to rural income. *Economic Botany 50, 243-251.*

Hlongwane, J. J., Ledwaba, L. J., and Belete, A. (2014). Analyzing the factors affecting the market participation of maize farmers: A case study of small-scale farmers in greater Giyani Local Municipality of the Mopani District, Limpopo Province. *African journal of agricultural research, Vol.9 (10), 895 – 899*, 6 March, 2014.

Hoskins, M., (1990). The contribution of forestry to food security. *Unasylva Vol. 41, No.1: 3– 13.*

Howley, P., Hynes, S., and Donoghue, C.O. (2012). *Explaining the non-economic behaviour of farm foresters: The effect of productivist and lifestyle motivations.*

IFAD (2008). Gender and non-timber forest products: Promoting food security and economic empowerment. International Fund for Agricultural Development. International Fund for Agricultural Development, Rome, Italy.

IFAD (2015). The State of Food Insecurity in the World 2015. Meeting the 2015 international hunger targets: taking stock of uneven progress. International Fund for Agricultural Development. International Fund for Agricultural Development, Rome, Italy.

Ita, P. B., and Offiong, E. (2013). ACCESS Non-Timber Forest Products for Food Security and Development in Nigeria. *American Journal of Social Issues and HUmanities*, *3* (July).

IUCN (2008). Securing the sustainability of the Mount Elgon forest ecosystem. International Union for Conservation of Nature.

Jagwe, J., Machethe, C., and Ouma, E. (2010). Impact of Transaction Cost on the Participation of Smallholder Farmers and Intermediaries in the Banana Market in Burundi, Democratic Republic of Congo and Rwanda. *African Journal on Agricultural and Resource Economics, 6:1.*

Jagwe, J.N. (2011). Impact of Transaction Costs on the Participation of Smallholder Farmers and Intermediaries in the Banana Markets of Burundi, Democratic Republic of Congo and Rwanda. Ph.D. Thesis (Agricultural Economics), University of Pretoria, Pretoria, submitted.

Jamnadass, R. H., Dawson I.K., Franzel, S., Leakey, R. R. B., Mithöfer, D., and Akinnifesi, F. K. (2011). Improving livelihoods and nutrition in Sub-Saharan Africa through the promotion of indigenous and exotic fruit production in smallholders' agroforestry systems: a review. *International Forest Review 13: 338 – 354.*

Jimoh, S. (2006). Sustaining the roles of non-timber forest products in rural poverty-Reduction and household food security in Nigeria. *Journal of Fisheries International, 63–69.*

Jones, B. (2009). Logit and Probit. Department of Political Science, University of California, Davis.

Kaggwa, R., Hogan, R., and Hall, B. (2009). *Enhancing Forests' Contribution to Growth, Employment and Prosperity. UNEP Poverty Environment Initiative.* Kampala, Uganda.

Kaimowitz, D. (2003). Forests and Rural Livelihoods in Sub-Saharan Africa. In *Forests in Poverty Reduction Strategies: Capturing the Potential, EFI Proceedings*, No. 47, Joensuu, Finland.

Kalu, C., and Rachael, E. (2006). Women in Processing and Marketing of Non-timber Forest Products: Case Study of Benin City, Nigeria. *Journal of Agronomy* 5(2): 326–331.

Kamanga, P., Vedeld, P. and Sjaastad, E. (2009). Forest incomes and rural livelihoods in Chiradzulu District, Malawi. *Ecological Economics, vol.68 (3): 613-624*

Kamara, J.N. (1986). Firewood energy in Sierra Leone: production, marketing and household use patterns. Studies No. 9, Hamburg, West Germany.

Kanabahita, C. (2001): Forestry Outlook Studies in Africa (FOSA). Uganda Forestry Department: Ministry of Water, Land and Environment.

Kar, S. P. and Jacobson, M. G. (2012). Market constraints in NTFP trade: household perspectives in Chittagong Hill Tracts of Bangladesh. *International Forestry Review, 14: pp 50–61.*

Kepe, T.V. (2002). *Grassland vegetation and rural livelihoods: a case study of resource value and social dynamics on the Wild Coast, South Africa*. PhD thesis, University of the Western Cape, Cape Town. p. 267.

Key, N., Sadoulet, E., and DeJanvry, A. (2000). Transactions Costs and Agricultural Household Supply Response. *American Journal of Agricultural Economics, 88 (2): 245-259.*

Kideghesho, J.R., Msuya, T.S. (2010). Gender and socio-economic factors influencing domestication of indigenous medicinal plants in the West Usambara Mountains, northern Tanzania. *Int J Biodivers Sci Manag 6(1/2): 3–12.*

Krantz, L. (2001). The sustainable livelihood approach to poverty reduction. Swedish International Development Cooperation Agency (SIDA).

Krause, M., Uibrig, H., and Kidane, B. (2007). Decision modelling for the integration of woody plants in smallholder farms in the central highlands of Ethiopia. *Journal of agriculture and rural development in the tropics and subtropics, 108 (1), 1–17.*

Leakey, R.R.B., and Jaenicke, H. (1996). The domestication of indigenous fruit trees: opportunities and challenges for agroforestry. *In: Proceedings of 4th International BIO-REFOR Workshop. Tampere, Finland, 15-26.*

Lehmann, N., Finger, R., Tommy Klein, T., and Calanca, P. (2013). Sample Size Requirements for Assessing Statistical Moments of Simulated Crop Yield Distributions *Agriculture* 2013, *3*, 210-220.

Mamo, G., Sjaastad, E., and Vedeld, P. (2007). Economic dependence on forest resources: a case from Dendi District, Ethiopia. *Forest Policy Econ. 9 (8), 916–927.*

Marshall, E., Newton, AC., and Schreckenberg, K. (2005). Commercialization of Non-Timber Forest Products: First Steps in Analysing the Factors Influencing Success. *IntFores Rev, 5: 128-135*.

Mbowa, S., Shinyekwa, I., and Lwanga, M. (2012). Dairy Sector Reforms and Transformation in Uganda since the 1990s. *Economic Policy Research Centre (EPRC) Research Report No. 4*. Kampala, Uganda.

McElwee, P.D. (2008). Forest environmental income in Vietnam: household socioeconomic factors influencing forest use. *Environ. Conserv. 35, 147–159.*

McFadden, D. (1974). Conditional Logit Analysis of Qualitative Choice Behavior in Zarembka. P. (ed.), Frontiers in econometrics. New York: *Academic Press.*

MEAAI. (2010). Making charcoal production in Sub Sahara Africa sustainable. The netherlands.

Mishra, S.N., Sharma, N., & Sharma, K. (1984). Participation and development. NBO Publishers' Distributors Delhi.

MoFPED. (2014). the Republic of Uganda Poverty Status Report 2014.

Moseley, W. G. (2012). Famine myths: five misunderstandings related to the 2011 hunger crisis in the Horn of Africa. *Dollars and Sense, 299, pp 17-21*

Muhammad, I., Khan, A., and Mitsuhiro, I. M. (2011). Identifying factors affecting agroforestry system in Swat, Pakistan. *Afr J Agric Res 6(11): 2586–2593.*

Mukuralinda, A., Ndayambaje, J.D., and Marara, J. (1999). Situation de l'agroforesterie au Rwanda apres 1994: Rapport d'enquete. Projet AFRENA-ECA, Butare.

Mulenga, B. P., Richardson, R. B., Mapemba, L., and Tembo, G. (2011). The Contribution of Non-Timber Forest Products to Rural Household Income in Zambia. *Working Paper No. 54, Food Security Research Project, Lusaka, Zambia (Vol. 2011).*

Mulenga, B. P., Richardson, R. B., Mapemba, L., and Tembo, G. (2013). Rural household participation in markets for non-timber forest products in Zambia**.** *Environment and Development Economics, vol. 19(4), pp 487 -504*

Musah, A.B., Osei-Asare, Y. B., and Wayo, S. (2014). Market participation of smallholder maize farmers in the upper west region of Ghana. *African journal of agricultural research, Vol. 9(31), 2427-2435*, 31 July, 2014

Ndayambaje, J.D., Heijman,W.J.M., and G.M.J. Mohren (2012). Household determinants of tree planting on farms in rural Rwanda. *Small-scale forestry, 11 (4), 1–32.*

NDPII (2015). Strenghtnening Uganda Competitiveness for Sustainable Wealth Creation, employement and Inclusive Growth. Second National Development Plan. *The Republic of*

Uganda Kampala, Uganda.

NEMA (2001). State of environment report for Uganda 2000-2001. National Environment Management Authority, Kampala, Uganda.

NEMA (2004). State of Environment Report. Kampala, Uganda.

Neumann, R. P., and Hirsch, E. (2000). Commercialisation of non-timber forest products: review and analysis of research. *Center for International Forestry Research*, (Bogor, Indonesia).

NSW. (2003). Farm Forestry Strategy for NSW.

Offiong, E. E. and Ita, P. B. (2013). Non-Timber Forest Products for Food Security and Development in Nigeria. *American Journal of Social Issues and Humanities, vol. 3(4)*

Ogden, C. (1990). Building nutritional considerations into forestry development efforts. *Unasylva Vol. 41, No.1: 20–28.*

Ogle, B.M. and Grivetti, L.E. (1985). Legacy of the chameleon. Edible wild plants in the Kingdom of Swaziland, southern Africa: a cultural, ecological and nutritional study. *Ecology of Food and Nutrition, in four parts: 16(3): 193–208, Parts II-IV: 17(11): 1–64.*

Okigbo, B.N. (1975). Neglected plants of horticultural and nutritional importance in traditional farming systems of tropical West Africa. *Acta Horticulturae, 53: 131–150.*

Okorio, J. (2006). Final report on status of forestry and agroforestry in the lower kagera, uganda. FAO Transboundary Agro-ecosystem Management Programme (TAMP). 40 pages.

Oladejo, J. A., Olawuyi, S., and Anjorin, T. D. (2011). "Analysis of Women Participation in Agricultural Production in Egbedore Local Government Area of Osun State, Nigeria", *International journal of agricultural economics and rural development,* vol 4 n01, 2011.

Olwande, J., and Mathenge, M. (2012). Market Participation among the Poor Rural household in Kenya. Tegemeo Institute, Egerton University, Kenya. *International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, Brazil, 18-24 August.*

Omiti, J. M., Otieno, D. J., Nyanamba, T. O., and Mccullough, E. (2009). Factors Influencing the Intensity of Market Participation by Smallholder Farmers: A Case Study of Rural and Peri-urban areas of Kenya. *Afjare 3 (1): 57-82*

Osmani, A. G., and Hossain, E. (2015). Market Participation Decision of Smallholder Farmers and Its Determinants in Bangladesh. *Economics of Agriculture, 62(1), 163–179.*

Patience Tugume. P., Buyinza, M., Namaalwa, J., Kakudidi, E. K., Mucunguzi, P., Kalema, J., Kamatenesi, M. (2015). Socio-economic predictors of dependence on Non-timber forest products: lessons from Mabira Central Forest Reserve Communities. *Journal of Agriculture and Environmental Sciences, Vol 4(2), pp 195-214*

Paumgarten, F. (2007). *The significance of the safety-net role of NTFPs in rural livelihoods, south africa, environmental sciences*. Rhodes University, Grahamstown, South Africa.

Pimentel, D. M., McNair, L., Buck, M., Pimentel, M., and Kamil, J. (1997). The Value of Forests to World Food Security. *Human Ecology 25: 91-120.*

Piya, L., Maharjan, K. L., Joshi, N. P. and Dangol, D. R. (2011). Collection and marketing of non-timber forest products by Chepang community in Nepal. *the journal of agriculture and environment, vol. 12*

Rademaekers, K., Eichler, L., Berg, J., Obersteiner, M., and Havlik, P. (2010). *Study on the evolution of some deforestation drivers and their potential impacts on the costs of an avoiding deforestation scheme*. Rotterdam, The Netherlands.

Randela, R., Alemu, G., and Groenewald (2008). Factors enhancing market participation by small-scale cotton farmers: *Agrekon 47:4.*

Rodrigez F.Z. (2007). Socio - economic determinants of Non-Timber Forest Products Collection. A case study among indigenous people in Karnataka, India. Universitat Autònoma de Barcelona, Spain.

Rungie, C. M., Coote, L. V., and Louviere, J. J. (2012). Latent variables in discrete choice experiments. *Journal of Choice Modelling, 5(3), 145–156.*

Rutto, J. K., Odhiambo, E. M., and Murithi, F. M. (2013). Determinants of market participation decisions in small ruminants' market by livestock keepers in Isiolo and Marsabit Districts, Kenya. Department of Agricultural Economics and Resource Management, Moi University.

Schreckenberg, K., Awono, A., Degrande, A., Mbosso, C., Ndoye, O. and Tchoundjeu, Z. (2006). Domesticating Indigenous Fruit Trees as A Contribution To Poverty Reduction. *Forests, Trees and Livelihoods, Vol. 16: 35–51.*

Scott, P. (1994). Assessment of Natural Resource Use by Communities from Mount Elgon National Park. *Technical Report No. 15.* IUCN unpublished.

Sebatta, C., Johnny, M., Enid, K., Apolo, K., and Kyomugisha, H. (2014). Smallholder Farmers' Decision and Level of Participation in the Potato Market in Uganda. *Modern Economy, 2014, 5, 895-906.* Published Online July 2014 in SciRes.

Shackleton and Shackleton, S. (2004). The importance of non-timber forest products in rural livelihood security and as safety nets: a review of evidence from South Africa. *Journal of Science. 26(2004):364-381.*

Shackleton, S., Paumgarten, F., Kassa, H., Husseelman, M., and Zida, M. (2011). Opportunities for enhancing women's economic empowerment in the value chains of three African non-timber forest products (NWFPs). *International Forestry Review*, special issue, 13 (2).

Shiferew, B.A., Obare. G., Muricho, G., and Silim. S. (2009). Leveraging Institutions for Collective Action to Improve Market for Smallholder Producers in Less – Favored Areas. *African Journal of Agricultural and Resource Economics, 3:1-18.*

Shillington, L. J. (2002). *Non-timber Forest Products, Gender, and Households in Nicaragua: A Commodity Chain Analysis. M.Sc. thesis, Virginia Polytechnic Institute and State University, Virginia. 103 p.*

Shone, B.M., Caviglia-Harris, J. L. (2006). Quantifying and comparing the value of non-timber forest products in the Amazon. *Ecological Economics 58, 249– 267.*

Shumsky, S. A., *Hickey*, G. M., *Pelletier, B. and Johns, T. (2014).* Understanding the contribution of wild edible plants to rural social- ecological resilience in semi-arid Kenya*. Ecology and Society, vol. 19(4): 34*

Sigei, G., Bett, H., and Kibey, L. (2014). Determinants of Market Participation among Small-scale Pineapple Farmers in Kericho County, Kenya. Egerton University, Kenya. *Munich Personal RePEc Archive, Paper No. 56149, posted 26. May 2014.*

Sikei, G., Mburu, J., Lagat, J. K. (2008). Household labor allocation to forest extraction and other activities in areas adjacent to tropical forests: the case of Kakamega forest, Western Kenya. *Int J Environ Workplace Employ 1(4):32–44.*

Singh, N. (2006). Women's Participation in Local Water Governance: Understanding Institutional Contradictions. *Gender, Technology and Development*. 10(1): p.61-76.

Soini, E. (2007). Land tenure and land management in the districts around Mount Elgon: An assessment presented to Mount Elgon Regional Ecosystem Conservation Programme (MERECP). *ICRAF Working Paper no. 49*. Nairobi, Kenya.

Sood, K. K., and Mitchell, C. P. (2009). Identifying important biophysical and social determinants of on-farm tree growing in subsistence-based traditional agroforestry systems. *Agrofor Syst 75:175–187*.

Springate-Baginski, O., Soussan, J.G., Dev, O.P., Yadav, N.P., and Kiff, E. (1999). Community Forestry in Nepal: Impacts on Common Property Resource Management. *School of Environment and Development, Series No. 3. University of Leeds, UK.*

Sunderland, T., Besong S., and Ayeni, J. (2003). Distribution, Utilization and Sustainability of Non-timber Forest Products from Takamanda Forest Reserve, Cameroon. *Smithsonian Institute/MAB Biodiversity Program*, Series 8. Washington D.C., USA.

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, vol. 12(13)*

UBOS (2009). Population Estimate, Uganda Bureau of Statistics, Kampala, Uganda.

UBOS (2010). Summary report on Uganda Census of agriculture 2008-2009. Kampala, Uganda.

UBOS (2011). Uganda Census of Agriculture (UCA) 2008-2009 at a glance. The Republic of Uganda.

UBOS (2016). The National Population and Housing Census 2014. Uganda Bureau of Statisitics, Main Report. Kampala, Uganda.

UMCA (2015). Training Manual for Applied Agroforestry Practices. University of Missouri Center for Agroforestry 203 ABNR Columbia, Mo 65211.

UNEP (2008). Non Timber Forest Products in Uganda. Retrieved April 26, 2016, from http://www.unep.org/training/programmes/Instructor

Van Dijk, J. F. W. **(**1999). Non-timber forest products in the Bipindi-Akom II Region, Cameroon: A socio-economic and ecological assessment. *Tropenbos-Cameroon Series*, 197 p.

Vikram, D. (2006). A microeconometric analysis of household extraction of forest biomass goods in Ranthambhore National Park, India. *J For Econ 12(2):145–163.*

Vojacek, O., and Pecakova, I. (2010). Comparison of Discrete Choice Models for Economic Environmental Research. *Prague Economic Papers* (Vol. 19).

Wilson, M. (2015). Agroforestry tree products , markets and decision making: a grounded theory study of smallholders' experience of market participation in Manafwa district, Uganda.

World Bank (2016). World Bank. Retrieved from: http://databank.worldbank.org/data/views/reports/tableview.aspx

Wynberg, R. (2004). Achieving a fair and sustainable trade in devil's claw. In Sunderland, T and Ndoye, O. (eds.). *Forest Products, Livelihoods and Conservation. Case Studies of Non-Timber Forest Product Systems. Volume 2 – Africa.*

Zegeye, T., Tadesse, B., Tesfaye, S., Nigussie, M., Tanner, D., and Twumasi. A. S. (2001). Determinants of Adoption of Improved Maize Technologies in Major Growing Region of Ethiopia. *Second National Maize Workshop of Ethiopia, 12 - 16 November, 2001.*

7.0: APPENDICES

Appendix 1: Results of the multicollinearity tests

Table 1: Variance inflation factors for explanatory variables used to model household decision to collect NTFPs

Variables	VIF
Age of household head	1.29
Education of household head	1.45
Occupation of household head	1.12
Gender	1.17
Household size	1.14
Farm size	1.24
Access to market information	1.16
High agro-ecological zone	2.00
Middle agro-ecological zone	1.86
Advanced material for wall construction	1.12
Mean VIF	1.29

Source: Author's computation

Table 2: Variance inflation factors for explanatory variables used to model household choice of the source of NTFPs

Variables	VIF
Education of the household head	1.40
Age of the household head	1.22
Occupation of the household head	1.04
Gender	1.08
Household size	1.20
Farm size	1.13
Access to market information	1.06
High agro-ecological zone	2.95
Middle agro-ecological zone	2.64
Advanced material for wall construction	1.18
Presence of trees on farm	1.10
Mean VIF	1.45

NTFPs: Non-timber forest products
Source: Author's computation

Table 3: Variance inflation factors for explanatory variables used to model household decision to sell NTFPs

Variables	VIF
Education of the household head	1.30
Age of the household head	1.23
Gender	1.13
Household size	1.18
Group membership	1.16
Farm size	1.23
Access to market information	1.16
Access to credit	1.15
High agro-ecological zone	3.95
Middle agro-ecological zone	3.64
Presence of trees on farm	1.09
Road condition	1.03
Distance to nearest market for NTFPs	1.08
Source of NTFPs	1.42
Mean VIF	1.51

NTFPs: Non-timber forest products
Source: Author's computation

Appendix 2: Survey questionnaire

Factors affecting households' participation in non-timber forest products market in Kapchorwa district, Uganda

The aim of this questionnaire is to gather information on household activities related to non-timber forest products and their socioeconomics characteristics. The non-timber forest products that this study is interested in are products such as bamboo shoot, honey, nuts, mushroom, fuelwood, materials for basketry. These products can be found in the forests or households can also produce them through agroforestry (trees planting on farm)

Confidentiality: All information collected in this survey is strictly confidential and will be used for statistical purposes only

Household Number _____

Date: (dd /mm /yy) **DATE**_____

Head of Household Name _____

Respondent Name _____

(***Instruction***: *Record the member number* ***(MEMID)*** *of the Respondent from the Demography table on page 2 after the survey is completed)*

Enumerator's name	
County	
District	
Division	
Location	
Sub location	
Village	

Section 1: Household socio-economic and demographic characteristics

A- Household demographics characteristics

We would like to make a complete list of household members. Can you give me the name of the household head, spouses, followed by the children and the other household members living in the house of each of the wives? **Please include anyone who has lived in one of the houses for at least 3 of the past 12 months, as well as any new HH member that has arrived less than 3 months ago but intends to stay (e.g. newborn)**

PERSON ID	**NAME**	**Sex** 1=M 2= F	What is the **relationship** of [NAME] to the head of the household? 1= Head 2= Spouse 3=Son or daughter 4= Grand child 5= Parent of head or spouse 6=Daughter-in-law 7=Sister or Brother of head or spouse 8= Nephew/Niece 9=Step child 10=Adopted child 11= Other relatives 12= Servant 13= Non-relative 14= Other (specify)	What **year** was [NAME] born? Indicate year of birth YYYY	*For persons 16 years and above* What is the present **marital status** of [NAME]? 1=Married monogamous 2=Married polygamous 3=Divorced or Separated 4= Widow or Widower 5= Single 999 = Not applicable	What is the highest **level** of **education attained** by [NAME]? See codes below	Is [NAME] **currently enrolled** in college or university? 1=Yes 2=No
01							
02							
08							

B- Households activities

Did the household produced non-timber forest products on his farm or collect them from the forest between March 2015 and February 2016? (In case the household is involved in both, ask the respondent to identify the main source of NTFPs)

1= production of NTFPs on farm 2= collection from the forest 0 = otherwise

List the activities in which you or any member of the household is engaged in. Rank the activities in order of importance (1, 2 and 3 being most important, important and least important respectively. What is the main reason for the assigned ranks?

Activity	**Rank**	**Reason for rank**
Crops production		
Non-timber forest products production		
Livestock production		
Collection of non-timber forest product from forests		
Non-timber forest products selling		
Agricultural products selling (other than NTFPs)		
livestock products selling		
Other off farm activities(specify)		

C- Land Ownership

C.1. Do you own land? 1=YES [……..] 0=NO […….]

C.2. If yes, what is the type of land ownership? (1=communal, 2= Individual or Private, 3=state-owned, 4=other (specify) _____

C.3. How many acres of land do the household own? _____

C.4. Who owns this field? (Use member's numbers from demographic table) _____

C.5. How many acres of land has the household rented? _____

C.6. What is the cost (Ush) of rent for the previous season (March 2015-February 2016)? _____

C.7. How many acres of land were under crops cultivation in the previous season (March 2015-February 2016)? _____

C.8. How many acres of land were under agroforestry practices in the previous season (March 2015-February 2016) _____

Section 2: Agroforestry practices in the households

Crop enterprises (use codes below)[1]	Reason	Quantity produced monthly	Unit

Non timber forest products from household farm

1. Did the household have trees on his farm?

_____ 1= yes 2= no

2. If yes what are the tree species you have on your farm? Please list in order of importance, where are they planted and three main products you derived from the trees.

Rank	Tree Species	Where planted[1]	Main products derived from trees (CODES)[2]		
			Product 1	**Product 2**	**Product 3**
1					
2					
3					

[1]1=along hedges, 2=intercropped, 3=homestead, 4=woodlot, 5=other (specify)

[2]1=building materials, 2=timber and poles, 3= fodder, 4=fruits, NTFPs (5=materials for basketry, 6= medicine 7=fuelwood, 8=bamboo shoots, 9= nuts 10= honey, 11= mushrooms, 12= Spices), 13=others (specify)

4. What are the **FIVE** main products that you had collected from your farm in the previous season (March 2015 – Feb 2016)? List the products in a ranked order and give reasons for the ranks assigned to the first five most important products.

Codes for products: 1=building materials, 2=timber and poles, 3= fodder, 4=fruits, NTFPs (5=materials for basketry, 6= medicine 7=fuelwood, 8=bamboo shoots, 9= nuts, 10= honey, 11= mushrooms, 12= Spices), 13=maize, 14=bananas, 15=beans, 16=coffee, 17=others (specify)

Section 3: Non timber forest products selling

1. Did this household sell non timber forest products between March 2015 and February2016? _____1= yes, 2= No
2. If yes, let's talk about them

NTFPs sold[1] (use codes below)	**Forms** 1=Processed 2=Unprocessed 3=Other (specify)	**Mode of sale** 1=Through farmer group 2=Individually	**Buyer type** 1=Small trader 2=Large trader 3=Exporter 4=Processor 5=Supermarket 6=NGO 7=Consumer 8=Broker 9=Other (specify)	**Why did you sell to this buyer?** 1=Only available 2=Better prices 3=Nearest 4=Contractual arrangement 5= Other (specify)	**Distance (KM) to this buyer**

1=Material for basketry, 2=fuelwood, 3= bamboo shoots, 4= nuts, 5= honey, 6=mushroom, 7= Spices

3. How many times did this household sell the following NTFPs per week between March 2015 and February 2016?

NTFPs	**Frequency of sale**
1=Fuelwood	
2= Bamboo shoots	
3= Nuts	
4= Honey	
5=Mushroom	
6= Spices	
7=Material for basketry	

Section 4: Household income

List all income generating activities that household members were involved in between March 2015 and February 2016

Person name (*As in demography table)*	Person ID (*As in demography table)*	Which **income earning activity(ies)?**	Months involved in the activity in the last 12 months	What was the monthly estimate of income (Ush) from this activity
Income generating activities: 1= crops selling, 2= livestock selling, 3= NTFPs selling, 4= boda-boda. 5= others				

Section 5: Household construction materials

Please provide information about the type of housing

Roofing material of the household's most important residence		1=straw/thatch, 2=mud, 3=wood or planks, 4=iron sheets, 5=asbestos, 6=bricks/tiles, 7=tin, 8=cement, 9=other
Wall material of the household's most important residence		
Floor material of the household's most important residence		
Number of rooms (minus kitchen and bathrooms)		

Section 6: Constraints faced by household

1. What are the three main constraints that you face in the production of non-timber forest products on farm?

NTFPs 1=Material for basketry 2=fuelwood 3= bamboo shoots 4= nuts 5= honey 6=mushroom 7= Spices	Production constraint 1	Production constraint 2	Production constraint 3
1=Lack of clean planting materials 2=Unfavorable weather 3=Lack of agronomic advice 4=High cost of inputs 5=High incidence of pests 6=High incidence of diseases 7=Lack of agronomic management skills 8=Other (specify)_____			

2. What are the three main constraints that you face in the collection of non-timber forest products from forest?

NTFPs variety code 1=Material for basketry 2=fuelwood 3= bamboo shoots 4= nuts 5= honey 6=mushroom 7= Spices	Collection constraint 1	Collection constraint 2	Collection constraint3

3. What are the four main constraints that you face in selling of non-timber forest products?

NTFPs variety code	Marketing constraint 1	Marketing constraint 2	Marketing constraint 3
1=Material for basketry 2=fuelwood 3= bamboo shoots 4= nuts 5= honey 6=mushroom 7= Spices			

Section 7: Access to agricultural and market information

What are your main sources of information on agricultural production and marketing? (*Rank in order of importance*)

FINFO1____ FINFO2_____ FINFO3_____

1=Government extension agents	*6=Newspapers*	*11=mobile phones*
2=Non-governmental extension agents	*7=Farmers' magazines*	*12=Private service providers*
3=Other farmers	*8=Input dealers*	*13=Research institutions*
4=Farmers organizations	*9=Field demonstrations*	*14=Commodity traders*
5=Radio	*10=Extension leaflets*	*15=Other (specify) _____*

Section 8: Transport services, road systems and other infrastructures

Pease provide information about transport services, road systems and other infrastructures that you have access to

Item description	Do you have a […….] in your community? _____ 1=Yes 2=No	What is the commonest mode of transport used to reach the nearest [……]? 1= Walking 2= Taxi (car) 3= Boda-boda 4= Bus/minibus 5= Motorcycle 6= Bicycle 7= Boat 8= Other (Specify)	How long does it take you to travel to the nearest […]? **TIME IN MINUTES**	What is the distance from your household to the nearest […..]? **KILOMETERS**	Is the road usable during rain seasons? 1=Yes 2=No
Tarmac					
Market for crop					

THANK YOU