

**PERCEIVED IMPACT OF CLIMATE VARIABILITY ON AVAILABILITY AND
UTILISATION OF NON-WOOD FOREST PRODUCTS AMONG RURAL
HOUSEHOLDS IN BAHI DISTRICT, TANZANIA**

MARIETHA MAUTA MASSIMBA

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ABSTRACT

Climate variability is currently one of the greatest environmental challenges facing humankind, whereby increased temperature and changing rainfall patterns are predicted to impact upon livelihoods in Tanzania. This study highlights the perceived impact of climate variability on availability and utilization of non-wood forest products (NWFPs) among rural households around the East Chenene Forest Reserve in Bahi District, Dodoma Region. The main objective of the study was to examine rural peoples' attitude on the impact of climate variability on availability and utilization of NWFPs. Specifically, the study focused on: (i) assessing the perceived changes in climate that happened in Eastern Chinene Forest (Mtungutu) from 1993 to 2013, (ii) identifying changes in NWFPs available in East Chenene Forest Reserve (Mtungutu) and (iii) assessing utilization of NWFPs among households in the face of climate variability. Participatory Research Approach mainly focusing on group discussions (FGD) and non-participatory approach; and household questionnaire survey were used to collect data. The Statistical Packages for Social Sciences (SPSS), both descriptive and inferential statistical were used to analyse the data collected through the questionnaire survey. Content analysis was used to analyse the data collected through FGD and key informants (KIs). The rural communities living near East Chenene Forest Reserve perceived that there was impact of climate variability on availability and utilization of NWFPs. They indicated that NWFPs decreased especially mushrooms, honey, wild animals, wild rope, and weaving materials. However, other NWFPs available, such as wild fruits (baobab and *tamarindus indica*), thatch grasses and wild vegetables were not badly affected by climate variability. Communities living around the Forest rely more on NWFPs for food, health and income especially during severe droughts and floods as compared to the past 20 years. In conclusion, climate variability

has affected the availability and utilization of NWFPs among rural communities in Bahi. There is a need for both private and government environmental activists to provide education and training on the impact of climate variability on NWFPs sustainable utilization.

DECLARATION

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

Marietha Mauta Massimba

M.A. (Rural Development)

Date

The above declaration is confirmed by

Dr. C. I. Nombo

(Supervisor)

Date

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DEDICATION

This work is dedicated to my lovely daughter Irene Joseph Machange and my family members, especially my mother Margareth Massimba and my elder brother Joseph Massimba.

TABLE OF CONTENTS

ABSTRACT	ii
DECLARATION	iv
COPYRIGHT	v
ACKNOWLEDGEMENTS.....	vi
DEDICATION.....	vii
TABLE OF CONTENTS.....	viii
LIST OF TABLES	xii
LIST OF FIGURES	xiii
LIST OF APPENDICES.....	xiv
LIST OF ABBREVIATIONS AND ACRONYMS	xv
CHAPTER ONE.....	1
1.0 INTRODUCTION.....	1
1.1 Background Information	1
1.2 Problem Statement	3
1.3 Justification of the Study.....	4
1.4 Objectives.....	5
1.4.1 General Objective.....	5
1.4.2 Specific objectives.....	5
1.4.3 Research Questions	5
1.5 Conceptual Frame Work	6
CHAPTER TWO.....	8
2.0 LITERATURE REVIEW.....	8
2.1 Definition of Key Concepts.....	8

2.1.1 Climate variability	8
2.1.2 Impacts of climate variability	8
2.2 Local Perception on Perceived Impact of Climate Variability on Non Wood Forest Products	9
2.3 Vulnerability	10
2.4 Availability of Non Wood Forest Products to Rural Household Communities	10
2.5 Utilization of Non Wood Forest Products and Types Used During Climate variability Effects	12
2.6 Perceived Climate variability Effects on Non Wood Forest Products Utilization	13
2.7 Non Wood Forest Products Utilization in Association to Perceived Impact of Climate Variability	15
2.8 Participation of Household Members in Utilization of Non Wood Forest Products in Climate variability	16
2.9 Climate Variability Effects on Non Wood Forest Products With Relation to Agricultural Activities	17
2.10 Previous Research on Impact of Climate variability in Other Fields Rather than Non Wood Forest Products Availability and Utilization	19
CHAPTER THREE	20
3.0 METHODOLOGY	20
3.1 Description of the Study Area	20
3.2 Research Design	23
3.3 Sampling Procedures and Sample Size	23
3.4 Data Collection Methods and Tools	23
3.4.1 Primary data collection	24
3.4.2 Secondary data collection	25

3.5 Data Analysis	25
CHAPTER FOUR	27
4.0 RESULTS AND DISCUSSION.....	27
4.1 Demographic Characteristics of the Respondents	27
4.1.1 Sex of household heads	28
4.1.4 Age	29
4.1.5 Education level	29
4.1.6 Household size	30
4.1.7 Occupations	31
4.1.8 Sources of Income in the households	32
4.1.9 Living period of the respondents in the study area	33
4.2 Peoples' perception on Climate variability Impacts.....	34
4.2.1 Perception of the respondents to climate variability impact	36
4.2.2 Perceive climate variability among surveyed wards	37
4.2.3 Climate variability impacts indicators.....	37
4.3 Non Wood Forest Products Availability in East Chinene (Mtungutu) Forest Reserve	39
4.3.1 Reasons why time and distance for searching Non Wood Forest Products increased.....	42
4.3.2 Time spent for Extracting NWFPs in different wards.....	43
4.4 Utilization of NWFPs among Household Experiencing Climate Variability Impacts	44
4.5 Participation of Households' Members on Activities Related with Non Wood Forest Products	46
4.5.1 Various Utilization of Non Wood Food Products among rural households	50

CHAPTER FIVE.....	52
5.0 CONCLUSION AND RECOMMENDATIONS	52
5.1 Conclusion.....	52
5.2 Recommendations	53
5.3 Recommendation for Further Research.....	54
REFFERENCES.....	55
APPENDICES	72

LIST OF TABLES

Table 1: Demographic characteristics of respondent	28
Table 2: Household source of income	33
Table 3: Peoples' perception towards climate variability	35
Table 4: Comparison of perception among surveyed wards	37
Table 5: Indicators of climate variability impact	38
Table 6: Availability of NWFPs during severe droughts and floods	40
Table 7: Utilization periods of NWFPs in household	45
Table 8: Involvement of Household Members in Non Wood Forest Products	
Activities	47

LIST OF FIGURES

Figure 1: Conceptual frame work showing causal and effect relationship among variables	7
Figure 2: A map of Bahi District showing the study wards and villages	22
Figure 3: Living period of the respondents in the area concern	34
Figure 4: Climate variability impacts indicators	39
Figure 5: The reasons why time and distance for searching NWFPs increased.....	43
Figure 6: Time used for searching NWFPs in the forest across wards	44
Figure 7: Various Utilization of NWFPs among rural households	51

LIST OF APPENDICES

Appendix 1: Questionnaire for head of the household.....	72
Appendix 2: Market interview guide for sellers of NWFPs.....	77
Appendix 3: Focus group discussion guides for participants.....	78
Appendix 4: Key informant interview guide	80

LIST OF ABBREVIATIONS AND ACRONYMS

BANET	Bahi Environmental Networking
CBOs	Community Based Organization
CCV	Climate Change Variability
CCVA	Climate variability Vulnerability Assessment
CFR	Chenene Forest Reserve
DCG	Drylands coordination groups
DONET	Dodoma Environmental Networking
FAO	Food and Agriculture Organization
FDG	Focus Group Discussions
IPCC	International Governmental Panel for Climate Change
ISDR	International Strategies for Disasters Reduction
IUFO	International Union of Research Organization
MEA	Millennium Ecosystem Assessment
MNRT	Ministry of Natural Resources and Tourism
MoEFF-GPRB	Ministry of Environmental and Forest government of People's Republic of Bangladesh
NAMSA	National Metrological Service Agency
NDUFR	New Dabaga Ulongomba Forest Reserve
NGOs	Non-Governmental Organization
NSGR	National Strategy for Growth and Reduction of Poverty
NTFPs	Non Timber Forest Products
NWFPs	Non Wood Forest Products
REDD	Reduced Emissions from Deforestation and Forest Degradation

SNAL	Sokoine National Agriculture Library
SPSS	Statistical Package for social Science
SSA	Sub Saharan Africa
SUA	Sokoine University of Agriculture
UNDP	United National Development Programme
UNFCCC	United National Framework Conversion on Climate variability
URT	United Republic of Tanzania
VEO	Village Executive Officer
WEO	Ward Executive Officer

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Non-Wood Forest Products (NWFPs) are defined as products of biological origin other than wood, derived from forests, other wooded land and trees outside forests (Kowero, 2011). NWFPs are both products and services. The products include the use of plants for food, vegetables, fruits, beverages, forage and medicine; animals, birds, reptiles and fish for food; fur, flowers, and feathers for decoration and clothing. Other products include honey, and silk. Services regarded as NWFPs include conservation, rituals and recreation.

NWFPs play a great role in the international market with over US\$1.1 billion worth in trade and about 80% of African rural poor households relying on them for nutritional and healthcare needs (Wall, 1998; FAO, 1999; Karki, 2001; Makonda and Gillah, 2007). IUFRO (2009) reported that temperature increase is projected to be higher in Africa than it will be in other continents, with greatest warming in semi-arid regions. NWFPs contribute substantially to national economic growth and international trade. In addition, wild plant resources contribute to an income of around US\$ 1200 per household per year in Southern Africa (Shackleton *et al.*, 2001). Likewise, Jimoh *et al.* (2007) reported that NWFPs have potential to contribute around 68% of the total monthly household income within Onigambari Forest Reserve, Nigeria. Forest assets represent important livelihood opportunities for many rural households by providing cash income, fuel and timber for building, valuable medicines, and an improved ground water supply (Barrow *et al.*, 2007). Most sub Saharan countries including Tanzania have been hit by successive droughts from the 1970s through the 1990s leading to serious deterioration and depletion of natural

resources (Hulme *et al.*, 2005). These climate variability in turn affect availability and utilization of NWFPs to the rural households. Climate variability is referred to as a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean or the variability of its teaching, and that persists for an extended period, typically decades or longer (IPCC, 2013). Totten *et al.* (2003) and IPCC (2001) argue that climate variability is currently one of the greatest environmental challenges facing humankind and Africa is predicted to suffer the most.

Most forests in Tanzania, both non-reserved and reserved ones for instance Chinene Forest, NWFPs species are depleted due to both climatic and human factors, (DCG, 2006). Most of the NWFP producing species have decreased in distribution, as well as in abundance, (Msalilwa, 2013). The total volume of the NWFPs produced is low due to climatic and human induced factors. Some of the valuable species have disappeared from most areas and the rural households are negatively affected. However, according to climate variability vulnerability assessment (CCVA, 2012). Climate variability is mostly evidenced by both extreme drought and amount of rainfall that may result into floods, cyclones as well as high evaporation.

In Tanzania, for example, rain-fed agriculture continues to be the backbone of the economy which accounts for half of the national income, contributing to three quarters of the exports, and is a source of livelihood for people (URT, 2001; Kashuliza *et al.*, 2002; Majule, 2008). Periodically, there has been a shortfall of rain pushing people to live off natural products such as honey, wild fruits, vegetables, roots, tubers and edible mushrooms (Hakonen *et al.*, 1995). Most forest dependent communities seek forest product alternatives during little, high rainfall or drought periods when agricultural

products are not enough to satisfy their basic needs. Increasing impacts of climate variability in particular drought and floods on agriculture have been associated with various adaptation and coping mechanisms (Gwambene, 2007). Many rural households and a number of urban communities collect and trade NWFPs in order to meet their food and nutritional requirements and other domestic needs. In Bahi District, forestry products such as timber, honey, and wax are among the prominent sources of the economy together with farming and livestock keeping. According to Majule *et al.* (2011), NWFPs might be affected by climatic changes such as an increase in temperature or changing rain patterns.

Many studies show that perception of local communities towards availability and utilization of NWFPs under climate variability has important role for their livelihood. (Agrawal *et al.*, 2008; Odjugo, 2010). For example, Majule *et al.* (2011), indicated that in most African countries local communities after having the perception on climate variability on NWFPs constructed various adaptation and mechanism for their livelihoods. Based on the literature on perception of local communities towards climate variability impact on NWFPs elsewhere, it is worth, therefore, to them in Tanzania. This study focused on perception of local communities towards impact of climate variability on NWFPs such as mushrooms, wild fruits and vegetables, honey and bee wax, bush meat, weaving materials for basketry and traditional medicines in Bahi.

1.2 Problem Statement

There is growing evidence that climate variability has impact on livelihoods of forests dependent communities (Chamshama *et al.*, 2009). Despite the existing body of knowledge on the impact of climate variability leading to various changes in different fields, many of the reviewed studies in Tanzania hinged on perception of communities'

towards Climate variability adaptation strategies taken and climate variability impact (Majule *et al.*, 2013), very few studies such as which have been done by (Msalilwa *et al.*, 2011) focused on the local peoples' perceptions of climate variability and the change in use pattern of NTFPs as a response to perceived change and to develop and sustain adequacy in national capacity to participate in climate variability initiatives and address effects and challenges of Climate variability with particular emphasis to REDD initiatives respectively. Little is known on perceived impacts of climate variability on availability and utilization of NWFPs in Bahi District. This study focused specifically on perceived impacts of climate variability on availability and utilization of NWFPs in East Chenene Forest Reserve and not non timber forest products (NTFPs) as previous studies have been done. Equally, some studies done in Tanzania (Msalilwa *et al.*, 2011; Majule *et al.*, 2008) have focused on peoples' perceptions on climate variability and the change in use pattern of NTFPs as a response to perceived change. However, they have not explored the perceived impact of availability and utilization of NWFPs.

The government and other stakeholders have introduced various interventions to counter adverse effects of climate variability on the livelihoods of forests dependent communities, including those depending on NWFPs in Bahi District. Despite the various interventions, it has been proved that NWFPs in Bahi District has been declining, for instance honey and mushroom products. Based on the reviewed literature, this study goes beyond to most previous studies by examining the perceived impacts of climate variability, specifically on availability and utilization of NWFPs which are used as open public resources.

1.3 Justification of the Study

Perception of local communities towards the importance of climate variability on availability and utilization of NWFPs for the livelihoods of themselves is important (Majule *et al.*, 2008; Majule *et al.*, 2005; Kangalawe *et al.*, 2005). This has been observed

in various places in the world (Yanda *et al.*, 2005; Liwenga, Mary *et al.*, 2003), with exception of Bahi Districts. This study is therefore worth to be undertaken. This study is in line with Cluster 1 of the National Strategy for Growth and Reduction of Poverty (NSGRP) II, aiming at ensuring food and nutrition security, environmental sustainability and Climate variability adaptation and mitigation (URT, 2010). The knowledge gained from this study serves as an information tool for implementing development programmes for Climate variability adaptation and mitigation to policy makers and local communities relying on NWFPs.

1.4 Objectives

1.4.1 General objective

The general objective of the study was to examine the perceived impacts of climate variability on availability and utilization of NWFPs.

1.4.2 Specific objectives

Specifically, the study intended:

- i. To assess peoples' perception towards variability in climate among rural households in East Chinene Forest Reserve (Mtungutu) from 1993 to 2013;
- ii. To identify the changes in NWFPs availability in East Chenene Forest Reserve; and (Mtungutu)
- iii. To assess utilization of NWFPs among households in the face of climate variability.

1.4.3 Research questions

1. What are peoples' perception on impacts of climate variability on NWFPs availability and utilisation in East Chenene Forest Reserve since 1993-2013?

2. What are the changes of NWFPs that have been realised in East Chenene Forest Reserve as a result of climate variability?
3. How utilisation of NWFPs has been affected by climate variability impacts in East Chenene Forest Reserve?

1.5 Conceptual Frame Work

The conceptual framework in Fig. 1 shows relationship between the independent variable which is climate variability be evidenced by either changes in rainfall pattern, temperature, relative humidity, Vegetation cover and Prolonged dry periods which may affects the quality and quantity of non-wood forest products utilized such as honey and bee wax, mushrooms, weaving materials, wild fruits and vegetables, traditional medicines. Also, other household characteristics may be assessed to whether they have effects to utilization of NWFPs in term of quantity, quality and price.

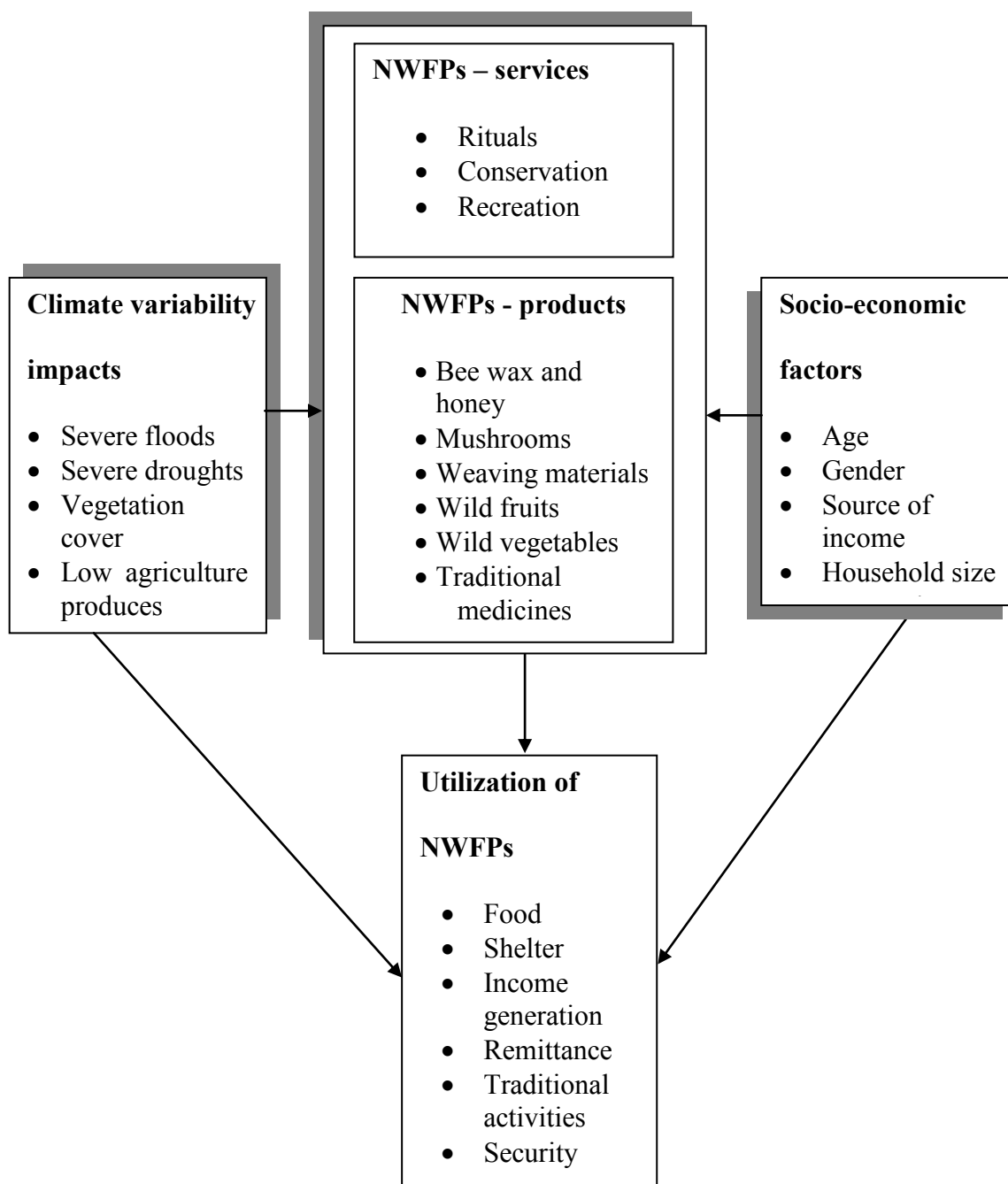


Figure 1: Conceptual frame work showing causal and effect relationship among variables. (Modified from MEA 2005).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Definition of Key Concepts

2.1.1 Climate variability

Climate variability refers to any long-term significant change in the “average weather” that a given region experiences (Ngaira, 2007). It involves changes in the variability or average state of atmosphere over duration ranging from decades to millions of years. These changes can be caused by dynamic process on earth, external forces including variations in sunlight intensity and more recently by human activities. The term climate, therefore, can be thought of as a long-term summary of weather conditions, taking account of the average conditions as well as the variability of these conditions, including the fluctuation that occurs from year to year, and the statistic of extreme conditions such as severe storms or unusually hot seasons. All these refer to climatic variability (ISDR, 2008).

2.1.2 Impacts of climate variability

Ishaya *et al.* (2008) asserted that, Climate variability is an environmental, social and economic challenge that impacts on a global scale. Climate variability can be exacerbated by human induced actions such as: the wide spread use of land, the broad scale deforestation, and the major technological and socioeconomic shifts. As defined by World Bank (2008) impact refers to the way a human or natural system reacts to Climate variability. Often, reference to impacts refers also to secondary and tertiary consequences. For example, climate variability can result in less rainfall, which will inhibit crop growth. This is either because it means less water falling on plots, less groundwater recharge, or

less water in streams from which water is taken to irrigate crops. The secondary consequences of this are less crop product, which can lead to economic difficulties or hunger.

A study done by Abaje *et al.* (2007) revealed that, the most devastating adverse impacts of climate variability in Nigeria and other subtropical countries include frequent drought, increased environmental damage, increased infestation of crop by pests and diseases, depletion of household assets, increased rural urban migration and increased biodiversity loss. Others include depletion of wildlife and other natural resource base, changes in the vegetation type, decline in forest resources, decline in soil moisture and nutrients, increased health risks and the spread of infectious diseases and changing livelihood systems.

2.2 Local Perception on Perceived Impact of Climate Variability on Non Wood

Forest Products

According to MoEF- GPPB (2005), people in Nawabganj and Naogaon Districts of Northern Bangladesh hold various perceptions towards the current and past risks in the study area. People perceive that the current climate in the area has been behaving differently from the past years. Production of the varieties of crops has been affected due to variations in rainfall, temperature and drought occurrences.

Furthermore, Deressa *et al.* (2008) analyzed the perception of farmers to Climate variability in the Nile basin of Ethiopia. The study indicated that most farmers for this study were aware of the fact that temperature is increasing and the level of the precipitation is declining. To obtain information on their perception to climate variability,

farmers were asked two set of questions. The first was asking them if they had observed any change in amount of temperature or rainfall over the past twenty years. The second set consisted of asking them if the number of hot or rainy days increased or decreased over the past twenty years. The responses from the farmers were in line with the Ethiopia's National Metrological Services Agency (NAMSA) report of 2001 which depicted an increasing trend in temperature and decreasing trend in precipitation.

2.3 Vulnerability

UNDP (2004) defines vulnerability as a human condition or process resulting from physical, social, economic and environmental factors, which determine the likelihood and scale of damage from the impact of a given hazard. According to Yamin (2005), the disaster community defines vulnerability as the conditions determine by physical, social, economic and environmental factors or process, which increase the susceptibility of a community to impact of hazard. A study by Deressa (2007) revealed that, in Ethiopia the level of vulnerability of social groups to climate variability is determined both by socioeconomic and environmental factors.

2.4 Availability of Non Wood Forest Products to Rural Household Communities

The majority of the rural communities depend heavily on forest products for their livelihoods both wood and NWFPs. A study by Monela *et al.* (2000) as reported by MNRT (2009) concluded that sampled households in Dodoma and Morogoro regions derived more than 50% of their cash income from sale of forest products, such as charcoal, honey, wild fruits and firewood, with the peri-urban households deriving almost 70% of their cash income from the woodlands. Increasing agricultural production costs in relation to product prices and increasing living costs in general have pushed people to exploit more

intensely forests, particularly on the general lands, to generate cash income. Miledge *et al.* (2007) reported that forests support the livelihoods of 87% of the rural poor. The importance of commercial NWFPs to livelihood strategies of rural people is increasingly recognized in recent times (Larsen *et al.*, 2000). In the tropics, the NWFPs are the important source of livelihoods to rural communities particularly for their food, medicines, and raw materials for house construction as well as firewood consumption (Martin, 1995; Wollenberg, 2000; Wollenberg *et al.*, 1999).

Non Wood Forest Products are goods of biological origin derived from forests, wooded lands and trees outside forests. The modern scope of forestry is being reported to have expanded, reflecting the fact of the importance of many non-wood forest products which has increased, leading to new interfaces with related disciplines (Tanzania country report (FAO, 2000). Non wood forest products (NWFP) play a crucial role in the daily life and welfare of people all over the world. They cover a wide range of food, fodder, fibre, fertiliser, organic construction materials, non-wood lingo-cellulosic products, natural dyes, tannins, gums, resins, latex and other exudates, waxes, essential oils, spices, edible oils, medicinal extracts, python-chemicals, aroma-chemicals, decorative articles, horns, bones, pelts, plumes, hides and skins. Forest assets represent important livelihood opportunities for many rural people, providing cash income, fuel and timber for building, valuable medicines, and an improved ground water supply (Barrow *et al.*, 2007).

A large number of NWFPs appears to be rudiments of varying medicines, perfumes, suns lotions, nail polish, mouth wash, hair butter, breakfast cereals, golf balls, paints, insecticides, fungicides, and host of others. Wild plants are an important source of edible fruits, leafy vegetables, and herbs, and are particularly important in ensuring food security

and maintaining the nutritional balance in peoples' diets (Falconer, 1994; FAO, 1995). NWFPs are used as alternatives of food stuffs especially in drought and floods which end up to famine, wild plants become essential to human survival, and at other times they both prevent the need for cash expenditure and provide a source of income to cash-poor households (Guijt *et al.*, 1995; Cunningham *et al.*, 2002).

2.5 Utilization of Non Wood Forest Products and Types Used During Climate variability Effects

According to (Dako *et al.*, 2011), in many years early man's interaction with and dependence on the forests was almost exclusively centred on non-wood forest a product which is still occurring to many rural communities today. However, most of the Forest management systems consider NWFPs as secondary while trees are primary due to man's dependence on forests and trees. It is therefore important to understand the broad range of products and services from the forests, trees and woodlands. There are many types of NWFPs, including shrubs, wild fruits and wild vegetables, mushrooms, bush meats, honey and bee wax, weaving materials for basketry and thatches. About 70% of species used as vegetable are gathered from the wild according to an inventory study in Benin Dako *et al.* (2010). The utilization of NWFPs is expected to be shifted due to Climate variability effects.

NWFPs are used as medicine in diet such as wild fruits and vegetable, some honey hence the demand and supply increased. A variety of NWFPs worldwide are used either directly or as supplements of human food and animal fodder, i.e. honey, mushrooms, fruits, nuts, tubers, bush meat, medicine and construction materials. The importance of NWFPs is related to three main groups (Chikamai *et al.*, 2004). Firstly, NWFPs are particularly

important to forest-dwellers and rural communities who use the products for livelihood support, or social and cultural purposes; Secondly, to the urban consumers, and thirdly to the traders/product processors. There are also other uses of NWFPs such as farm tools and implements, household baskets, mats, pillows, tanning materials, sponges and brooms (FAO, 1995; Arnold, 1995).

2.6 Perceived Climate variability Effects on Non Wood Forest Products Utilization

According to Boon *et al.* (2011), Climate variability is perceived in terms of changes in rainfall pattern and prolonged dry Seasons. Perceived climate variability is the situation where by local people are aware with series of years respectively to variability of rainfall, temperature and relative humidity with comparison to yearly production. Climate variability refers to a change in state of climate that can be identified (using statistical test) by changes in mean and or variability of its properties that persist for extended period typically a decade or longer. Indicators of climate variability are temperature increases, varying rainfall patterns, sea level rise, rapidly change seasons, ocean acidification, glacial melting and more extreme weather events such as storms, floods, drought and heat waves. A study by Ngana (1983) on drought and famine in Dodoma District indicated that the presence of dry spells in critical periods for most crops contributed considerably to crop failure and famine. This means Climate variability can make rural people to opt for NWFPs so as to replace agricultural products.

Most scientists study on the potential impact of climate variability have predicted that Africa is also likely to experience the Climate variability all of which could affect much of its population. Sub-Saharan African (SSA) is viewed to be particularly vulnerable to Climate variability, especially changes in rainfall (Majule, 2000; IPCC, 2007). Several

factors contribute to this vulnerability, among other things, a large rural population highly dependent on rain-fed agriculture coupled with structural problems of chronic poverty, food and livelihood insecurity and socioeconomic and political inequality (IPCC, 2007). Coping with and adapting to climate variations is not a new phenomenon for farmers in SSA, indeed it has been an ongoing process for centuries (Majule *et al.* 2002). Moreover rural people try to diversify their economic activities from pastoralist and agriculture to NWFPs activities which are their only hope since NWFPs are not all severely affected by climate variability.

Some literature on the effects of climate variability on NWFPs utilization among rural household though consider other factors like household size, income level, distance and gender and they excluded climate variability. It is widely recognized that climate variability has caused substantial impacts on forest ecosystems (Parmesan *et al.*, 2003; Kirilenko *et al.*, 2007). While on the other hand Climate variability literature indicates that effects of Climate variability including variation in temperature and rainfall, drought, floods, heat waves, hurricanes and typhoons have already occurred across the world; affecting countries, income groups and occupations differently (Chaudhary *et al.*, 2009; Intergovernmental Panel on Climate variability (IPCC), 2007).

The negative effects of climate variability are more severe in sub-Saharan Africa, including Tanzania (Cline, 2007; Haque, Yamamoto and Sauerborn, 2012). According to Msalilwa *et al.* (2013), the general perception is that the NWFPs are becoming scarce. For example, villagers say that due to the change in rain patterns mushrooms were nowhere to be found in the rainy season in Kilolo, even though they were collected in plenty 30 years ago. While in real situation little is known about the local perceptions of Climate

variability and real change by communities living around East Chenene Forest Reserve (Mutungutu). The role of NWFPs as climate variability adaptation strategy and other coping strategies by the communities in the study area is not well known and documented.

2.7 Non Wood Forest Products Utilization in Association to Perceived Impact of

Climate Variability

In the study done by Brown *et al.* (2005), it is revealed that most utilization of NWFPs are taken as coping strategies to climate variability, and that differs with time and location. good example is that of Mbitini in 1951 where the sale of sisal dominated as a coping strategy and in Saweni where they ate indigenous fruits, engaged in casual labour and received American aid, while wild tubers were the means of survival in 1992 Therefore people adopted different coping strategies to overcome climate variability due to the experiences and the surroundings they live in. Moreover rural people in different areas in Tanzania seek on different opportunities to cope with climate variability for instance, the use of NWFPs in household is the common alternative chosen by people to survive during food shortage.

The need for forest resources conservation and securing livelihoods of the rural communities has prompted change from government controlled management to involvement of communities (Adhikari *et al.*, 2004; Agrawal and Gibson, 1999). Many developing countries in the world are pursuing some forms of decentralized forest management (FAO, 1999), which involve local people. NWFPs need special attention of the community to be addressed effectively. In Tanzania, traditional by-laws, rule and regulations have been formulated such as Ngitili in Shinyanga. The majority of the forest dependant people have less opportunity to cope effectively with the adversities of climate

variability due to low capabilities, poverty, weak institutional mechanisms and lack of access to resources (Shackleton *et al.* 2004).

NWFPs are generally most extensively used to supplement diets and household income, notably during particular seasons in the year, and to help meet medicinal needs. NWFPs are also widely important as a subsistence and economic buffer in hard times. There is growing evidence that climate variability is impacting on forests and forest ecosystems (Mukhopadhyay, 2009). Thus need for Tanzania to think of adaptation and mitigation measures and include them through mainstreaming the existing development policies. Moreover, Dodoma region in Tanzania is among the regions severely affected by failing agriculture due to climate variability, as the region is situated in semi-arid areas (FAO, 2008). NWFPs are therefore vital products for coping with food shortage and famines.

It is obvious that people in drought and flood-affected communities have evolved their own adaptation strategies to protect their families, assets and secure food security (Agrawal *et al.*, 2008; Odjugo, 2010). Moreover, previous studies by various scholars including Maddison (2006), Ishaya *et al.* (2008), Paavola (2008), Mutekwa (2009) and Lema *et al.* (2009) have reported farmer observations of climate variability and existing adaptation strategies for managing climate risks, for example, proper timing of agricultural operations and use of different crop varieties.

2.8 Participation of Household Members in Utilization of Non Wood Forest Products in Climate variability

Women are involved in organized small enterprises where income that is earned by women is often re-invested into providing for family needs such as food, clothing, and

schooling Arnold (1995). It is the commercial aspects of NWFPs that can help women become more financially empowered and diversify the source of household income, leading to indirect impacts on education. Men are involved in income generation and market issues concerning NWFPs more than other activities. The involvement and engagement of household members is influenced by climate variability based on gender, age, education level, occupation and income level. At the national level, the importance of NWFPs lies in the large numbers of people engaged in gathering, hunting, processing, trading and other aspects of their production and use (Tieguhong *et al.*, 2009; Arnold, 1995).

Age affects the type and amount of resources utilized. NWFPs and related activities have few entry barriers and together with their nutritional benefits, can contribute significantly to the livelihoods of the elderly households with an elderly head or children who opportunistically collect wild fruits, insects and small mammals, while travelling to school, herding livestock and so forth (Cavendish, 2000; Shackleton *et al.*, 2004). The National Strategy for Growth and Reduction of Poverty recognized the threats caused by climate variability effects on agriculture, by identifying floods and droughts from the fact that agriculture in Tanzania is primarily rain-fed, with only 2% of arable land having irrigation facilities – far below the potentially irrigable share (FAO, 2009). The village's location affects resource use. There is a difference between 'forest dependence' and using accessible natural resources that offer a cheap alternative (Angelsen *et al.*, 2003). Villages closer to natural forests have easier access to the resources provided.

2.9 Climate Variability Effects on Non Wood Forest Products With Relation to Agricultural Activities

There is substantial evidence that the mean and extremes of climate variables have been changing in recent decades, and that rising atmospheric greenhouse gas concentrations

could cause those trends to intensify in the coming decades (IPCC, 2007). These changes are particularly important for agriculture (Lobell *et al.*, 2008; Otieno, 2000; Majule *et al.*, 2008) and therefore also have critical implications for developing countries, both because the majority of the poor reside in rural areas where farming is the dominant economic activity and also because the poor may spend as much as two-thirds of their income on food (Cranfield *et al.*, 2003). Similarly to other parts in Tanzania Loibooki *et al.* (2002) found that, in north-western Tanzania, households responded to crop failure by hunting wild meat and extracting other NWFPs for consumption and sale.

The importance of agriculture to the poor is particularly true for Tanzania, where agriculture accounts for about half of gross production, and employs about 80 percent of the labour force (Thurlow *et al.*, 2003).

Agriculture in Tanzania is also primarily rain-fed, with only 2 percent of arable land having irrigation facilities – far below the potentially irrigable share (FAO, 2009). Tanzanian yields, especially of staple foods like maize, are particularly susceptible to adverse weather events. However farmers are now supposed to seek for alternative arena to overcome the failure productivity in agriculture. The community attitude towards forest resources vary depending on distance of forest, availability of resource and access status (Sundriyal *et al.*, 2004). The forest products and services can provide promising solution. Rural people can go for NWFPs to obtain their basic needs. That is proved by Augustino *et al.* (2013), who reported that communities living around NDUFR are increasingly relying on NWFPs for food, health and income security among the strategy to cope with change in climate compared to the situation 20 years ago.

2.10 Previous Research on Impact of Climate variability in Other Fields Rather than Non Wood Forest Products Availability and Utilization

Among the few reviewed previous studies (Msililwa *et al.*, 2011 and Miledge *et al.*, 2007). largely done in Tanzania focused on the local peoples' perceptions of climate variability and the change in use pattern of NTFPs as a response to perceived change and to develop and sustain adequacy in national capacity to participate in climate variability initiatives and address effects and challenges of climate variability with particular emphasis to REDD initiatives respectively. The results indicate there are increasingly relying on NTFPs for food, health and income security among the strategy to cope with change in climate currently than past 30 years and the NTFPs are becoming scarce and which previously could collect around the forest reserve, are now not available and people need to go into far into the reserve to find them.

Furthermore researches (Haule, 2011; Kitundu, 2010; Philipo, 2011; Msafiri, 2011 and Mdoe, 2011) done in Tanzania have largely focused on both farmers' and pastoralists' perception toward impact of climate variability on agriculture fields and the way forward to overcome changes brought by climate in the field and impact of climate variability on water resources and ways forward to overcome the problem. The results show there were impacts of climate on agriculture system production, livestock keeping and water resource management, the perception of community to climate variability impact was negative. People were aware to adopt different strategies to survive the threats from climate.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

The study was conducted in six villages namely Babayu, Kongogo, Mayamaya, Zamahela, Nagulo and Uhelela selected from three wards, known as Zanka, Babayu and Bahi, in Bahi District, Dodoma Region. This District was selected because most rural households often turn to NWFPs in response to agricultural crop failures and other contingencies and the area seriously suffers from chronic food insecurity due to climate variability. Most areas in central regions are found in semi-arid agro-ecological zone in which rainfall is already uncertain even without climate variability and change (Kabote *et al.*, 2013). Loibooki *et al.* (2002) found that in north western Tanzania households responded to crop failure by hunting wild meat and extracting other NWFPs for consumption and sale. Dodoma region in Tanzania is among the regions severely affected by failing agriculture due to climate variability impact, as the region is situated in semi-arid areas (FAO, 2008). Bahi District has an annual average rainfall of about 500 to 700 mm and annual average temperature of about 22.6°C. The economies of Bahi District depend on agriculture (crops and livestock production). The main crops grown in Bahi District are pearl millet, sorghum, paddy and ground nuts (URT, 2003). It is situated in semi-arid areas and has dry savannah type of climate, which is characterized by long dry season, unimodal and erratic rainfall that falls between November/December and April.

Bahi District is one of the six districts of Dodoma Region. Other districts are Kondoa, Chamwino, Dodoma Municipality, Mpwapwa and Kongwa. The headquarters of the district is located in Bahi ward which is 50 km away from Dodoma Municipality and located

close to the highway linking Singida and Dodoma regions. Bahi District extends between latitude 40 and 80 South and between longitude 350 and 370 East. On the east, the district shares its boarder with Chamwino and Dodoma Municipal; Kondoa district on the north, Iringa region on the Southwest, and Manyoni District on the West.

The study was specifically focused on East Chenene forest reserve which occupies 22 852 ha, the forest was bordered by hills as elaborated, Mati in the east, Magomba in south, Chenene in north and Msangani in west. The estimate terrain elevation above seal level is 1325 metres. Chenene Forest Reserve (CFR) is located in Bahi District, Dodoma Region at latitude 4o to 8oS and longitude 35o to 37oE. The vegetation is mainly natural including dry Miombo woodlands, scattered small trees, acacia woodlands, shrubs and grasslands. Various species of animals like antelopes, hare, hyena, monkeys, squeals and wild dogs are found in that forest. NWFPs are extracted including honey, wax, herbs, fodders, fruits, vegetables, birds, and wild meat.

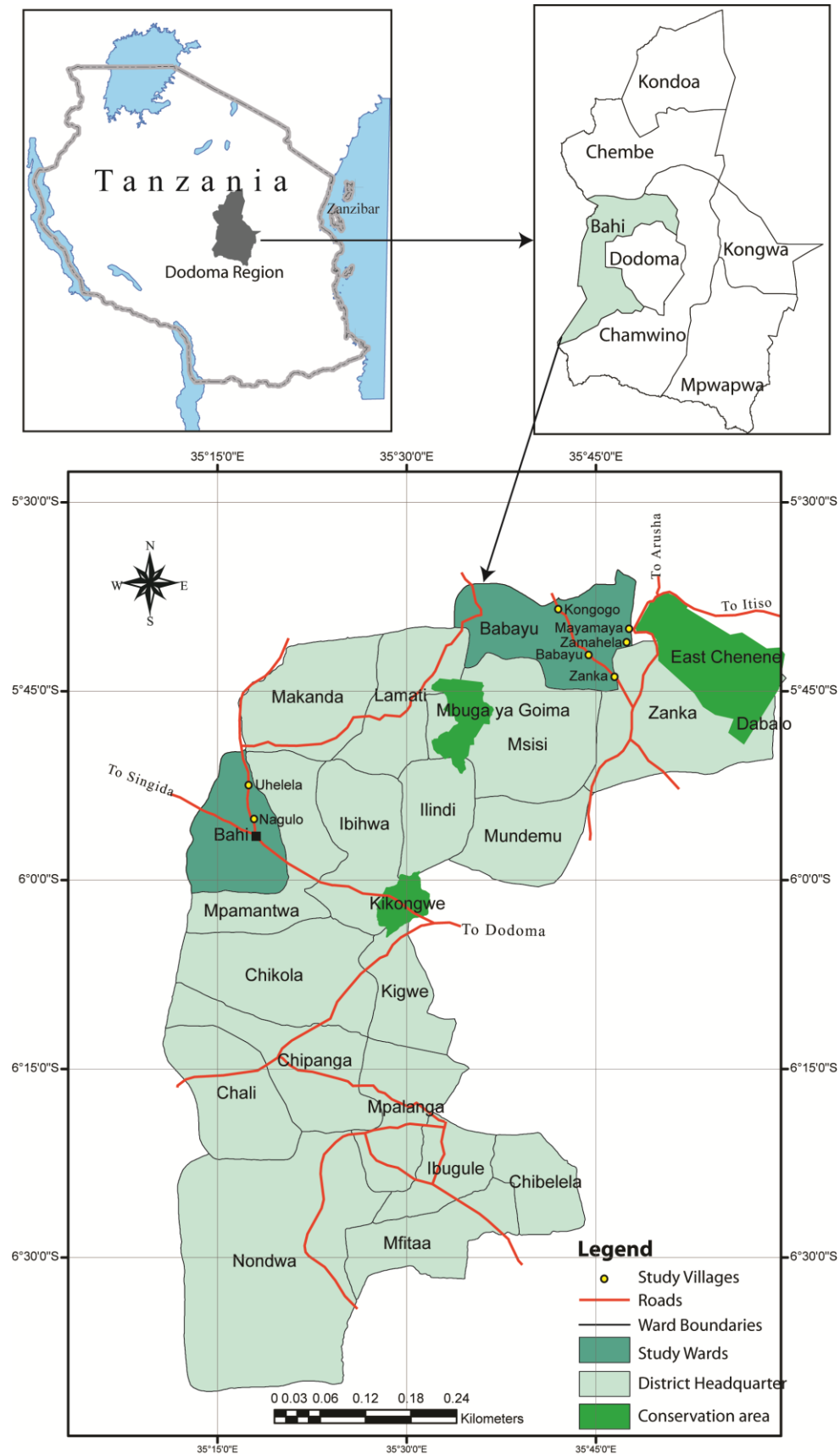


Figure 2: A map of Bahi District showing the study wards and villages

3.2 Research Design

The study employed a cross-sectional research design. The design enabled the researcher to collect data at a single point in time. This design is considered important because it is less expensive due to scarce resources. According to Kothari (2004), the design is cheaper, quicker and effectively utilizes limited resources in terms of time, resources and labour. In addition, the design employs a survey method and can be used for a descriptive study as well as for determination of relationships among variables (Bernard, 1994).

3.3 Sampling Procedures and Sample Size

A multi stage sampling procedure was applied to select the study area. Mundemu and Bahi divisions were purposively selected from the study area. The main reason of selecting the division was that the forest is located in the divisions and the rural households which live near the forest easily go for NWFPs as alternative sources of their livelihoods. Purposive sampling was used to select three wards which were located near East Chenene Forest Reserve, while simple random sampling procedure was used to select two villages from each ward. The sampling frame was all households living close to the village land forest and chosen from village registers by the help of WEOs and VEOs. The study units were the households, whereby heads of households were the respondents.

A total of 120 households were selected randomly of which 20 households were randomly selected from the selected village. According to Bailey (1998), 30 cases are the minimum and appropriate sample size for a statistical data analysis, which gives the empirical evidence.

3.4 Data Collection Methods and Tools

Both primary and secondary data were collected using a combination of both qualitative and quantitative methods of data collection.

3.4.1 Primary data collection

For primary data, household questionnaire survey, FGD and Key Informant interview (KIs) methods were used to collect the data.

i. Household survey

A questionnaire (Appendix 1) with both closed and open-ended questions was administered to heads of households to collect the data. The questionnaire was designed to focus on key issues including local communities' perception on climate variability, impact of climate variability on utilization of NWFPs, identifying the changes on NWFPs availability and utilization caused by climate found in Mtungutu. Also, a Likert scale was employed to assess the perception of the community around East Chinene forest towards climate variability impact on availability and utilization of NWFPs.

The questionnaire was pre-tested to ten (10) individuals before the actual survey at Kintiku village in Manyoni District. The area was chosen because it have the similar characteristics with the study area. The pre-test proved that there was a language barrier; hence the researcher translated the questionnaire in to Kiswahili to be easily understood by the respondents. Mettrick (1993) argues that it is essential to pre-test the questionnaire in order to take into account relevance of some of the questionnaire items.

ii. Focus Group Discussion (FGDs)

Four focus group discussions of about six to eight people ($n = 6$ or 8) of both sexes were conducted. The FGD was used to examine the perception of community on climate variability and how climate variability affects the utilization of NWFPs in the study area.

The discussion was guided by a interview (Appendix2), and the answers obtained from the discussion were recorded and summarized in a note book by a researcher.

iii. Key informants interview (KIs)

Key informants are not the only members of the clientele, but also are most often informed outsiders (Mettrick, 1993). Key informants in the study area were: Village Executive Officers (VEO) and Ward Executive Officers (WEO). Elders and traditional healers from each ward, forest officers, and land officers in the district from each village were interviewed. An interview guide (appendix3) was used to guide the researcher to obtain data on people's experiences on the NWFPs utilization found in the area.

3.4.2 Secondary data collection

Secondary data on efforts made to conserve NWFPs, past records of harvest and information on the impact of climate variability concerning the availability and utilization of NWFPs were obtained from Journals, books and the Internet access. Other information on study area population, socio economic, natural vegetation were on the district profile found in administration offices of Bahi District.

3.5 Data Analysis

Data were summarized, coded and entered into the SPSS computer software where Descriptive and inferential statistical analysis such as one way Anova, frequencies, percentages, minimum and maximum values were computed. A likert scale of 16 statements was used to capture people's perception on the impact of Climate variability on availability of utilization of NWFPs.

A Likert Rating Scale (LKS) was graded as follows: Strongly agree = 5; Agree = 4; Neutral = 3; Disagree = 2 and strongly disagree = 1. However, in order to bring more

meaningful results, the scale was merged into three Likert rating scale as follows: Strongly agree (5) and Agree (4) = Agree (1); Neutral = 3 and Disagree (2) and strongly disagree = Disagree (2). Therefore, the average percentage of the agreed, uncertain and disagreed was computed and used to determine the overall perception of the respondents on climate variability. Qualitative data was analysed by using content analysis.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This Chapter discusses major findings arising from the study data analysis covering the general objectives and specific objectives concerning the study area.

4.1 Demographic Characteristics of the Respondents

Age, sex, education, household size and occupation have influence an attitude of respondents towards the climate variability impact on availability and utilization of NWFPs (Tieguhong *et al.*, 2009). Table 1 presents the summary of demographic characteristics, where details of each characteristic are provided in its respective subsection. These demographic characteristics are significant parameters determining the ability of the households in utilizing NWFPs in different ways during severe droughts and floods (Cavendish, 2000).

Table 1: Demographic characteristics of respondent (n=120)

Variables	Categories	Frequency	%
Sex	Male	82	68.3
	Female	38	31.7
Age (years)	25-45	63	52.5
	46-66	45	37.5
	67-86	12	10.0
Education level	Illiterate	56	46.7
	Primary level	60	50.0
	O-level education	04	3.3
Household size	1-5	48	40.0
	6-10	60	50.0
	11-15	10	08.3
	16-20	2	1.7
Occupation	Formerly employed	24	20.0
	Farmer	94	78.3
	Fisherman	2	1.7

4.1.1 Sex of household heads

Sex is an important consideration in many Tanzanian societies. Men are the core decision makers compared to women in relation to socio-economic activities like activities related to NWFPs (Angelsen and Wunder, 2003). Three-quarters (75%) of the households in Tanzania are male-headed (NBS, 2009). The findings in Table 1 indicate that the majority of households (68%) were male-headed while female-headed households were only 31.7%. This was expected since most African societies practice a patriarchal system of life. Terry (2009), argued in the same line of the study findings that in African societies males are decision makers

4.1.4 Age

Age group is an important demographic factor which influences demographic activities carried by both independent and dependent age groups. In this study, the findings in Table 1 indicate that, majority of the respondents belonged to age group of 25-45 years which accounted for 52.5%, followed by the age group 46-66 years which accounted for 37.5%. This possibly reflects the reality of working group and dependants in the study area. The study reveals the activeness of seeking economic diversification options based on youth and middle age who engaged in various economic activities like collection of NWFPs (Wunder, 2003). Therefore findings indicate that most of the respondents were in active group.

This implies that in the study area, the active age group was the one that looked at alternative to climate variability risks when the situation becomes worse according to Fidel (2008), age of the respondent is important in determining the vulnerability of the household against the scourge of climate variability. It has been revealed that NWFPs and related activities have few entry barriers. The livelihoods of the elderly, households with an elderly head or children who by chance collect wild fruits, insects and small mammals (Cavendish, 2000; Shackleton and Shackleton, 2004).

4.1.5 Education level

The education level of members in the community is essential in determining household's perception on climate variability and adaption strategies (Stinfeld, 2001). In Table 1, the majority (50%) of the respondents had primary level education, while 46.7% of the respondents had no formal education and only 3.3% had secondary education. The education level of individuals has influence on attitude towards availability of NWFPs

(Tieguhong *et al.*, 2009). This finding is in agreement with URT (2006) that suggests, in Tanzania there is great achievements in primary school enrolment. From the study area most of the respondents were out of illiterate and they were able to observe the climate variability easily.

The findings indicate that most of the respondents who have primary level of education are more likely to discern the perceived effects of climate variability on availability and utilization of NWFPs than those without formal education level. From the surveyed area as all respondents were aware with climate variability, it was therefore observed that most of the illiterates use their experiences and local knowledge in understanding the impact of climate variability on their surroundings. This concurs with UNDP (2004). who reported that the level of education in the rural areas is low thus utilization of NWFPs depends on indigenous knowledge.

Paulo (2007), in his study revealed that primary education can foster human creativity in utilization of NWFPs and considers this education level to be an important factor in relation to natural resources conservation. The local calendar is more flexible than the western calendar because it is linked to severe droughts, floods and agricultural activities (Kitula, 2007). Therefore, the knowledge might vary accordingly between educated and non-educated respondents.

4.1.6 Household size

Household size is defined as a number or group of persons who usually eat and share some common living arrangements (Belcher *et al.*, 2007). In this study, the findings in Table 1 show that 50% of the households had 6 to 10 members, and 1 to 5 members were found in

only 40% of the households. This means that the majority of households had members ranging between 1 and 10 household members. As revealed during a FGD, the occurrence of large household size was because of extended families which were as a result of a polygamous way of living, early pregnancies and early marriages which result to extended family.

Literature shows that the larger the household size, the higher the collection and demand for NWFPs, (Paulo, 2007). The size of the household determines their consumption of NWFPs for various purposes such as food, health as well as income generating activities. Despite their main income generating activities most households diversify NWFPs as among other economic activities supporting their livelihoods. Nyigili (2003) also argues that if the number of dependent is large in household, there would be low ability of diversification while big number of active members results to high capacity to economic diversity.

4.1.7 Occupations

According to Majule *et al.* (2008), economic activities are human activities which are performed in exchange for money or money's worth, or those efforts which are undertaken by man to earn income, money, wealth for his life and to secure maximum satisfaction of wants with limited and scarce means. In the study area, the major economic activity was farming. The findings in Table 1 indicate that 75% of the respondents were farmers dealing with agricultural activities that depended on rain fed. At occurrence of severe droughts and floods might affect directly the productivity of agricultural produce which in turn would lead to households for NWFPs utilization. (Vogel, 2000; Ikeme, 2003, IPCC, 2007; Tschakert and Dietrich, 2010).

4.1.8 Sources of Income in the households

NWFPs are particularly important to rural communities in terms of food and nutritional requirements, medicines, fodder for livestock, fibre, fertilizers, and construction materials, cosmetic and cultural products. To capture these multiple response question was used, in Table 2 the findings indicate that the majority (97.5%) were engaged in activities related with NWFPs, while 95% of the respondents were farmers, and 42.5% were involved in petty trade. Therefore, activities related to NWFPs and agriculture were the major source of income in households. These findings imply that rural people have different experience from climate variability impact related according to the economic activities. NWFPs support village-level craft, activities and provide raw materials to support processing enterprises hence increased household income. NWFPs include internationally important commodities used in food products and beverages, confectionary, flavourings, perfumes, medicines, paints and polishes.

Based on these findings, it is evident that majority of rural people depend on agriculture and NWFPs activities as their main source of income. Many people are aware of the impact caused by climate variability on the NWFPs that they utilize. According to Belcher (2007), commercialization of NWFPs is often seen to generate income for local communities while conserving biodiversity in an environment. According to Belcher (1998) Commercialization of NWFPs is important because it helps rural dwellers to diversify their sources of income, which contributes to their food security and reduce their level of poverty.

Therefore, the study findings reveal that the utilization of NWFPs was increasing due to high demand and supply from rural households during severe droughts and floods.

Referring to FGDs conducted in Zamahela Village, people confirmed that agricultural products were no longer enough to satisfy the basic needs as well as subsistence due to floods and droughts. The situation leads to more economic diversification such as NWFPs activities, petty trade and burning charcoal in the study area.

Table 2: Household source of income (n=120)

Variables	Yes %	No %
NWPs activities	97.5	2.5
Farming	95	5
Petty trade	42.5	57.5

This table represent multiple responses

4.1.9 Living period of the respondents in the study area

Living period of the head of household is crucial as it shows skilfulness, knowledge ability and experiences with utilization and the determination of decline and increase of NWFPs (Loibooki *et al.*, 2002). In Fig 3, the results indicate that a good number of the respondents (50.8%) had been living in the study area for 25 to 40 years, while 36.7% had been living there for 41 to 56 years. This shows that the respondents had been living in the study area for at least 25 years. That means the respondents were knowledgeable and experienced enough to be creative on making decision in utilization of NWFPs resources during severe droughts and floods. Based on their experiences, during FGDs conducted in the Uhelela, Kongogo and Zamahela villages, participants reached to the consensus pointed that availability and utilization of NWFPs were being observed during severe droughts and floods. Example, mushrooms and honey had decreased when there were floods and drought respectively, compared to the previous 20 years.

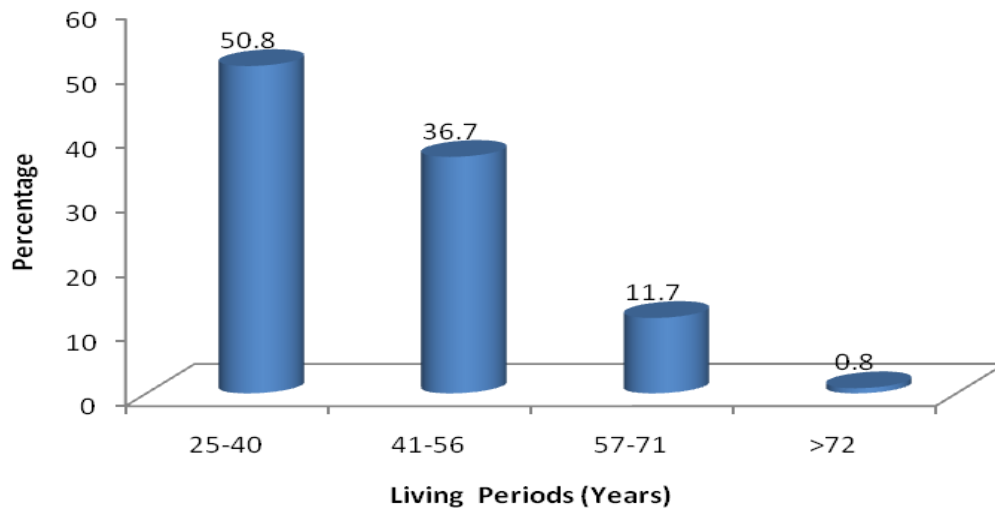


Figure 3: Living period of the respondents in the area concern

4.2 Peoples' perception on Climate variability Impacts

To capture the perception of the respondents towards climate variability, a likert scale of 16 statements was used. The respondents were given options for rating either disagreeing, agreeing or undertrained with the given indicators of perceptions.

Table 3: Peoples' perception towards climate variability (n=120)

Perception statements	Percentages			Mean Score
	Disagree	Undecided	Agree	
Little rainfall has no effects to crop Cultivation	76.7	8.3	15	29
There is no severe droughts and floods in the study area.	69.2	16.7	14.2	34
Severe droughts and floods are not a threat to bee keeping	67.5	10.8	21.7	34
Presence of weaving materials has relationship with severe droughts and floods	65.8	9.2	25	34
The availability of tradition medicine from forest has relationship with severe droughts and floods	46.7	25.8	27.5	34
There are approaches formulated by various institutions to overcome severe droughts and floods to rescue NWFPs	52.5	12.5	35.0	34
Unavailability of mushroom is not related to climate variability	62.5	14.2	23.3	32
There are various approaches established by institutions which does not consider severe droughts and floods on NWFPs	55.8	13.3	30.8	34
Change on rainfall can result to decrease of honey production	24.2	19.2	56.7	33
Severe droughts and floods contribute to presence of pest and diseases	30	25.8	44.2	34
In 20 years NWFPs have been affected by weather patterns	56.7	16.7	26.7	31
Recently there is decrease of bee products because of change in weather patterns	61.7	11.7	26.7	32
The use of NWFPs have been affected by severe droughts and floods	56.7	11.7	31.7	32
The strategies introduced to cope with severe droughts and floods can protect NWFPs	46.7	11.7	41.7	32
There are institutions which provide education and training among community members on how to conserve NWFPs	33.3	18.3	48.3	33
Climate variability effects do not lead to high demand and supply of NWFPs among rural community members	49.2	15.0	35.8	31
Mean Score/s evaluation(MSE)	33.3	17.5	49.2	34.8
Note: MS =Mean Score/s				

4.2.1 Perception of the respondents to climate variability impact

Based on the findings in Table 3, a good number (49.2%) of the respondents agreed that there was variability in climate; (33.3%) of the respondents had positive perception toward the impact of climate variability; and (17.5%) of the respondents were neutral towards climate variability. From the findings, it implies that people in Bahi District, were actively experiencing changes which occurred in their area, on the availability and utilization of NWFPs in connection to climate variability impact. The rest did not believe on the impacts caused by climate variability on NWFPs. In the study area there was no special education provided by different environment conservation stakeholders based on NWFPs with association to climate variability. This is revealed in this study that 52.5% of the respondents disagree that there are approaches formulated by various institutions to overcome severe droughts and floods to rescue NWFPs. The findings prove that in spite of the presence of organizations like BANET, DONET and HADO in Bahi District, people lacked proper information on impact of climate variability on availability and utilization of NWFPs. Similar finding was revealed by focus group discussants and key informants that explained there were seminars and training provided by DONET (Dodoma Environmental Network), BANET (Bahi environmental Network) and HADO (*Hifadhi Ardhi* Dodoma) which provide education on environment, but people still do not believe whether there are specific impacts caused by climate variability on NWFPs.

Table 3 presents people's perception towards utilization and availability of NWFPs on the distance walked to reach the forest, time used to extract NWFPs and disappearance of vegetation cover from the village for the past 20 years, only 5% of the respondents disagreed while a large percentage of the respondents (95%) reported that the walking distance to reach the forest has increased compared to the past 20 years.

4.2.2 Perceive climate variability among surveyed wards

To compare perceptions on climate variability among respondents from the surveyed wards, one way analysis of variance (ANOVA) was used. Results as presented in Table 4 revealed that the perceived climate variability impacts differ significantly $F(2,306) = 6.909$, $p < 0.01$ implying that there was statistically significant difference in perceptions among the respondents in respect to the surveyed ward. The fact was that variability in climate was not impact similar in all wards that means the perception from every wards differed according to the essence of NWFPs availability and utilization. The vegetation cover disappearance, extraction time of NWFPs and distance walked to reach the forest made the respondents from three wards to perceive climate variability differently.

Table 4: Comparison of perception among surveyed wards (n=120)

Perceptions	Sum of squares	Df	Mean square	F	Sig.
Between groups	894.138	2	447.069	6.909	0.001
Within groups	1979.74	306	64.705		
Total	2873.878	308			

4.2.3 Climate variability impacts indicators

Majority 95% of the respondents indicated that in 1993, distance from the village to forest was short compared to 2013 whereby recently increased. That revealed by the fact that in the past 20 years, 1 hour was enough to reach the forest. While currently (2013), two (2) to three (3) hrs were utilized, as a fact that vegetation cover has disappeared due to human activities and climate variability impact. The community perception towards forest resources varies depending on distance of forest, availability of resource and access status (Sundriyal and Sundriyal, 2004). In the study area it was observed that, respondents who

lived near forest utilized NWFPs frequently than those staying far and hence their rate of acquisition is higher.

The results revealed that majority (94.2%) of the respondents agreed that there was disappearance of vegetation cover in 2013 compared to 1993. Moreover the time used to extract NWFPs for 20 years was clearly noted as majority (90.8%) the agreed that there was an increase in time used to extract NWFPs in 2013 compared to the past. The disappearance of vegetation cover and increase of the NWFPs searching time proved that in the study area NWFPs declined as the result of climate variability impacts.

Table 5: Indicators of climate variability impact (n=120)

Variables	Frequency		Percent	
	Yes	No	Yes	No
Distance walked	114	6	95.0	5.0
Time used for searching NWFPs	113	7	94.2	5.8
Vegetation cover distance	109	11	90.8	9.2

In assessing climate variability impact, severe droughts and floods and NWFPs productivity (NWFPs PR) are crucial factors used to measure climate variability impact in the study area. In Fig. 4, the findings from the study area showed that majority (92.5%) of the respondents were aware with the severe droughts. Furthermore, majority (88.3%) of the respondents agreed that there was occurrence of severe floods. Moreover majority (85%) of the respondents were aware that there was low NWFPs produced yearly in the study area. From that findings majority (92.5%) of the respondents in the study area were aware that there were climate variability impacts through severe droughts and floods and low NWFPs produces yield. The findings reflect by those reported by Msaliwa *et al.*

(2013), showing that 97% and 92% of the respondents agreed that there were severe droughts and floods and NWFPs produce declined yearly in New Dabaga Ulongomba Forest Reserve (NDUFR) respectively.

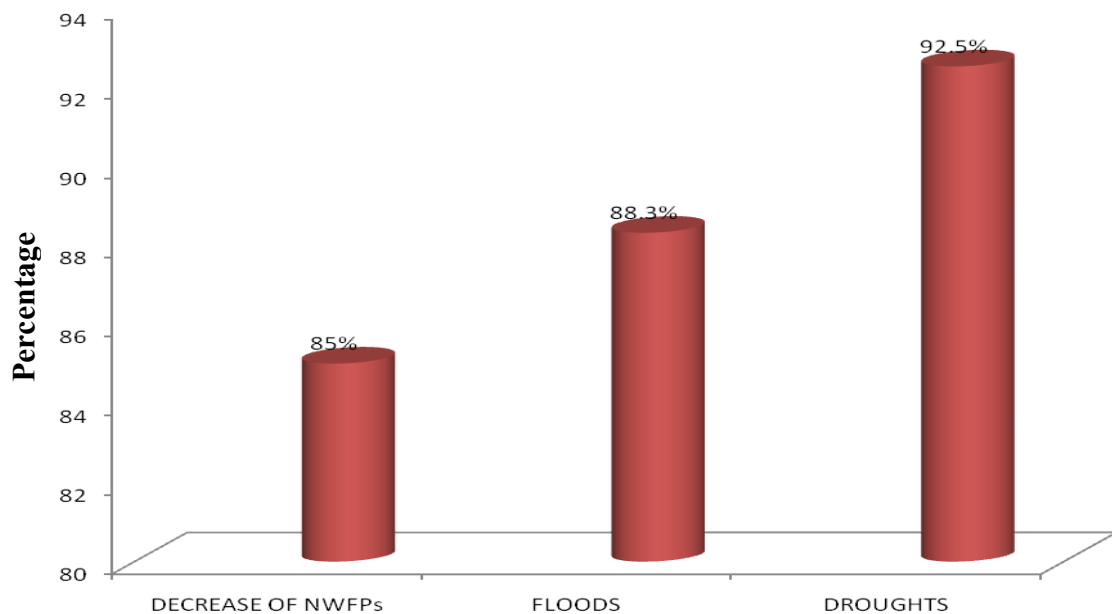


Figure 4: Climate variability impacts indicators

4.3 Non Wood Forest Products Availability in East Chinene (Mtungutu) Forest Reserve

In the study area there were increase and decrease of NWFPs, quantity and quality of NWFPs, the walking distance to reach the forest and time spent to extract NWFPs as well as the indicative prices for NWFPs. Specific objective number (ii) was to identify the changes in NWFPs availability in East Chenene Forest Reserve (*Mtungutu*), the research found that quantity sold and consumed in household per year in the recent two decades increased in association with variability, severe droughts and floods affected availability of NWFPs in the study area. Moreover this specific objective focused on the

wards location and quantity of NWFPs both consumed in households and sold by households in the market per year.

Table 6: Availability of NWFPs during severe droughts and floods (n=120)

NWFPs	Increase n (%)	Decrease n (%)	Not affected n (%)
Honey	22 (18.4)	79 (65.8)	19 (15.8)
Mushroom	17 (14.2)	96 (80)	7 (5.8)
Wild vegetables	5 (4.2)	36 (30)	79 (65.8)
Weaving materials	16 (13.3)	54 (45)	50 (41.7)
Bush meat	7 (5.8)	97 (80.8)	16 (13.3)
Wild rope	6 (5)	101 (84.2)	13 (10.8)
Baobab	13 (10.8)	44 (36.7)	63 (52.5)
<i>Tamarindus indica</i>	6 (6)	45 (37.5)	69 (57.5)
Plant medicine	9 (7.5)	34 (28.3)	77 (64.2)

The findings as in Table 6 indicated that availability of NWFPs had been affected by severe droughts and floods in the study area. The findings show that majority of the respondents indicated that NWFPs were decreasing. According to FGDs, the participants reached mutual agreement, that as rainfall amount decreased (drought) availability of many products such as honey, mushroom, wild ropes and bush meat also decreased. NWFPs decreased too and when amount of rainfall increased (normal amount) the availability of these products increased as well. For example, if there was no severe drought, the flowers used by bees to produce honey became inadequate, hence low production of honey.

Furthermore, in some villages like Uhelela and Nagulo-Bahi some NWFPs (honey, mushrooms) were nowhere to be found due to the weather change patterns. During FGD conducted in Nagulo-Bahi a male participant admitted that:

“Nowadays there is no hope in life as we used to depend on forest, but forest has been severely affected by variability of weather conditions, there is no Enough NWFPs supply some products disappeared totally such as honey and mushroom in Nagulo and Uhelela which were among the sources of income.”

In addition to that from the FGDs conducted in the four villages namely Kongogo, Babayu, Zamahela and Mayamaya, participants reached mutual agreement and asserted that the availability of mushroom decreased during severe droughts and floods. The participants further explained that the disappearance of vegetation cover caused them to walk long distance to collect mushrooms and other NWFPs. In some villages like Nagulo Bahi and Uhelela, mushrooms and honey were scarce due to severe droughts and floods. Majority (65.8%) of the respondents agreed that some of the NWFPs such as wild vegetables, baobabs, *tamarindus indica* and medicine plants have not been severely affected by either droughts or floods because their availability was constant. According to FGDs participants most of the wild vegetables consumed in the study area were used during both droughts and floods events. These included leaves from baobab trees, cassava, wild sweet potatoes and “*mlenda*”. Contrary to other discussions from FGDs, participants mutually agreed that wild vegetables have decreased due to the fact that livestock feed on them as their grazing fields.

According to FGD conducted in Mayamaya village a female participant mentioned that:

“Wild vegetables are scarce because they are eaten by domestic animals for example goats prefer wild sweet potatoe leaves and in general various types of vegetables are scarcely available nowadays”

Lema (2003) reported that majority (59%) of the respondents indicated constant existence of wild fruits as well as the *tamarindus indica* and baobabs fruits were constantly available inspite of the severe droughts and floods.

According to FGDs held in Kongogo village, it was admitted that:

“Tamarindus indica trees as well as baobab trees were used in various ways such as barks, roots and leaves for traditional medicine, in spite of all these uses they survived the risks from climate variability impact.”

Furthermore, the findings indicate that majority of the respondents indicated that NWFPs species used as traditional medicine were not badly affected by severe droughts and floods. Female participant in FGDs conducted at Uhelela village explained that:

“Traditional herbs are still in plenty in spite of climate variability, as we cannot afford health care expenses in hospital”

This is because in the study area the few health centres available were ill-equipped.

4.3.1 Reasons why time and distance for searching Non Wood Forest Products increased

In the study vegetation cover distance and disappearance of NWFPs were the main factors to measure the changes in availability and utilization of NWFPs. The results in Fig. 5 indicate that majority (92.5%) of the respondents agreed on disappearance of NWFPs species in the study area. So majority (90.8%) of the respondents believed that distance and time were different recently compared to the past based on the fact that vegetation cover being far from their village. The respondents reported that they walked long distance and use more time in searching for NWFPs. According to FGDs conducted in Babayu and Nagulo-Bahi, a male participant from Babayu said that:

“We used to walk shorter distance to collect NWFPs from the forest but nowadays we walk long distance and spend more time to extract NWFPs”

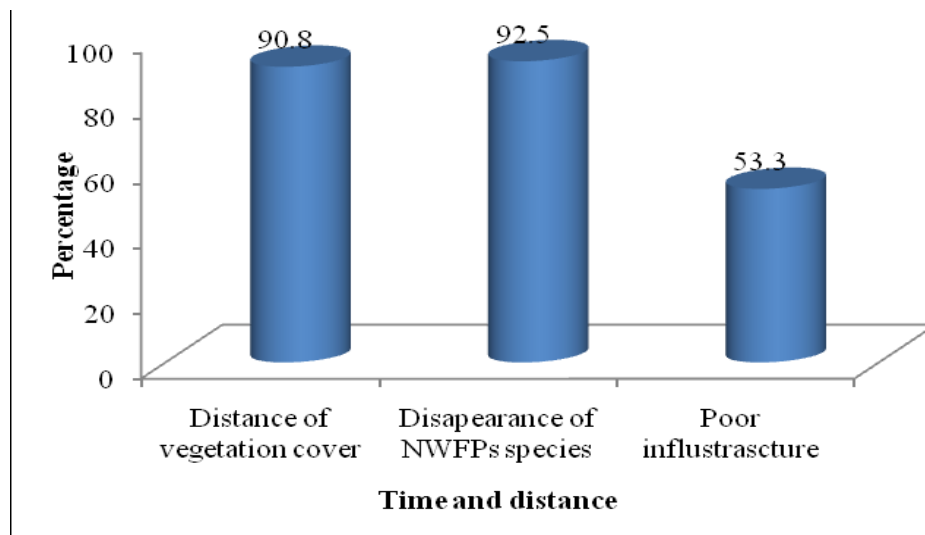


Figure 5: The reasons why time and distance for searching NWFPs increased.

4.3.2 Time spent for Extracting NWFPs in different wards

The distance of the ward from the village land forest reserve did not affect the capability of utilizing NWFPs considering time spent to walk to reach forest to extract NWFPs. As the findings in Fig. 6 indicate that majority (73.2%) in Zanka the closest ward from the forest, followed by 61% of the respondents from Bahi which is the farthest ward from the forest and at last 55.3% of the respondents in Babayu the second near ward from the forest used the same time of extracting NWFPs which is about 1-2 hours. This therefore shows that the distance from forest determines the frequency of utilization hence the nearby villagers are more likely to access the NWFPs.

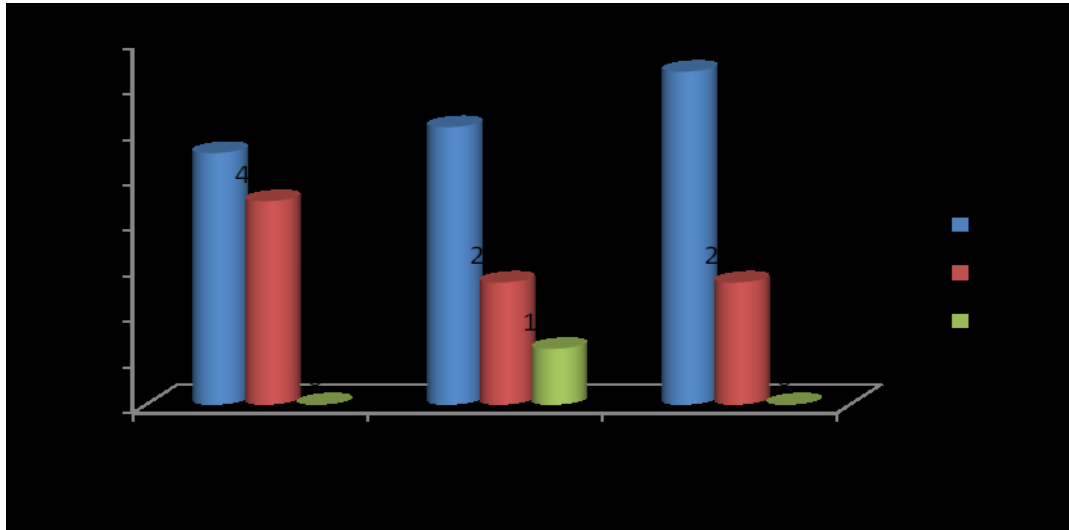


Figure 6: Time used for searching NWFPs in the forest across wards

The location of wards however, does determine time spent to extract NWFPs. Among the three wards, findings show that there was a lot of time spent to extract NWFPs in each ward. In a way the findings imply that there were differences between ward location and time spent to reach the forest reserve to extract NWFPs. This was evidently portrayed by participants from FGDs conducted in the different villages in different wards who confessed that:

“The distance walked and time used to search for NWFPs in 2013 had increased compared to that in 1993”

This is supported by the study done by Nyigili (2003), who reported that people walk long distance and use more time searching NWFPs as compared to the past. This might be probably due to disappearance of vegetation cover caused by climate variability.

4.4 Utilization of NWFPs among Household Experiencing Climate Variability

Impacts

In climate variability impacts, utilization of some forest products such as honey becomes multi-purposes, used as food, medicine and cosmetics. People who live near forest and

depend on forest products increased the demand and supply of NWFPs. According to Kitula (2007), the reality is that climate variability impacts caused eruption of diseases which were cured by some NWFPs.

In this study majority (96.7%) of the respondents utilized NWFPs in their households. The findings concurred with those reported by World Bank (2008), that about 60 million local communities around the globe are estimated to depend on forests. In the study area majority of the respondents used NWFPs for different purposes at different times due to climate variability impacts. Moreover wild plants are an important source of edible fruits, leafy vegetables, and herbs, and are particularly important in ensuring food security and maintaining the nutritional balance in peoples' diets (Falconer, 1994; FAO, 1995).

Table 7: Utilization periods of NWFPs in household (n=120)

Periods in years	Frequency	Percents
1-20	73	60.8
21-40	34	28.3
41-60	13	10.8
Total	120	100

In Table 7 the findings indicate that majority (60.8%) of the respondents are engaged in NWFPs utilization between 1 and 20 years, while 28.3% of the respondents were utilizing NWFPs in their households between 21 and 40 years and only 10.8% were utilizing over 40 years. This indicates that majority started using NWFPs from 1993 to 2013 as the Climate variability impacts became worse. In the study area the use of NWFPs was expected to be high recently because the area is severely affected by climate variability impacts. Collection of wild foods is one of the strategies adapted for coping with food deficit in Dodoma Rural District (Mwagile, 2001).

Furthermore, a female participant during FGD in Kongogo village said that:

“We now depend on forest products as in the past for almost all of our home consumption as long as agriculture is no more giving us enough for survival. This means being engaged long in NWFPs utilization easily noting changes in comparison to past and current year”

According to Nyigili (2003) and Paulo (2007), it was asserted that the individual was able to identify changes on price, quality and quantity, if they have the opportunity to compare periods in respect to events occurring and variability of demand and supply among household. Utilization of NWFPs is currently common to forest dependant community as several people have resorted to using these NWFPs due to climate variability, a circumstance that collocates with neo-traditionalism. This means people turn to nature for their livelihood as they used in the past to depend on the environments (Kitula, 2007).

4.5 Involvement of Household Members in Non Wood Forest Products Activities

In socio-economic activities, participation and division of labour based on sex and age are crucial to improve work efficiency in the vulnerable periods (Nombo *et al.*, 2009). In Table 7, the findings indicate the participation of households' members in NWFPs activities in relation to different NWFPs obtained from the forest reserve. In this study, the findings indicate that majority (97.5%) of the respondents showed that males were involved in hunting wild animals, while 96.7% of the respondents showed that males engaged in honey harvesting and 95.8% making wild rope. On the other hand, females engaging in collection of mushrooms accounted for 92.5%, while 86.7% for wild vegetables, thatch grasses 65.8% and weaving materials 59.2%. Majority (60.8%) of the respondents indicated that both females and males engaged in activities related to wild fruits and vegetables collection.

According to FGD conducted in Zamahela village, a female participant mentioned that:

“Nowadays there is no specific job selection for men or women. Weaving activities were common for women, but today, you will find a strong young man involving in these activities. The big issue here is to survive, during period of scarcity.”

This may provide interpretation that climate variability impacts shifted the division of labour and changed their attitude toward life styles. In some literatures authors reported that women are more active involved in NWFPs which contributes directly to food security in Singida Rural District and the same as in Mgori Forest Reserve whereby women were more actively in mushroom, vegetables and firewood collection while men were more active in charcoal, poles and honey collection Hamza *et al.*(2007). In addition to that Nyigili (2003) concluded that 59% of the forest products were collected by women and 31.6% were collected by men. From the findings presented in this study, the situation of climate variability impacts in the study area forced both women and men to engage in various NWFPs activities.

Table 8: Involvement of Household Members in Non Wood Forest Products Activities (n=120)

NWFPs	Men n (%)	Women n (%)	Both n (%)
Wild Plant medicine	75 (62.5)	4 (3.3)	41(34.2)
Honey	116 (96.7)	1 (0.8)	3 (2.5)
Wild Mushroom	10 (8.3)	104 (86.7)	6 (5)
Wild fruits	15 (12.5)	32 (26.7)	73 (60.8)
Wild vegetables	3 (2.5)	111 (92.5)	6 (5)
Wild animals	117 (97.5)	2 (1.7)	1 (0.8)
Wild ropes	115 (95.8)	1 (0.8)	4 (3.3)
Thatch grass	79 (65.8)	8 (6.7)	33 (27.5)
Weaving materials	22 (18.3)	71 (59.2)	27 (22.5)

In this study, the findings reflect that there were activities related to NWFPs that were mostly done by men only, women only while others were done by both. Those include honey, hunting wild animals and making wild ropes. This was also observed by (Kessy, 1998; Otieno, 2000). The authors reported that locally recognized traditional healers, whether men or women, frequently carry out the collection themselves in the forests partly to maintain secrecy of knowledge of relevant species.

NWFPs activities which benefit the whole family and consume time to be extracted are mostly taken up by women than men. These include: building materials and utilization of wild fruits. According to FGD, it was noted that during disasters whereby there were no enough grains, rural people utilized baobab powder and little amount of sorghum flour to cook stiff porridge.

While on contrary men happen to be involved in both more income generating NWFPs such as honey and dangerous NWFPs such as hunting for bush meat compared to women in the study area. On the other hand, females were more interested in NWFPs, for home consumption and family gains. Nearby homesteads to NWFPs mainly used leaves of sweet potatoes, cassava, baobab and “*mlenda*”. The study findings reflect report by Hamza *et al.* (2007) who show that women are more active in forest related activities undertaken near households. Katani (1999), points out that women collect fire wood and wild foods and also women are knowledgeable about tree species suitable for fuel wood, vegetable and fruits found near homesteads.

Honey harvesting and hunting activities help to boost the household income whereby one litre of honey was sold at Tshs 2,500 to Tshs 3,000 and for bush meat Tshs 4,000 to Tshs

5,000 per kilogram. High price of honey and bush meat attracted men to be involved in such activities. Paulo (2007) observed that men have more access to cash related activities than women. Most often women were involved more in subsistence needs of the household or direct consumption than men. The activities on the particular NWFPs, such as collection of thatch grass and wild ropes were done by both women and men. Women also involved more in mushroom collection and utilization than men in the study. The study done by Kagya (2002), in Morogoro Rural District shows that male are responsible in hunting wild animals and collecting honey, while women are largely involved in collection of vegetables and mushrooms.

This implies that in the study area, people were engaged in different NWFPs related activities considering the knowledge, skills, experiences, distances from forest, income generation, portability and mobility. For example men involved in bee keeping because the activity provided high income compared to mushroom. Women involved in wild vegetables because consumed time, skills and knowledge and were directly utilized by family, while men involved in wild animals were supposed to have skills, risk taking and walking long distance.

The findings concure with those reported by Majule (2002) and Liwenga (2003), that during drought many communities in Tanzania divert to alternative sources of food such as food available from the forests. These findings also in line with those from different studies (Guijt *et al.*, 1995; Cunningham *et al.*, 2002) plants become essential to human survival, and at other times they both prevent the need for cash expenditure and provide a source of income to cash-poor households.

4.5.1 Various Utilization of Non Wood Food Products among rural households

In Fig. 7, the findings show that majority (96.7%) of the respondents used NWFPs for food, that means NWFPs were taken as main source of food by rural people. FAO (1995). asserts that NWFPs have been an important food source from prehistoric times and are among the most nutritionally concentrated of human foods, high in protein, oil, energy, minerals and vitamins. While on other hand about 96% of the respondents used NWFPs for business activities to generate income in the study area. Moreover, 86.7% of the respondents in the study area used NWFPs for building their houses especially in roofing and 67.5% of the respondents used NWFPs for health care purposes. The findings are against those of (Monela *et al.*, 2000), who reported that, households live in Miombo woodland in Tanzania derive more than 50% of their cash income from selling forest products such as honey and wild fruits. On other hand utilization of NWFPs in the study area is becoming high compared to other areas in the country because of the fact that the area is semi arid.

About 40% of the respondents use NWFPs for weaving activities such as making basket, mats and ropes. These activities previously were done by women but nowadays due to Climate variability, men are also engaged in selling and producing those goods from weaving materials. The findings indicate that majority of the rural households depend on NWFPs for their economic diversification especially during disaster caused by climate variability. The study done by Nyigili (2003) and Paulo (2007) observed the same that variability of rainfall compels people to rely on NWFPs for their livelihoods in Mbozi and Kilwa respectively. However, people choose to rely on NWFPs because situation and environment circumstances caused by Climate variability hazards forced them to, in order to survive. In the study area rural households utilized NWFPs for main food, income generation, health care, house roofing and weaving.

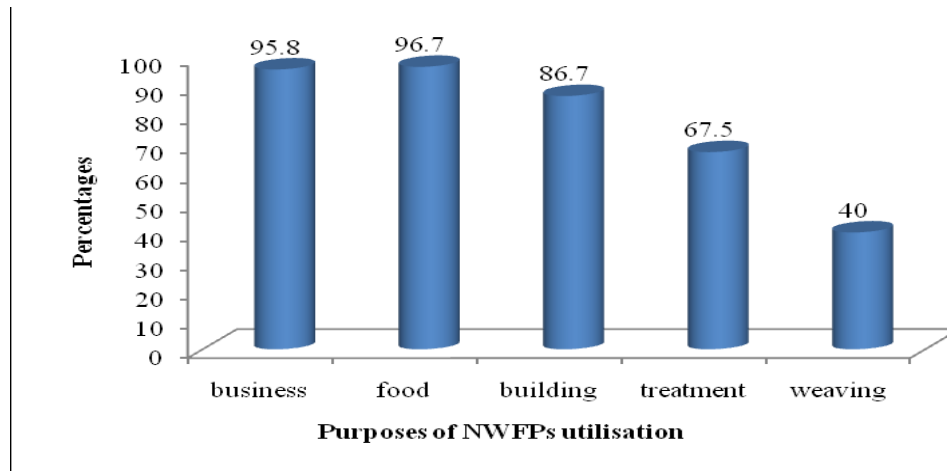


Figure 7: Various Utilization of NWFPs among rural households

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study concludes that majority of East Chenene Forest Reserve (Mtungutu) communities have been experiencing variability in the climate. Majority of them agreed that there had been changes in climate patterns in the area and that affected availability and utilization of NWFPs. The main climatic variability comprises increase in occurrence of droughts and floods perceived to be caused by impacts of climate variability. Rural communities had been depending on NWFPs for their livelihoods during floods and droughts. The study further concludes there were differences of availability and utilization of NWFPs across the study area caused by impact of climate variability. From the study area NWFPs are in high demand, however the increasing hours and distance in searching for them have limited their effective utilization. Forests are no longer close to the village as it used to be this is because of floods and drought hence limited access to NWFPs.

From the study area findings indicated that the availability of NWFPs were affected by climate variability in different ways. NWFPs such as honey and mushrooms were severely affected by climate variability to become of low quality and scarcely found or disappeared in some areas. On other hand some of NWFPs such as thatch grasses and wild fruits were slightly affected by climate variability and they were plenty found in all surveyed area. In addition to that, the findings indicated that there were changes in the use of NWFPs and were highly demanded in the households because of climate variability impacts. Apparently NWFPs were used for subsistence in the household and not used as surplus.

As most of respondents suggest, past gender roles were differentiated between men and women this has however changed in recent times. Nowadays there is no specific job selection for men or women concerning NWFPs activities. Both men and women had positive perception on climate variability, which means they were aware of the destruction caused by climate variability impacts on NWFPs.

5.2 Recommendations

In the view of the above discussions, and conclusions, thus study recommends as follows:

To enhance the sustainable conservation of NWFPs and improve livelihoods of rural communities Government, NGOs and CBOs should collaborate to create more attentiveness on climate variability and NWFPs in order to boost their knowledge to sustain and conserve NWFPs. Generally respondents have knowledge on climate variability impact on NWFPs. The education and training provided by stakeholders should focus directly on conservation of NWFPs so as to increase their understanding on issues pertaining conservation and utilization of NWFPs.

Efforts such as planting of the most utilized species on adjacent farms should be encouraged as alternatives to NWFPs extraction from the forest. As long as the study revealed that decreasing of NWFPs was severely affected by droughts and floods in the study area. Forest enrichment planting and the setting of harvesting levels and cycles have been introduced in recent years in various areas, but care should be taken to approach these practices against the background of potential ecological and socio-economic impacts.

On the utilization of NWFPs community should be encouraged to learn how to alternatively sustain themselves by means of keeping bees in their farms. Mushroom

growing program in the households should be introduced to overcome the scarce of mushrooms caused by climate variability impacts. This will help to maintain the supply of honey to suit the demand during severe droughts.

Interest in NWFPs should be associated with preferences to natural products of domestic origin. Promoting activities inside forests support the marketing of NWFPs by enhancing people's personal relationships with the forest and their knowledge about forest products. It is thus reasonable to strengthen the connection between social and ecological forest services and NWFP that is supposed to involve the environmentalist who will empower and sensitize the rural community on sustainable use of NWFPs.

The climate variability stakeholders must empower and sensitize the rural community to utilize NWFPs equally among their households in order to effectively and efficiently use their natural experiences and knowledge concerning NWFPs.

5.3 Recommendation for Further Research

Further research should be done to assess other factors for depletion of NWFPs species other than climate variability. Experts should focus on local peoples' experience and knowledge to be linked with new technology in order to conserve NWFPs from impacts of climate variability and other factors.

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APPENDICES

Appendix 1: Questionnaire

Household survey questionnaire to head of the household

Village-----

Ward -----

Household's identification number-----

Division -----

Date -----

Background information

1. Gender of the respondent 01. Male----- 02. Female-----
2. Age of respondent.....
3. Education level of the respondent?
 - (i). Informal education (ii).Primary level (iii). O level education (iv). A level education (v). Adult education (vi.) College
4. Occupation of respondents: i. Formerly Employed ii. Farmer iii. Fisherman
 . Others (specify)-----
5. Utilization of NWFPs: (i). Home consumption and dietary (ii). Market purposes
 (iii). Spiritual and customs purposes (iv). subsistence and special occasions (v).others
 specify
6. Household size
7. Major sources of income i. Farmer 02 Petty trade ii. NWFPs activities iii. Others
8. For how long have you been living in this village? (a) 2-4yrs (b).5-7yrs (c).8-10yrs
 (d).11 and above specify-----

9. Do you use non-wood forest products? i. Yes ii. No

10. If yes how?

i.....

ii.....

iii.....

11. How long have you been engaging yourself in NWFPs activities.

12. What factors make you go for collection of NWFPs? (i)-Famine-----

(ii) Climate variability----- (iii) Income generation----- (iv).All of the above

13. According to your experience who collects the non-wood forest products in the household? -----

Product	Men	Women	Both of them
Plant medicine			
Honey			
Wild mushrooms			
Wild fruits			
Wild vegetables			
Wild animals			
Ropes			
Thatch grasses			
Weaving material			
Others			

14. How has the availability of NWFPs been affected by climate variability in this year (2013).

Main NWFPs extracted	Uses	Quantities (per day)	How NWFPs affected by CV	
			In quality	In prices

15. What do you think is/are the cause of climate variability in this area.

i) Keeping of livestock.....1.YES 2..... NO

- ii) Crop production.....1.YES 2..... NO
- iii) Cutting of trees.....1.YES 2..... NO
- iv) Burning of forest1.YES 2..... NO
- v) Increase in population as well increase demand of NWFPs...1.YES 2..... NO
- vi) Demand for areas for animal and crop cultivation.....1.YES 2..... NO
- vii) Construction activities like roads.....1.YES 2..... NO
- vii) Great demands for weaving materials.....1.YES 2..... NO
- viii) Higher investment in bee keeping.....1.YES 2..... NO
- ix) Charcoal burning1.YES 2..... NO
- x) Lack of awareness on climate variability effects.....1. YES 2. NO

16. What are climate variability indicators in your area?

- i. Low NWFPs products ii. Severe droughts iii. Severe floods

17. How frequently do you go for collection of NWFPs? (i). Daily (ii). Weekly

- (iii). Monthly (iv). Occasionally-how many times per week/month?

18. How do you use the income generated from NWFPs?

- (i). Taking children to school (ii).paying health care bills (iii).investing in other activities (iv). Buying agricultural equipments (v).all home expenditures

19. When do you collect NWFPs in your area?

- (i). Dry season (ii).rain seasons (iii).both seasons

20. Where do you extract/collect NWFPs

- (i). Village land forest (ii).village forest plantation (iii).both of the above

21. How do you utilize NWFPs in household level?

- (i). To generate income (ii).As alternative during food shortage periods (iii).As subsistence (iv) .All of the above.

22. If yes how?

(i).decreases in quantity (ii).decrease in quality (iii).increase in quality (iv).increase of time in extracting (v).increase in distance when reaching the forest to extract (vi)All of the above mentioned.

23. How much time do you take to reach the forest in order to extract NWFPs

(i).1hr to 2hrs (ii).3hrs to 4hrs (iii).5hrs to 6hrs (iv). 7hrs to 10hrs

24. Can you compare the time used in past 20yrs with what used today?

01.01. Yes 02.No

25. Why do you think it take long time now to collect NWFPs?

(i). Vegetation cover of the forest is quite a distance faraway from the village

(ii). Disappearance of some species of NWFPs

(iii).poor of the road infrastructures (iv) All of the above mentioned

26. Is there any different in the distance you used to walk in past 20yrs to today?

01.Yes 02.No

27. If yes give reasons how? (i). There is more hrs spent to reach forest (ii). Distance increased (iii). All of the above

28. What types of non-wood forest products do you collect since1993 up to 2013?

Products	Frequency of collection	Quantity consumed per month	Quantity sold per month	Series of time in years
	Yearly			
Plant medicine				
Honey				
Mushrooms				
Fruits				
Vegetables				
Wild animals				
Others				

29. Put a tick in the respective box against each statement in the table below indicating

1. Disagree 2. Undecided 3. Agreed.

No.	Statements	Disagreed	Undecided	Agreed
1	Reduced rainfall has no effects to crop cultivation			
2	Climate variability has the relationship with the variability of rainfall, temperature and relative humidity			
3	Climate variability is not a threats to bee keeping			
4	Presence of weaving materials has the relationship to climate variability			
5	The availability of traditional medicine from forests has the relationship with climate variability			
6	There are approaches formulated by various institutions to overcome climate variability effects to rescue NWFPs.			
7	Unavailability of mushroom is not related to climate variability			
8	There are various approaches established by institutions which does not consider climate variability effects on NWFPs.			
9	Changes in rainfall can result to reduced occurrence of honey			
10	Do you consider climate variability to contribute to presence of pests and diseases			
11	In past 20 years NWFPs have not been affected by changes in climate and weather patterns			
12	Recently there is no decrease of bee products because of climate variability and weather variability			
13	The use of NWFPs have not been affected by climate variability			
14	The strategies introduced to cope with climate variability effects can not rescue NWFPs.			
15	There institutions which provides education and training among community on how to conserve and use NWFPs			
16	Climate variability effects do not lead to high demand and supply of NWFPs among rural communities.			

THANK YOU FOR YOUR COOPERATION

Appendix 2: Market interview guide for sellers of NWFPs

1. Do you sell non-wood forest products collected from Mtungutu forest?
2. If yes, what types of products do you sell?
3. Do you sell what you have been collected yourself from forest reserve?
4. If buy from collectors, how much did you purchase in (TAS)
5. If you have collected from the forest fill the table below

NWFPs	Time spent collecting (days)	Transport cost to the market

6. What is the unit price per item sold?
 Collect yourself----- (TAS)
 Buy from collectors----- (TAS)
7. How frequent do you sell the NWFPs? 01. Daily 02. Weekly 03. Monthly
8. How much money do you get per week /month/year from selling NWFPs?
9. What are the main NWFPs you sell/buy during the rain/dry season?

Main product	Price per unit(TAS)	
	Rain	Dry

10. How is the marketing situation of NWFPs in this village since 1993 to 2013 in consideration to climate variability effects?

THANK YOU FOR YOUR COOPERATION

Bush meat									
Wild fruits									
Wild vegetables									

THANK YOU FOR YOUR COOPERATION

Appendix 4: An interview guide for key informants

1. In the following table indicate the climate variability event which happened according to the years given and how much have been harvest and what types happened to be used.

Time in years	Type of events occurred	Types of NWFPs utilised	Quantity in kg/litres
1993			
1994			
1995			
1996			
1997			
1998			
1999			
2000			
2001			
2002			
2003			
2004			
2005			
2006			
2007			
2008			
2009			
2010			
2011			
2012			
2013			

2. What variable types of NWFPs are available in your area since 1993-2013?

4. Do you think climate variability has affected NWFPs utilization in your area since 1993-2013?

5. How is NWFPs trade contributing to generate income at district level since 1993-2013?
6. What are the peoples' perceptions towards NWFPs since 1993-2013?
7. What is the demand and supply of NWFPs in your area since 1993-2013?

THANK YOU FOR YOUR COOPERATION