CONTRIBUTION OF INDIGENOUS KNOWLEDGE TO THE CONSERVATION OF WILD MEDICINAL PLANTS IN MVOMERO DISTRICT, TANZANIA

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

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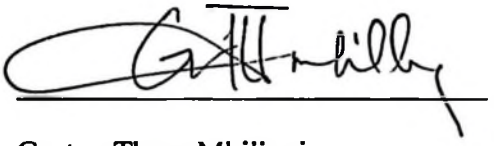
ABSTRACT

Wild medicinal plants are used and conserved based on indigenous knowledge. The objective of this study was to assess the contribution of indigenous knowledge to conservation of wild medicinal plants. Four villages were selected based on their proximity to the forest reserves. Data were collected through household questionnaires with 133 respondents, focus group discussions (FGDs), and transect walk. The Statistical Package for Social Sciences (SPSS) and MS Excel computer software tools were used to analyse qualitative and quantitative data respectively. One hundred twenty-seven out of 133 respondents (95%) reported using WMPs. A total of 91 WMPs reported to be used as traditional medicine by communities were identified and documented. Ten out of 91 WMPS were reported to be grown mainly on home gardens while the rest (81) are wild-harvested. Roots (57%) and leaves (57%) were reported to be harvested from grown and wild harvested WMPs respectively. Farmland, public land, homesteads and forest reserves were reported to be sources of WMPs. Though public land was reported to be the main source (39%), the study noted that most of the WMPs were harvested from the forest reserves as most of the identified WMPs were from forest reserves. Nine traditional practices were mentioned to be used in conservation of wild medicinal plants. These included domestication, beliefs in sacred plants and forests, respect of cultural forests, protection of plants at the burial sites, selective harvesting, secrecy on plants name, location, collection of deadwood for firewood, and use of energy-saving cooking stoves. The logistic regression test results showed that indigenous knowledge has an influence on conservation. The Likert-scale response categories of the respondents showed that 99% of the respondents had positive attitude towards local conservation methods. The study found that indigenous knowledge contributes to conservation of wild medicinal plants in the communities around Mvomero District.

DECLARATION

I, GASTON THOM MBILINYI, declare to the Senate of Sokoine University of Agriculture that this dissertation is my original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.



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Gaston Thom Mbilinyi — Date

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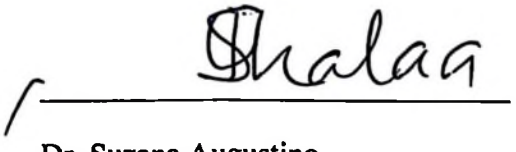

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DEDICATION

To my parents; the late Thom Gavineleke Mbilinyi and the late Tumwise Jotam Sanga who laid foundation of my academic achievements. May the Almighty God rest your souls in Eternal Peace. Amen!

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LIST OF ABBREVIATIONS AND ACRONYMS

BECAO	-	Beekeeping Community Awareness Organization
DIIS	-	Danish Institute for International Studies
FAO	-	Food and Agriculture Organization of the United Nations
FBD	-	Forestry and Beekeeping Division
FGDs	-	Focus Group Discussions
MNRT	-	Ministry of Natural Resource and Tourism
NMPB	-	National Medicinal Plants Board
SNAL	-	Sokoine University of Agriculture National Library
SPSS	-	Statistical Package for Social Sciences
TFCG	-	Tanzania Forest Conservation Group
TMPs	-	Traditional Medical Practitioners
UN	-	United Nations
UNIDO	-	United Nations Industrial Development Organization
URT	-	United Republic of Tanzania
USAID	-	United States Agency for International Development
WEO	-	Ward Executive Officer
WHO	-	World Health Organization
WIPO	-	World Intellectual Property Organization
WMPs	-	Wild Medicinal Plants
WWF	-	World Wildlife Fund

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background information

Plants with medicinal value have a global recognition in primary health care (Guerrant *et al.*, 2004; Colfer, 2008). Among the natural resources are wild medicinal plants (WMPs) which are gathered from the wild, particularly, in the natural forest. Literature shows that the most beneficiaries of WMPs are rural communities of the developing countries (Msuya and Kideghesho, 2009; Orodho *et al.*, 2013; Seid and Aydagnehum, 2013).

WMPs have been used in Africa as a source of medicines from ancient time to the present (Kisangau *et al.*, 2011, Seid and Aydagnehum, 2013). Similarly, in Tanzania people gather and use WMPs for traditional medicines as shown by many studies done in various areas (Mahonge *et al.*, 2006; Kitula, 2007; Augustino *et al.*, 2014). According to Mhame *et al.* (2004), more than 60% of the population in Tanzania depend on traditional medicines for the management of various diseases.

Mvomero is one of the Districts in Morogoro Region, rich in plant diversity from a range of natural forests of Mkindo and Nguru South Forest Reserves which altogether form the Mkingu Nature Reserve. The other natural forest reserves in Mvomero District include Kanga, Mziha, Bwage, Difinga, Dunduma, Lusungura, Mtibwa and part of Uluguru Nature Reserve. Almost all of these forests are under joint forest management (JFM) where forest management is done by the collaboration between the government and the communities around the particular forests by sharing the costs and benefits from the forests. Among other benefits they get, communities surrounding these areas collect forest products including medicinal plants from the forest nature reserves (Forestry and

Beekeeping Division, 2005; Bracebridge, 2006). It is apparent that local people treasure the rich knowledge of plant preservation and conservation including WMPs for a number of years. When this knowledge is combined with the modern conservation methods, under JFM the local people feel that their local conservation methods are respected (Kitula, 2007). This probably essentially inspires them to participate in conservation projects in their local areas.

The use of WMPs in most local communities is based on indigenous knowledge (UNIDO, 2003; Colfer, 2008) which is normally handed down from one generation to the next through oral traditions and not written records (Martin, 1995; Sinha, 1996). The indigenous knowledge, among other things, includes the way local people identify, collect, prepare, treat and administer plant species (Baillie *et al.*, 2004).

However, it has been reported that medicinal plants face many challenges, notably: threats due to increasing depletion of the natural resource as an impact of population increase, urbanization, modernization of agriculture and climatic change and the indigenous knowledge associated with the conservation and use of medicinal plants is also disappearing at an alarming rate (Kayombo *et al.* 2013). In addition to that, young people in most areas are constantly moving to urban centres in search of employment and education and thus, traditional knowledge of plants is concentrated in the few and older experts in most areas where traditional medicines are used (Silva *et al.*, 2011; Lense, 2012). It is apparent that commercialization of WMPs is also contributing to both the depletion of natural resources including WMPs and to the erosion of indigenous knowledge towards conservation. Therefore, there is a need to document the indigenous knowledge and how is applicable in conservation of wild medicinal plant in Mvomero District.

1.2 Problem statement and justification

Wild medicinal plants (WMPs) are used worldwide by both developing and developed countries (Guerrant *et al.*, 2004). FAO (2003) reported that more than 3.5 billion people in the world rely on plants for the treatment of both human and livestock diseases. According to WHO (2002), over 80% of the world's population relies on plant-derived medication for their healthcare needs. The use of WMPs, especially in developed countries, is reported to be based on indigenous knowledge which is embedded in the local peoples' culture and, in some cases in their religions (Colfer, 2008). However, besides manifold human interferences, overuse of WMPs threatens the taxa of medicinal plant to the extent of extinction (Guerrant *et al.*, 2004; Chaudhuri, 2007). Moreover, several studies have noted that there is erosion of indigenous medical knowledge as most of the traditional health practitioners are aging and dying, while the expected youths to inherit the practice shy away from practice (Lense 2012; Seid and Aydagnehum, 2013; Kayombo *et al.*, 2013).

Demography of Mvomero District communities as part of the world, among others, is composed of people of different ages and ethnicity who use natural forest resources including WMPs for their healthcare needs (Bracebridge, 2006; URT, 2013). According to FBD (2005) and Mahonge *et al.* (2006), in Mvomero District, WMPs and other forest plants are harvested from natural forests by traditional practitioners and other people who are unaware of sustainable use or conservation of the forest natural resources. This leads to forests destruction and hence extinction threat to some important healing plant species. Besides low knowledge on conservation of natural forest resource users, there is insufficient information on the contribution of indigenous knowledge to the conservation of WMPs in Mvomero District.

Therefore, this study aimed at assessing the contribution of the indigenous knowledge on conservation of WMPs as well as other plants in Mvomero District. The findings will add value to the scientific database on indigenous methods for conservation of natural resources in Tanzania and elsewhere. Moreover, the findings will be useful to policy makers, conservationists, scientists, and WMPs users in ensuring sustainable use of WMPs under threat as each stakeholder plays his or her roles on issues relating to plant conservation.

1.3 Objectives and Hypothesis

1.3.1 Overall objective

The overall objective of this study was to assess contribution of indigenous knowledge in conservation of wild medicinal plants around Mvomero District, Tanzania.

1.3.2 Specific objectives

The study had the following specific objectives:

a) To identify the type of conserved WMPs, their sources, and uses in the study area,
b) To examine the methods used in conservation of WMPs in the study area, and
c) To assess attitude of the people surrounding the natural forests towards indigenous knowledge used for conservation of WMPs.

1.3.3 Hypotheses

The study had the following assumptions:

H_0: Indigenous knowledge has no contributions on conservation of wild medicinal plants in the communities of Mvomero District.

H_1: Indigenous knowledge has contributions on conservation of wild medicinal plants in the communities of Mvomero District.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Global overview on wild medicinal plants

Wild medicinal plants (WMPs) have played a significant role in various ancient traditional systems of medication in many countries (Colfer, 2008). WMPs still play an important role in many developing countries like Tanzania, both in preventive and curative treatments, despite advances in modern western medicine (UNIDO, 2003). Many studies show that WMPs also generate income to the people who earn their livelihood by selling collected materials from the forest, or those who cultivate in their farms (McMillen, 2008; Trivedi, 2009).

The World Health Organization (WHO, 2002) estimated that 80% of the populations of developing countries rely on traditional medicine, mostly derived from plants, for their primary health care needs. Demand of medicinal plants is increasing throughout the world. Many studies show that modern drugs used worldwide are plant-based and collected from wild sources (Laird, 2002; Colfer, 2008; Kayombo *et al.*, 2013).

According to Quinlan and Quinlan (2007), introduction of western medicine in developing countries displaced local systems of animal and human health care. However, the expensive cost of conventional drugs and their short supplies, make their affordability difficult (Msuya and Kideghesho, 2009). Further, the authors observed that in Tanzania, even where modern medical services are available, the use of medicinal plants has remained a more feasible option due to a number of reasons like affordable prices, relative accessibility, local availability, and trust in the efficacy of medicinal plants.

The heavy dependency on medicinal plants renders them vulnerable to over-exploitation, triggering increased scarcity and even loss of certain species. Thus, conservation of the wild medicinal plants and other resources are essential, and this can be accomplished if traditional management practices are incorporated (Hamilton and Hamilton, 2006; McMillen, 2008; Akerele *et al.*, 2009).

2.3 Wild medicinal plants in Tanzania

Medicinal plants are those with medicinal values (National Medicinal Plants Board, NMPB, 2008) and are the roots of medical practice (Colfer, 2008). In this study, WMPs refers to undomesticated plants and their parts that provide health-promoting characteristics, temporary relief from symptomatic problems or has curative properties which are used by local people through knowledgeable people in their areas though they are not scientifically proven (Lewington, 1993).

Today many medicinal plants worldwide face extinction or severe genetic loss, and detailed information is lacking (Akerele *et al.*, 2009). According to Nahashon (2013), Tanzania has more than 10,000 plant species with many endemic species. Furthermore, the same author noted that about 25% of these 10,000 plant species were wild medicinal plant species. Like other areas around the world, WMPs in Tanzania are used and harvested at growing rates but not much is known about their future availability (McMillen, 2008). For example, Nahashon (2013) noted that about 60% of the entire Tanzanian population depends on medicinal plant species as their primary health care; and in most areas especially rural areas, herbalists play a crucial role in the health care system for both human beings and animals. However, it has been noted that some of the WMPs are depleted due to the rapid growth of industrialisation and mining, indiscriminate exploitation of resources, ecological imbalance due to pollution, forest fire, depletion of

soil due to poor agricultural practices, erosion of soil due to deforestation and poor water holding capacity of soil, drought, emerging unskilled collectors and many more (McMillen, 2008; Nahashon, 2013). Thus, the chance of total elimination of species increases and such loss of species is never healthy for the environment and the consequences become critical issue that affect human health, livelihoods, habitat conservation and genetic conservation.

Millions of people throughout the world derive an extensive portion of their health care needs and income from wild medicinal plants (Hawkins, 2008). For example, many studies (Msuya and Kidegesho, 2009; Seid and Aydagnehum, 2013; and Orodho *et al.*, 2013) showed that WMPs are essential components of primary health care, especially for rural communities in developing countries.

According to UNIDO (2003), East African countries are endowed with rich resources of WMPs and the demand by most of the people for WMPs has been met by indiscriminate harvesting of spontaneous flora including those in forests. As a result, many plant species in different places have become extinct and some are endangered (UNIDO, 2003; Msuya and Kideghesho, 2009). For example, it has been noted that trade and deforestation are the major factors threatening WMPs in Tanzania (Hamilton, 2003). Mahonge *et al.* (2006) observed that 37% of medicinal plants used by Waluguru, the ethnic group from Morogoro Region, are collected from the natural forests.

2.4 Conservation of Wild medicinal plants

According to Barth (1995), knowledge is what people employ to interpret and act on the world: feeling as well as thoughts, embodied skills, taxonomies and other verbal models. At the present, it is widely accepted that traditional knowledge is a body of knowledge

built by a group of people through several generations by living in close contact with nature (Johnson, 1992). On the other hand indigenous knowledge is a subcategory inside traditional knowledge, being then a sustainable traditional knowledge used by communities, people and nations that are indigenous (WIPO, 2001; Tapfumaney and Rupande, 2013).

In this study, the term "indigenous knowledge" is used synonymously with terms such as "local knowledge", "community knowledge", "traditional knowledge" and "traditional ecological knowledge". All of the above terms are generally defined referring to knowledge in local communities (people) about their everyday life experiences, their local environment included.

Plants are the source of food and medicine, mankind has focussed their attention on plants and their uses (Akarele *et al.*, 2009). These plants come from a number of different habitats, both natural/wild and altered. Field collections require a person who has undergone either formal or informal practical education or training in plant sciences to ensure the long term survival of wild populations and their associated habitats (WHO, 2003). This is because harvesting medicinal plant makes destruction to a plant. For example, Trivedi (2009) noted that over 70% of the plant collections involve destructive harvesting because part of plants harvested include roots, bark, wood, stem and sometimes the whole plant in the case of herbs. This suggested that collection that leads to sustainable use of plants requires skilled personnel and that plant destruction becomes severe if collection is done by unskilled ones. WHO (2003) suggested that when planning for plant collection, season and time must be taken into consideration.

The history of human existence and civilizations is intertwined with forests and trees (UN, 2011). For example, both traditional medical practitioners (TMPs) and herbal traders obtain medicinal plants from the wild particularly natural forests (Cunningham, 1993; Lense, 2012). For local communities, wild medicinal plants are used based on indigenous knowledge (TFCG, 2006; Amri and Kisangau, 2012). Some studies show that in Tanzania, medicinal plant collectors use methods that lead into some of plant resources to disappear .during the process of harvesting. It has been noted that harvesting methods which leads to extinction of medicinal plants include uprooting the whole plant or ring-debarking the stems of trees (Kasangau *et al.*, 2011; Augustino *et al.*, 2014) as well as over exploitation for commercial purposes unsustainably. Despite of climate change, anthropogenic factors that threaten forests include change of land use for industries, urban establishment, modern agriculture, uncontrolled burning and intensive livestock keeping (TFCG, 2006; Bracebridge, 2006; Kisangau *et al.*, 2011). Amri and Kisangau (2012) suggested that local communities should be educated on sustainable methods of harvesting medicinal plants without compromising their availability for future use. It is also imperative to train the community on the proper propagation techniques in order to encourage the domestication of valuable and threatened medicinal plants.

2.5 Indigenous knowledge in conservation of WMP

The value of indigenous knowledge to modern science and technology is unquestionable. Scientists, medical researchers, nutritionists and pharmaceutical companies exploit rural communities' knowledge of plants, animals and the environment for mainly commercial gain (Kothari, 1995). This can be due to the fact that indigenous people of various localities have developed their own specific knowledge on various aspects including plant resource use, management and conservation over time (Tapfumaneyi and Rupande, 2013). Generally, it forms the basis of survival for the people who own the knowledge.

Henceforth, if the indigenous knowledge can be employed effectively in conservation strategies, then the WMP species under extinction threat will be safe and be enough stock for the needy people. Natural resources conservation, WMPs being part of it is necessary as environmental issues are at the forefront of development (Mukoni, 2015). For example, traditional healers use WMPs to prepare remedies that they play an essential role in the health of millions of people (Yineger and Yewhalaw, 2007; Kayombo, 2013). According to Seid and Aydagnehum (2013), for example, more than 80% of Ethiopians rely on traditional healers. The same authors also noted that the population growth with increasing demand and consumption is distracting medicinal plants resources from their natural habitat. This signifies the need of conservation that will enhance sustainable use of these invaluable natural resources.

Conservation refers to the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet needs and aspirations of future generations (WWF and USAID, 1993 in Augustino, 2002). Thus, conservation of wild medicinal plants is the process of preserving, maintaining, protecting, using sustainably and restoring them in their natural environment. However, as WMPs receive scientific and commercial attention, there is increasing pressure on their populations from the source. For example, overharvesting, bad harvesting methods like uprooting the whole plant and ring-debarking the stem of a plant, and uncontrolled fire have placed many WMPs at risk of extinction (Bracebridge, 2006; Kisangau *et al.*, 2011; Amiri and Kisangau, 2012; Augustino *et al.*, 2014). WHO (2002) observed that indigenous knowledge and usage of medicinal plants are being lost globally at a fast rate because of the impact of modern education, increase in health coverage and urbanization.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study area description

3.1.1 Geographical location and size

The study was conducted in four villages of Hembeti, Mkindo, Mndela and Kilimanjaro in Mvomero District (Figure 1), Morogoro Region. The study was conducted in the named villages because the villages are very close to the forests and the study assumed that the people from these villages are forest-dependent. The District is one of the six Districts of Morogoro Region. Mvomero District lies between latitude 6° 25′ 00" South and longitude 37° 35′ 22" East of Greenwich. The District occupies a total area of 7 325 square kilometres. It is located at the northeast of the Morogoro Region and is bordered to the north by Tanga Region, to the northeast by the Coast Region, to the east and southeast by Morogoro Rural District and Morogoro Urban District and to the west by Kilosa District. Administratively (Table 1) the District is divided into 4 Divisions, 17 Wards, 101Villages and 577 Hamlets.

Table 1: Distribution of administrative units in Mvomero District

No.	Division	Wards	Villages	Hamlets
1.	Mvomero	4	31	154
2.	Turiani	5	27	158
3.	Mgeta	4	22	156
4.	Mlali	4	21	109
Total		17	101	577

Source: Mvomero District Council (2014)

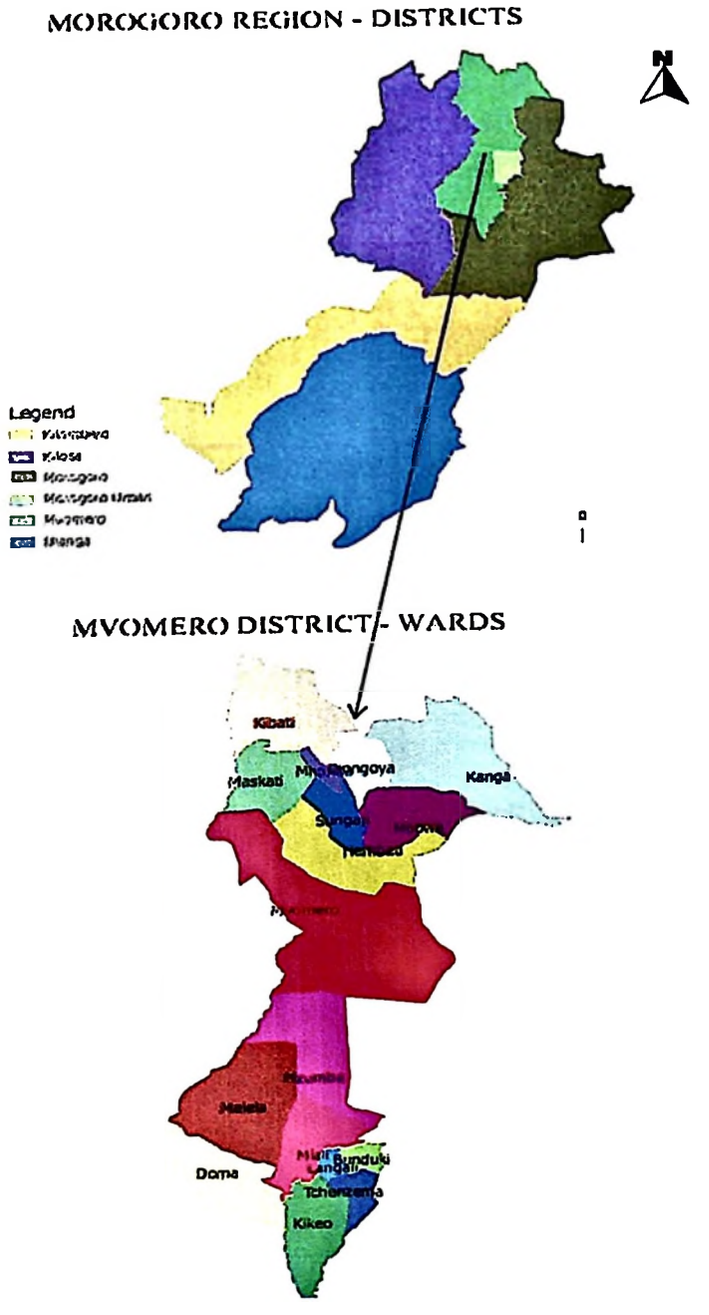

Figure 1: Map of the study area showing ward distribution in the District.

Source: Study survey (2014)

3.1.2 Population and ethnicity

According to the 2012 national human population census, the District is inhabited by 312 109 people (URT, 2013). Nguu and Kaguru people were the earliest settlers in the

landscape, followed by the Zigua, Maasai, Luguru, Chagga, Pare, Bena, Sukuma, Kinga, Hehe, Ngoni, and Nyakyusa ethnic groups who arrived later (DIIS, 2007). Yet, Luguru people form the majority of the inhabitants in Mvomero District (Mhango, 2008).

3.1.3 Topography and vegetation

The District varies greatly in its topography and climate. Mountains and highlands are located in the northwest, lowland rainforest in the north and central areas, and the drier woodlands in the south (Heather, 2008).

The vegetation of the study area differs depending on the topography of the area and the amount of rainfall received yearly at the particular location. However, this observation was done in villages very close to forest reserves. The forest reserves available in the District include Mkingu Forest Nature Reserve (Figure 2), Duduma Forest Nature Reserve (Figure 3), Kanga, Mziha, Bwage, Difinga, and part of Uluguru Nature Reserve.

Woodland species include *Annona senegalensis*, *Brachystegia boehmii*, *B. microphylla*, *B. spiciformis*, *Diplorhynchus condilocarpon*, *Julbernardia globiflora* among others. Lowland forest species include *Afrosersalisia cerasifera*, *Antiaris toxicaria*, *Bequaeritiodendron natalense*, *Cola greenwayii*, *Cola stelecantha*, *Milicia excelsa*, *Parinari excelsa* (FBD, 2005). Mtui *et al.* (2006) and Bracebridge (2006) reported that Turiani Division is characterized by lowlands, small hills and low undulating mountains. Important vegetation includes small forests with light grasslands dominated by *Panicum* species, mostly intermingled with shrub and leguminous trees.

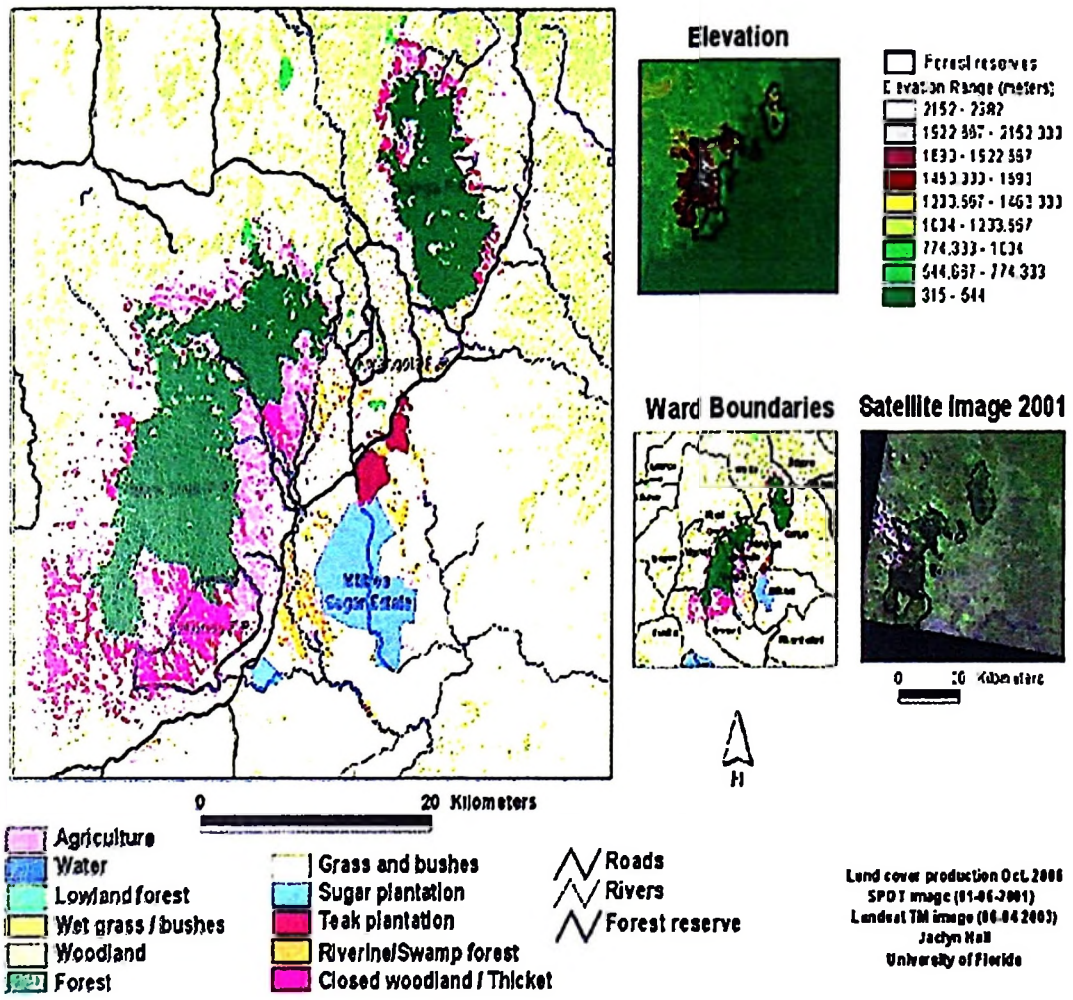

Figure 2: A map showing Mkingu (Mkindo and Nguru South) Nature Reserve

Source: Mkingu Nature Reserve Office (2014)

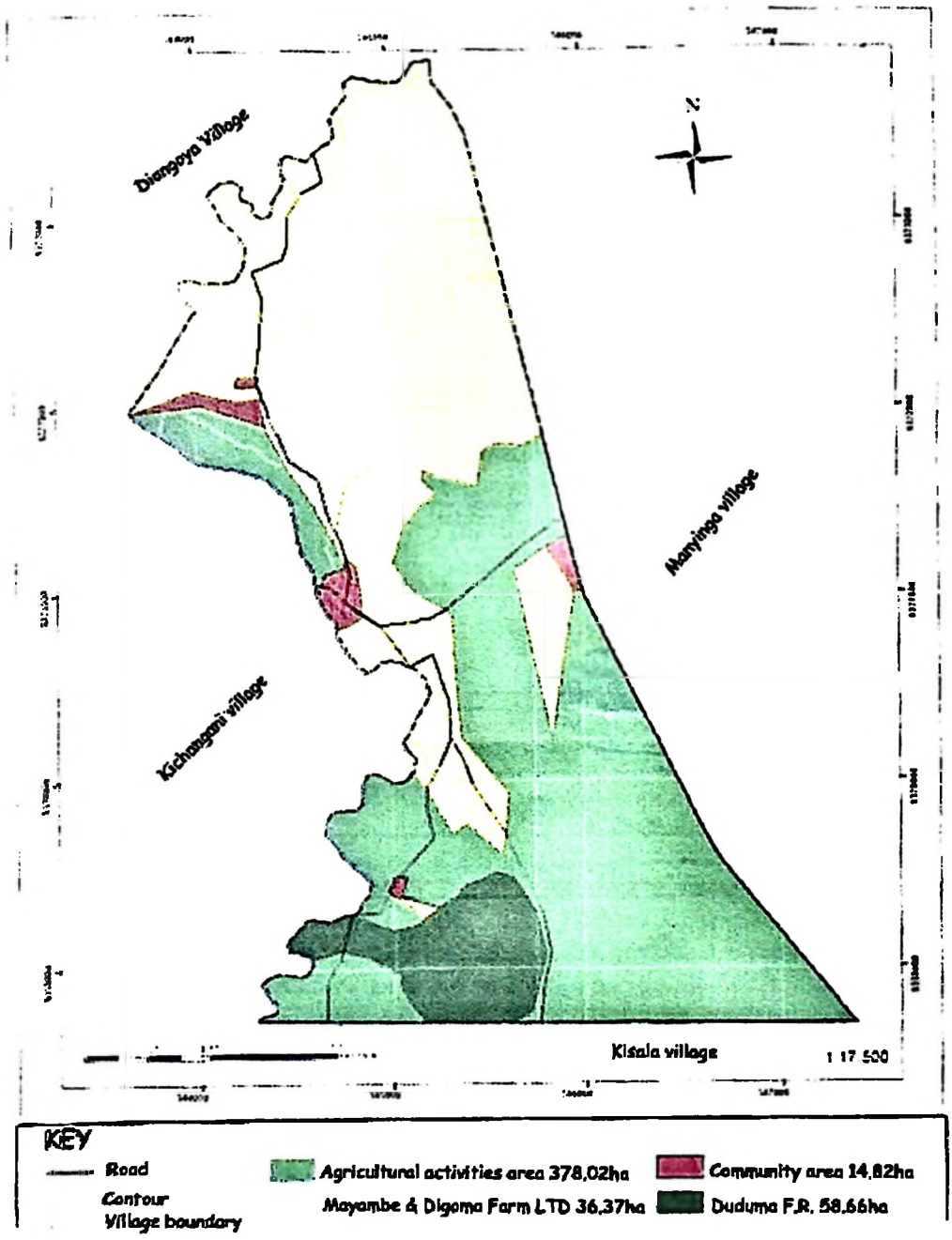

Figure 3: A map showing Dunduma Forest Nature Reserve

Source: Kilimanjaro Village (2014)

The forest reserves of the study area are vulnerable to illegal activities such as poaching and encroachment done by the villagers from the nearby communities (TFCG, 2006). According to Bracebridge (2006), there are increasing threats to forest reserves due to

clearing forest for opening new farms, frequent fire incidence, charcoal making, harvesting medicinal plants, cutting building poles/firewood, and timber /logs extraction. Also the same author noted that people were unaware of the importance of forests and conservation.

3.1.4 Climate

According to various studies done in Mvomero District, the northern area of the District receives rainfall twice a year that ranges from 1500 to 2000mm making humid or sub humid climate while the southern part is much drier with annual rainfall ranging between 600 and 1200mm (Lyimo *et al.*, 2004; Karimuribo *et al.*, 2005). However, Mkonda (2014) noted that rainfall in Mvomero District has been fluctuating at a decreasing rate. According to Mlozi *et al.* (2006) the average temperature in Mvomero ranges from 20-30^{0}C.

3.1.5 Socio-economic activities

The people in the study area are engaged in agricultural crop production and the main crops include rice, maize, cassava, fruits, together with the large scale sugarcane and sisal plantations (Mboera *et al.*, 2007). The same authors also recognized that the southern part of the area is primarily composed of pastoralists who keep livestock like cattle, goats and pigs to mention a few. Also, it has been observed by Bracebridge (2006) that people sell timber, charcoal and other non-wood forest products including WMPs.

3.2 Sampling and data collection

3.2.1 Research design

This study adopted a cross-sectional design in four villages: Hembeti, Mkindo, Mndela and Kilimanjaro which were in two wards of Hembeti and Sungaji in Mvomero District. A

cross-sectional research design allows data to be collected at a single point in time and is usually the simplest and least costly alternative (Neuman, 2007 and Ary *et al.*, 2010). The design uses minimum time and resources. The study adopted the sampling technique as postulated by Bailey (1994) who argued that a significant representation of a population is achieved when a sample of 30 households of the population size is enough for social science study.

3.2.2 Sources of data and sampling procedure

3.2.2.1 Source of data

In this study, both primary and secondary data were used. Primary data were collected using social survey methods involving focus group discussions, questionnaire survey, and transect walk; while secondary data were collected by consulting relevant documents both published and unpublished for the study area and other sources such as libraries and online web resources.

3.2.2.2 Sampling frameworks

The study was carried out in four villages (Hembeti, Mkindo, Mndela, and Kilimanjaro) from two wards (Hembeti and Sungaji). The four villages were purposively selected because they are very close to the forests Mkingu and Dunduma Nature Reserves. Using village registers, households were randomly identified to be representative of the population of this study where a household was taken as a sampling unit. A total of 133 households were interviewed out of which 27 households were from Hembeti, 28 from Mkindo, 30 from Mndela, and 48 from Kilimanjaro. From each household, only respondents dealing with WMPs (use, collect, grow, sell) were interviewed (questionnaire survey).

3.2.2.3 Sampling procedure

The study area has seven villages in Hembeti Ward with the population of 4 864 and six villages at Sungaji Ward with a human population of 3 512 making a total human population of 8 376 in the two wards. Hembeti Ward is near to Sungaji Ward and each ward is very close to forest. Hembeti Ward is close to Mkingu Nature Reserve while Sungaji Ward is close to Dunduma Forest Reserve. The actual data collection was preceded by a preliminary survey to determine the villages which were near to forest areas. The survey recognized that the Hembeti, Mkindo, Mndela and Kilimanjaro villages were close to forest reserves. Hembeti, Mkindo and Mndela Villages were in Hembeti ward and are near to Mkingu Forest Nature Reserve while Kilimanjaro village is close to Dunduma Forest Nature Reserve in Sungaji ward. By the help of village leaders, the village registers were used where households were randomly identified to be representative of the population of this study. By using simple random sampling procedure, a sample size of average of 33 households was taken in each selected village. This is almost equal to thirty households recommended as a suitable sample size for statistical analysis in social science studies (Bailey 1994). A household was taken as a sampling unit because some researchers (Colfer, 2008; McMillen, 2008) have argued that all decision about collection, consumption and production or conservation of WMPs is taken at household level. Considering age of members of a family, any youth or elder member capable of giving information on indigenous knowledge, medicinal plants or conservation was interviewed from each selected household. Each respondent was interviewed only once and individually to avoid answers being influenced by others. Further, focus was paid to WMPs dealers (consumers, healers, vendors, growers, collectors) in each household sampled. Therefore, a total of 133 households were interviewed out of which 27 households were from Hembeti, 28 from Mkindo, 30 from Mndela, and 48 from Kilimanjaro.

3.2.3 Data collection methods

Primary data on WMPs uses and their sources, extraction methods, and indigenous knowledge involved in conservation were collected using focus group discussions, questionnaire survey, and transect walk. The FGDs and questionnaire survey (face-to face interviews) used a checklist and structured questionnaire, (Appendix 2 and 3) respectively. A questionnaire was used to interview sampled household respondent capable of giving information while a checklist was used in FGDs. Questionnaire survey involved visiting individual respondent in their homestead with the exception of individuals involved in FGDs who were invited to their respective village office for discussion.

Secondary data were collected from different sources including reviewing relevant documents like journals and books, published and unpublished documents from Sokoine University of Agriculture National Library (SNAL) and websites. The collected secondary data were used to supplement the primary data, by extracting information on what has been done in relation to the contribution of IK to conservation of WMPs and identify gaps in information.

3.2.3.1 Focus group discussions

Focus group discussions were held in each of the selected village involving two traditional healers, two community elders, two members who were identified as knowledgeable in conservation issues within the surveyed village, any village leader who acted as a secretary, and the researcher who was the chairperson of the discussions. One FGD was conducted at each village, thus making a total of 4 FGDs. Participants for FGDs were selected purposefully with the help of village leaders in the respective villages in the study area. An interview schedule was used (Appendix 1) to collect information on wild medicinal plant species cultivated for medical purposes, reasons for some plants being cultivated while others are not cultivated as well as information on WMPs uses and

indigenous knowledge employed in conservation of essential plants like WMPs in each community.

3.2.3.2 Questionnaire survey

The questionnaire was designed to facilitate the collection of both quantitative and qualitative information. A structured questionnaire with both closed and open-ended questions (Appendix 2) was employed. The aim was to clearly focus responses while at the same time deriving reasons and supporting arguments. The questionnaire was designed in English but translated into Kiswahili, the language used by the respondents for ease of administration. Also, it collected information on various aspects of the study including understanding of the respondents about WMPs focusing on indigenous knowledge employed in sustainable WMPs harvesting methods which leads to conservation. Among the information collected were WMPs harvested and cultivated, their uses, parts used, and harvesting methods.

3.2.3.3 Transect walk

Transect walk (survey) was conducted in each of the visited villages with a villager knowledgeable in plant identification, botanist, and the researcher. The term transect in this study refers to a path from the point where a plant identifier was picked at 2:00am to any point where time compelled us to stop as agreed to walk for 8 hours per a day. Observations for WMPs were done in the width of about 10 meters, 5 meters on each side of the path we were walking. Likewise, the area of about $30m^2$ where WMPs were found was considered as a plot along the particular path or transect. Hence, the walk in each village was a criss-crossed transect according to the plant identifier who was taking the team to where he or she thought the listed plants were growing. The purpose of the transect walk was to be shown plants mentioned during the FGD and questionnaire survey

for identification. Furthermore, the walk assisted to ascertain the areas mentioned to be the sources of WMPs commonly used in the communities. Through transect walks, various ad hoc questions on WMPs were posed to plant identifier and observations were done to see if there were any plants affected by the WMPs users. Both, conserved WMPs and wild-harvested WMPs were recorded and identified through the transect walk. This was done with the help of the botanist using his expertise and various literatures like Beentje (1994), Lovett (2006), and Schulman *et al.* (1998).

3.3 Data Analysis

Data were analysed quantitatively and qualitatively using the Statistical Package for Social Science (SPSS version 16.0 (SPSS Inc., Chicago, IL, USA) and Ms Excel computer software tools.

3.3.1 Quantitative data analysis

Data collected through structured questionnaires were coded and subjected to SPSS for descriptive analysis to obtain information such as percentages and frequencies. Inferential analyses were also carried out to find relationships between some variables. Hence, Cross tabulations of variables were done, and chi-square test (χ^2) was used to determine the statistical significance between various variables. Ms Excel computer software tool was used to summarise the information of cultivated and wild-harvested plants. The results were summarized in tables and figures for interpretations. The respondents who mentioned less than five WMPs were considered to have lower knowledge WMPs and categorized into 0 values while those who mentioned five and above WMPs were considered to have high knowledge of WMPs and categorised into 1. Moreover, assessment of the contribution of indigenous knowledge on conservation was done using binary (dichotomous) logistic regression while controlling for a set of independent (predictor)

variables like sex, education, age, length of stay, religion, marital status, as well as knowledge in WMPs. Some scientific literatures show that binary logistic regression is suited to models where the dependent variable is dichotomous (Kleinbaum *et al.*, 2002, Ary *et al.*, 2010). Tests of significance were conducted at the 5% confidence level. The following regression equation was used:

$Y = f(X_1, X_2, X_3, \ldots, X_n)$

Where: Y is the dependent variable taking on the values 1 (if high knowledge) and 0 (if low knowledge).

f represents the logistic function, which describes the mathematical form on which the logistic model is based

$X_1 - X_n$ represents a set of independent (control) variables like age, sex, education, indigenous knowledge, etc.

From the model above, the independent variable included in the model are described in Table 2.

Table 2: Description of variables in the study

S/No.	Variable	Description
1.	Age groups	It was assumed that people in higher age groups know and deal (use, grow, sell, collect) with WMPs, hence conserve them
2.	Indigenous knowledge	It was assumed that indigenous people use their indigenous knowledge in using and conserving WMPs.
3.	Education level	It was assumed that educative people do not value traditional medication services; hence they do not deal with WMPs and conservation as well.
4.	Marital status	It was assumed that married people with families have a high chance of knowing and using WMPs and hence involved in conservation.
5.	Religion	It was assumed that some religions are against tradition medication. Thus, followers do not deal with WMPs, hence they do not conserve
6.	Length of stay	It was assumed that anyone stayed for long time of period in a study area is familiar with WMPs and possibly involved in conservation activities.
7.	Sex	Male and female in most areas have different roles. It was assumed that men know WMPs more than females and that men involve in conservation activities compared to females

3.3.2 Qualitative data analysis

Qualitative data and information were analysed by using content analysis techniques. This method, as explained by Dawson (2002) and Rugg and Petre (2007), is used for analysing respondents information and reduce the total content of communication to a set of categories that represent some characteristics/themes of research interest. The information (e.g. opinions/ideas) collected through verbal discussion with different respondents was documented and then broken down into small meaningful units of information to ascertain values and attitudes of the respondents.

To capture the attitude of the respondents on indigenous knowledge used for conservation of WMPs in their community, a Likert-scale question with scaled responses as Strongly Agree (SA), Agree (A), Neutral (N) Disagree (D) and Strongly Disagree (SD) with a corresponding score value of 5, 4, 3, 2 and 1, respectively was used. Each respondent was asked whether he/she strongly agree, agree, neutral, disagree, or strongly disagree with the traditional methods used in plant conservation including WMPs. Furthermore, inferential analysis was carried out to find the degree of independence or dependence between age groups and WMPs conservation methods. Then, a cross tabulation was applied to determine the degree of agreement or disagreement on WMPs conservation methods.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Characteristics of the respondents

The respondents' sex, age, marital status, ethnicity, residential period, educational levels, religion, and village were used as parameters to describe respondents' characteristics. About 74 (55.6%) of the respondents were males and 59 (44.4%) were females. Chi-square tests showed no significant difference in sex at 5% level of probability (Chi-square value = 2.594, df = 3, p = 0.459). This result suggests that males and females were not equally represented during the surveys. This is true because the study observed that men in each village were easily available and willing to give information compared to females. During the study time, most of the females were outside their homes for various activities including agricultural activities and if found at home some of them were not willing to give information because they were busy doing various home activities like cooking or washing clothes. This result is similar to what has been reported by Inglis (1993) and Colfer (2008) that participation of males in family activities is less compared to females' participation.

About 35.3% of the respondents were aged between 30 and 49 years old. Other age groups are as presented in Figure 4. These results imply that most of the respondents were above 30 years. The study considers that a person at 30 years has knowledge and experience associated with the use and conservation of WMPs and his or her information given to this study is useful.

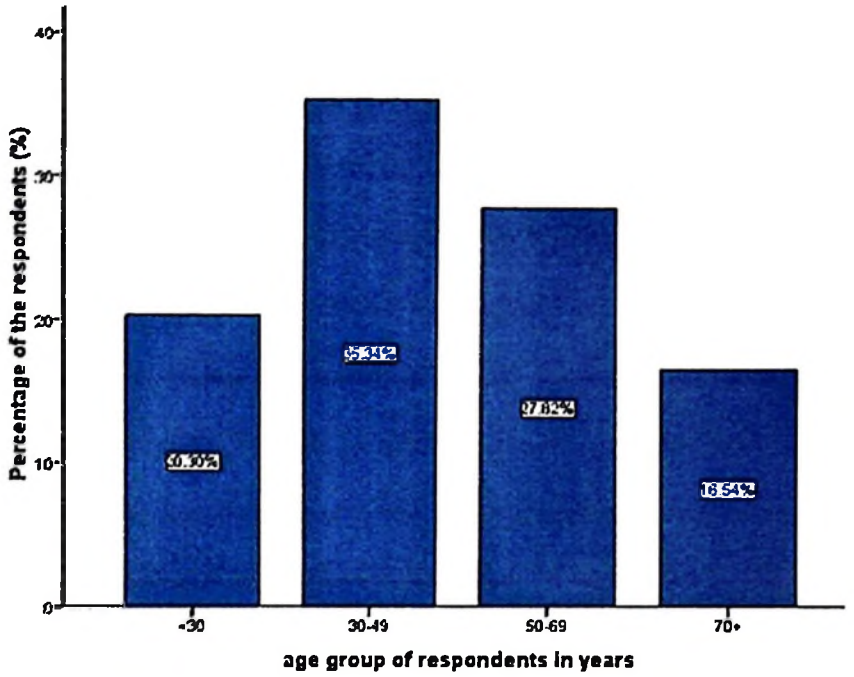

Figure 4: Age groups distribution of the respondents living in the study area.

These findings are similar to a study by Kitula (2001) who reported that the age of 40 years and above symbolizes not only status and respect but also experience and wisdom. Informal conversation during focus group discussion revealed that elders claimed that most of youths in their village are not willing to learn and participate in any matter relating to indigenous knowledge including using WMPs as local medicine when they are sick. The reason behind this is that, youths fear to be labelled as poor and old fashioned people. Besides, the elders in the study area also fear that IK and existence of WMPs in their communities will disappear as people of their age die. This finding is consistent with the finding by Schultes and Farnworth (1986) who expresses fear that those who hold this useful information may be buried with the information. Also, Kafetz (2002) noted that when old people die, a more complex process is going on than bereavement when younger people die. This may be attributed by the high stock of knowledge old people have compared to young people.

Figure 5 summarizes distribution of marital status of the respondents in the study area. Majority (75%) of the respondents interviewed were married, 11% widowed, 8% never married, 5% divorced and a few (1%) separated. The chi-square test indicated significant ($p<0.05$) difference in marital status (chi-square value = 22.694, df = 4, p = 0.001). Marital status may effect decision making at the household level, this includes the use and conservation of some WMPs for sustainable use. This implies that utilization and conservation of WMPs may be high in married families compared to single families. Understanding the distribution of marital status of respondent is important for assessing management and utilization of forest resources (Mukoni, 2015).

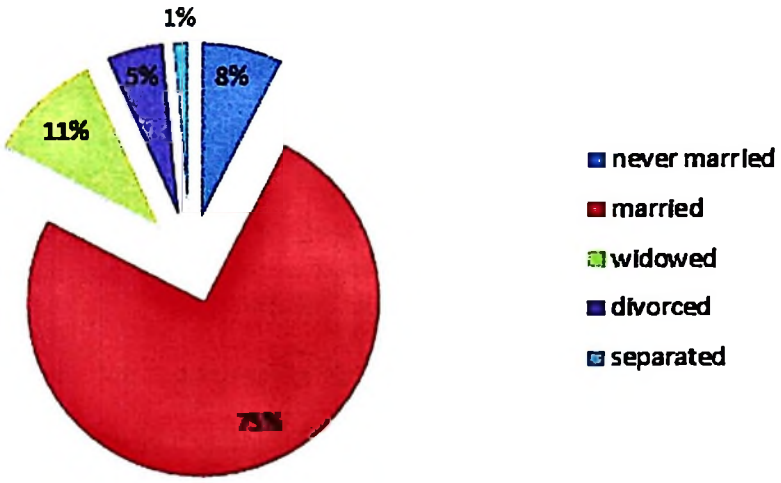

Figure 5: Distribution of marital status of the respondents living around the study area.

The respondents were categorized into four ethnic groups namely Luguru, Nguu, Zigua, and other tribes from outside Morogoro Region (Table 3). The main ethnic group of the respondents in the study area were Nguu (45) followed by Zigua (24). The chi-square test indicated insignificant ($p<0.05$) difference in ethnic groups of the respondents (chi-square value = 4.773, df = 3, p = 0.189). Further, discussion with focus group revealed that most of the people from other regions like Tanga and Kilimanjaro regions migrate to the study

area because of agricultural activities as the area is fertile and suitable especially for rice cultivation.

Table 3: Percentage distribution of the ethnic groups of respondents at the study area

Gender	Ethnic groups				Total	χ^2	p-Value
	Luguru	Nguu	Zigua	Other			
Male	8(6)	51(38)	22(16)	19(14)	100(74)		
Female	19(11)	37(22)	27(16)	17(10)	100(59)	4.773 (df = 3)	0.189
Total	13(17)	45(60)	24(32)	18(24)	100(133)		

Note: numbers outside of parentheses present percentages while numbers in parentheses present frequency

Table 4 summarises the duration a respondent stayed in the study area. The analysis showed that majority of the respondents (84%) had lived in the study area for more than 20 years. This result implies that the respondents who lived in the area for many years may have accumulated a lot of experience and knowledge on WMPs uses and conservation.

Table 4: Percentage distribution of residential period of the respondents in the study area basing on gender

Respondent category	Response on residential duration (years)			Total	χ^2	p-Value
	less than 10	11-20	above 20			
Male	10(7)	3(2)	88(65)	100(74)		
Female	17(10)	5(3)	78(46)	100(59)	2.319 (df = 2)	0.314
Total	**13 (17)**	**4(5)**	**84(111)**	**100(133)**		

Note: numbers outside parentheses present percentages while numbers in parentheses present frequency

The chi-square test results showed no significant difference ($\chi^2 = 2.319$, df = 2, *p*-value = 0.314) between residence period and utilization of WMPs. This implies that anybody could probably use WMPs and if found a plant useful and may be involved in conserving it for future use.

Moreover, the results revealed that the majority (74%) of the respondents had primary school education, followed by the respondents who had no formal education (18%) as shown in table 5.

Table 5: Educational level of the respondents around the study area

Respondents category	education level of the respondents					Total	χ^2	*p*-Value
	No formal education	Primary education	Technical or vocational education	Secondary education	College or university			
Male	16(12)	73(54)	1(1)	5(4)	4(3)	100(74)	2.021 (df=4)	0.732
Female	20(12)	75(44)	0(0)	3(2)	2(1)	100(59)		
Total	18(24)	74(98)	1(1)	5(6)	3(4)	100(133)		

Note: numbers outside parentheses present percentages while numbers in parentheses present frequency

It was observed that men had more formal education than women. The chi-square test indicated significant difference in education level in all villages visited (chi-square value = 2.021, df = 4, p = 0.732). Education enables people to easily accept and change with new technologies introduced in communities where people live. Changing with new technologies affects the use and conservation of WMPs (McMillen, 2008; Mhango, 2008).

From the results, majority (95%) of the respondents mentioned to use wild medicinal plants to treat various human ailments (Table 6).

Table 6: Status of the respondents with respect to WMPs uses

Status of respondent in relation to WMPs	Frequency (n)	Percentage (%)
Consumer	127	95
Healer	9	7
Vendor	4	3
Grower	15	11
Collector	42	32

Note: Frequencies add up to more than 133 (total number of respondents) due to multiple responses.

This result is in agreement with various scientific reports which show that beneficiaries of WMPs are people from local communities (WHO, 2002; UNIDO, 2003).

A significant relationship (χ^2 = 10.240, df = 3, p = 0.017) between collector and respondents age group was found in this study. This may imply that WMPs collectors must be aged enough to follow the guidelines on conservation.

Utilization of WMPs by most of the respondents indicates that most of them know the wild plant species with medicinal value. This may be influenced by being very close to the forest and the use of these WMPs is based on the indigenous knowledge which is part of their culture.

4.2 Type of conserved WMPs, their sources and uses

4.2.1 Types of conserved WMPs

In the current study, a total of 91 medicinal plant species (Appendix 3) which were used by the people in the communities of Mvomero District were documented and botanically

identified from four villages of Hembeti, Mkindo, Mndela and Kilimanjaro in Morogoro Region. Only 10 out of 91 medicinal plant species were mentioned to be cultivated while the rest were harvested from the wild. Nine out of the ten cultivated medicinal plants were WMPs and one plant species (*Moringa oleifera*) was an exotic domesticated medicinal plant species (Table 7). The plant parts of the cultivated medicinal plants used includes leaves, roots, and barks while the diseases reported to be treated are as indicated in brackets after each mentioned plant part in table 7.

Table 7: Medicinal plants commonly cultivated in the communities around the study area

S/No.	Scientific name	Vern. Name	Language	Plant form	Part used with disease cured in brackets
1	*Aloe vera*	Kikoli	Nguu	Herb	Leaves (malaria, gonorrhoea, headache, pneumonia)
2	*Cassia abbreviata*	Mkwizingwi	Nguu	Tree	roots (fever)
3	*Ehretia bakeri*	Mkilika	Luguru	Tree	roots (hernia, vaginal muscles, stomachache)
4	*Moringa oleifera*	Mlonge longe	Swahili	Herb	Leaves (aneamia)
5	*Ocimum suave*	Vumbasa	Nguu	Shrub	Leaves (coughs)
6	*Plectranthus sp*	Vuga	Luguru	Herb	Leaves (stomachache)
7	*Senecio sp*	Hoza	Zigua	Herb	Leaves (migraine, pain killer, stomachache, headache, fever, wizard antidote), roots (emetics)
8	*Suregada zanzibarensis*	Mdimu pori	Swahili	Tree	Roots (snakebites, pneumonia, hernia, throat pains), leaves (diarrhoea), barks (hernia, snakebites)
9	*Tamarindus indica*	Mkwaju	Swahili	Tree	Leaves (diarrhoea)
10	*Vangueria madagascariensis*	Mviru	Mmambwe	Tree	Roots (Madness, abdominal pains), leaves (intestine worms, coughs)

The number of WMPs conserved through cultivation seems to be low because most of the respondents who use the plants mainly harvest medicinal plants from the wild areas including public land, forest reserves and farms. This is probably due to easy availability of the particular WMP once required.

Figure 6 summarizes the plant parts of the commonly cultivated medicinal plants which are used in treating different human ailments. The plant parts are leaves (57%), roots (36%) and barks (7%). The respondents had no apparent reason as why they frequently use the particular plant parts. This implies probably their low knowledge on WMPs or fear to disclose their medicine to the researcher. Also, the study revealed that the respondents do not know the impact of using more leaves than other plant parts for the plant existence.

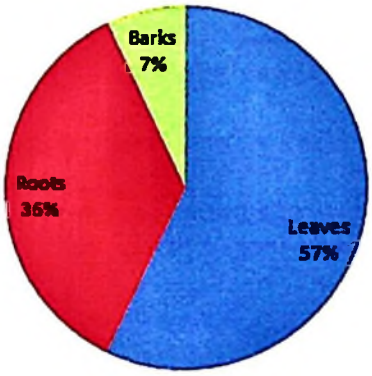

Figure 6: Plant parts of commonly cultivated medicinal plants

Leaves are the photosynthetic plant parts; and the consequences of overusing plant leaves may result the plant into death as a result of the failure to conduct photosynthesis and other metabolic activities for its survival.

Results from focus group discussion noted that most of the cultivated WMPs mentioned in Table 7 were cultivated because they are currently not easily found in areas growing. This could probably imply that the plant species were rare species in the area. Therefore, as a means of ensuring the availability of the particular plant species for current and future use, most of the people are growing them as a means of conservation. However, some plant species like *Senecio sp* were grown due to their importance as claimed to be a pain killer and an antidote against sorcery.

4.2.2 Sources of WMPs

Results showed that WMPs in the study area were mainly harvested from public land, forest reserves, farmland and homesteads (Figure 7). The study noted that men (9%) lead in harvesting WMPs from every source. Most of the WMPs are harvested from public land (39%) followed by farms (29%). However, the study recognized that the main sources of WMPs used in the study area were harvested from forest reserves as observed also during transect walk. Most of the WMPs shown were from forest nature reserves in almost all the villages visited. This observation concurs with what the elders were saying during the FGDs that most of WMPs are harvested secretly from forest nature reserves because people do not have money to pay so as to secure a permission of entering into the forest nature reserves for any reason.

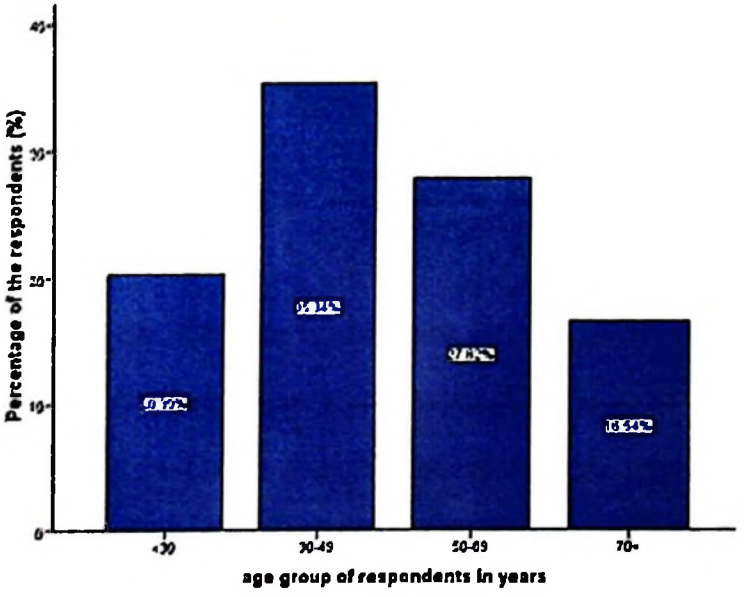

Figure 7: Sources of WMPs in the study area

4.2.3 Plant parts used

The study revealed that different plant parts of wild harvested medicinal plants were used by the inhabitants in the communities around the study area for medicine purposes. Roots got high frequency 57 (43%) followed by leaves 42 (32%) and barks 33 (25%) and the

uses of other plant parts were normal (Figure 7). It is apparent that high use of plant roots and leaves threatens the survival of the plant as roots are the plant organs that concerns with water and mineral absorption from the soil, while leaves are the photosynthetic materials of the plant. However, the respondents did not mention the use of the whole plants, seeds, and twigs. On the other hand, less use of whole plant and seeds guarantees the continuation of plant generations.

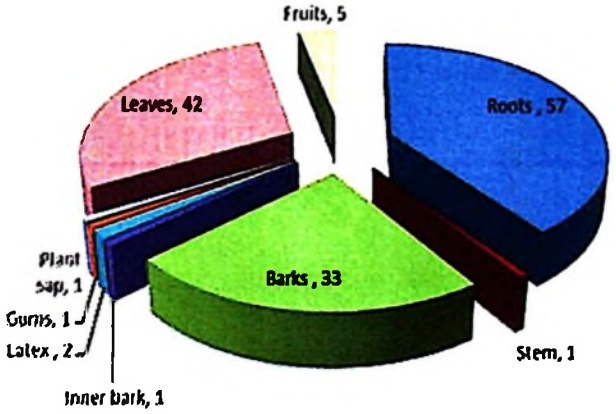

Figure 8: The common plant parts used by communities around the study area.

This is similar to what was observed by Augustino *et al.* (2014) in Urumwa Forest Reserve Tabora Region Tanzania, where whole plants, fruits, seeds, twigs and exudates were reported to be rarely used as medicine by communities around though other plant parts like roots were mostly used. However, the results differ from findings of a similar survey conducted in Uluguru Mountains of Morogoro Region, Tanzania (Mahonge *et al.*, 2006) where the use of leaves were found to be predominant. And, nobody stated a reason why there is a difference between leaves and roots harvested from cultivated and wild harvested WMPs. This may be due to the reason that people value and care much the plants they have planted compared to the plants they just find in the wild. The difference of plant part uses in different location probably indicates that indigenous knowledge rules

of the plant part to be used. However, using more roots and leaves may affect the survival of a plant as the parts are concerned with water and mineral absorption and photosynthesis respectively.

Majority of the respondents reported that preparations of most of traditional medicine involved mixing various plant parts from others such as roots and stems, leaves and barks, roots and barks and similar other mixtures. They also claimed that it is very rare to have a traditional medicine from one part of a plant. This may probably reduce the pressure of harvesting and hence promoting conservation as one is not depending on a single plant for the required medicine.

Table 8 presents wild medicinal plant species mentioned by respondents during the interview to be frequently used by communities in the study area. *Vangueria madagascariensis* found mostly used as was mentioned 19 times by different respondents.

Table 8: WMPs used most frequently by communities around the study area

Plant species	Frequency (n)
Vangueria madagascariensis	19
Tamarindus indica	17
Zanha Africana	8
Harrisonia abyssinica	11
Ficus sur	15
Ehretia bakeri	10
Steganotaenia araliacea	14
Combretum molle	13
Cassia abbreviate	17
Annona senegalensis	15

Other plant species also found in high use were *Tamarindus indica* and *Cassia abbreviata* which was mentioned 17 times each. This showed the importance of some of the WMPs to health care. The high frequency of using some plant species may result into the disappearance of the particular plant species. This is in line with Msuya and Kideghesho (2009) who noted that the heavy dependency on medicinal plants renders them vulnerable to over-exploitation, triggering increased scarcity and even loss of certain species. For this reason, conservation measures should be taken to protect the frequently used WMPs to allow regeneration of the plants for current and future use.

4.2.4 Factors influencing conservation

Age groups, education level, marital status, religion, length of stay, and sex had no statistically significant effect on conservation within the sample population (Table 9). However, logistic regression test results of the hypothesis rejected the null hypothesis, indicating that indigenous knowledge has an influence on conservation of WMPs in the communities of Mvomero District, $p < 0.05$. This implies that people also upholds the indigenous knowledge of conservation which is used in their communities for plant species including WMPs. Some research results conducted in West Usambara Mountains, Tanzania by Msuya and Kideghesho (2009) and Mwingi District, Kenya by Njoroge *et al.* (2010) show that local people conserve WMPs by using local knowledge.

Table 9: Results of the binary logistic regression model for parameter estimates

Variables	Parameter estimates	P-Value
Age groups	0.131	0.818*
Indigenous knowledge	0.469	0.023**
Education level	-0.102	0.863*
Marital status	-0.595	0.404*
Religion	18.646	0.998*
Length of stay	0.760	0.374*
Sex of respondent	1.385	0.072*

* Insignificant at 0.05% level ** Significant at 0.05% level

4.3 The methods used in harvesting and conserving WMPs

4.3.1 Harvesting methods

Figure 9 presents the results on the harvesting methods which affect sustainability of WMPs. The harvesting methods reported by the respondents that affect sustainability of WMPs included uprooting the whole plant (60%) followed by overharvesting roots (31%) and debarking/ring-barking (9%). This indicates that people are aware that uprooting the whole plant and overharvesting roots are not friendly harvesting methods to a plant. Besides, debarking or ring-barking is a harvesting method seems to be not very much common as very few respondents reported it.

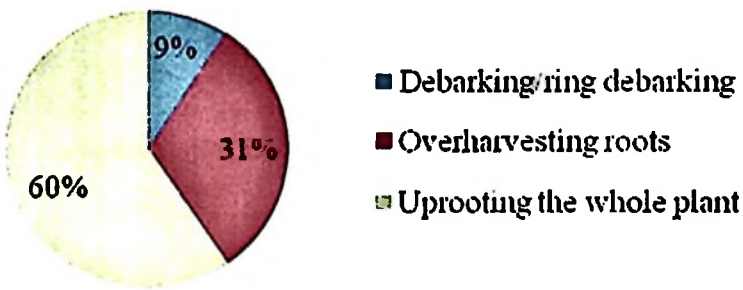

Figure 9: Harvesting methods which threaten sustainability of WMPs

These results are similar to a study conducted by (WCST, 2000) in the Uluguru Mountains where bark stripping was reported to be less practiced compared to root excavation. However, other studies done in other areas also report that bark striping, uprooting the plant or overharvesting roots are harvesting methods though have resulted in a decrease of plants (Colfer, 2008; Augustino *et al.*, 2014). This is because the methods harm plants and are unsustainable. To ensure the sustainability of plants including WMPs for future use, the respondents claimed that was possible by using their local knowledge.

4.3.2 The methods used in conservation of WMPs

The respondents were asked to list indigenous ways used in plant conservation assuming that the conserved plants includes WMPs. Results identified a total of nine indigenous methods commonly used in plant conservation (Table 10) with domestication being dominant. The methods fall into *in situ* and *ex situ* conservation.

Table 10: Percentage responses on traditional ways used in conserving WMPs in the study area

Category	Responses	
	Frequency (n)	Percent of Cases (%)
Domestication	112	84
Beliefs in sacred plants	15	11
Beliefs in sacred forests	19	14
Respect of cultural forests	79	59
Protection of plants at the burial sites	47	35
Selective harvesting	89	67
Secrecy on name, location	76	57
Collection of deadwood for firewood	96	72
Use of energy-saving stoves	52	39

Note: n= frequencies of mention; some of the respondents mentioned more than one method. This resulted into the percentage to appear as more than 100%.

The WMPs are *in situ* conserved when are protected where they are growing by ensuring that they are not destructed to death. They are *ex situ* conserved when are collected from the wild and grown in the homesteads areas which is categorised as domestication method. On-farm conservation refers to retaining a WMP on farm for continuous uses. However, collection of deadwood for firewood and use of energy-serving stoves are considered as indigenous conservation methods because by using only deadwoods for firewood and energy-serving stoves reduces pressure of people from cutting trees including WMPs from

forests for firewood. In turn, the forests continue to regenerate and that ensures the continuity of WMPs availability within a community.

The results show that 84% of the respondents in the study area mentioned domestication followed by collection of dead wood for firewood (72%) as a traditional conservation method. This is probably due to some conservation seminars and programs often conducted in different places within the country including the study area. Other methods and percentage in brackets were selective harvesting (67%), respect of cultural forests (59%), secrecy on name and location (57%), use of energy-saving stoves (39%), protection of plants at the burial sites (35%), beliefs in sacred forests (14%), and beliefs in sacredness of plants (11%). The results especially on traditional conservation methods with low percentages might be indicating the loss of the indigenous knowledge in conservation in the study area as some of the elders in FGDs claimed that traditional cultures are nowadays ignored. Other studies done in other places have reported that loss of indigenous knowledge is caused by the introduction of new cultural systems and use of western drugs (FAO, 1997; Msuya and Kideghesho, 2009). For example, some people are no longer worshiping in cultural forests and they do not have beliefs in sacred plants or forests anymore. Instead they trust in God and worship in churches or mosques.

The reason why WMPs are not intensively cultivated is due to the shortage of land and most of the respondents are not aware that WMPs can be cultivated for commercial purposes. Results imply that the pressure to the forests or forest reserves around the villages is high as the total of WMPs users depend on these sources. This suggests that if on-farm conservation education is well offered to WMPs users, the same small land they claimed to have will also be used to retain WMPs. Also, more education on importance of WMPs should be provided to the communities to create awareness to the people that

besides health care, WMPs may bring other benefits to them. However, people needs more education on WMPs uses and conservation and it is considered as a suggestion for future research.

In Mndela Village, nobody was found growing WMPs because the village is on hilly area and very close to Mkingu Forest Nature Reserve compared to other villages. So, the people from this village do not have enough land for both agricultural activities and growing WMPs. Therefore, whenever WMPs are required people go directly to the nature reserve for collection. This may lead to extinction of some plant species if the pressure to the forest reserve is high and left uncontrolled.

Besides, there were no vendors at Mkindo and Mndela villages. This may be due to the fact that most of the respondents were unaware that WMPs can be a major income generating resource for poor inhabitants. Also, this was confirmed by some of the elders in the focus group discussions that they do not know where the markets for WMPs are available. However, healers collect WMPs which are used in treating people by charging them money. This study considers the traditional healers as the WMP sellers although they were few and their effect on WMPs at the study area is expected to be low. And some of the traditional healers claimed that a purely traditional healer cannot involve himself or herself in destroying the WMPs because they usually get their daily bread through the WMPs. Hence, the traditional healers think that WMPs are destroyed by other forest product users like firewood collectors, charcoal makers, timber harvesters, beehive makers and by people who clear areas for agricultural purposes. Their claim is agreed by the observation made by other researchers in other area within and outside the country (Ishtiaq *et al.*, 2013; Augustino *et al.*, 2014).

The case of Mndela is different from Kilimanjaro village which is very close to Dunduma Forest Nature Reserve commonly used by a beekeeping registered organization called Beekeeping Community Awareness Organization (BECAO). BECAO uses the nature reserve for beekeeping activities (Plate 1).

Plate 1: A poster of BECAO that directs people to Duduma Forest Nature Reserve

To ensure the safety of beehives, people are strictly prohibited to enter the forest reserve. This resulted into a great number of WMPs users in this village to grow some of the WMPs in their home gardens. This undoubtedly means that difficult access to forest reserve influences people to plant various plants including WMPs, hence practicing plant conservation.

Informal discussion during FGDs revealed that before independence in 1961, indigenous conservation practices were mainly based on the harvesting methods, taboos and belief, spirit values, and sacred landscapes. Taboos and believes involved "dos" and "don'ts" from community leaders and elders without concrete explanations given to their juniors. Such taboos included forbidding cutting some plant species and people respected the

instructions given. Also, there were restrictions on harvesting medicinal plants especially by some people such as a pregnant women or a woman in menstrual period. Cutting the whole wild medicinal plant was forbidden and nobody was allowed to debark the wild medicinal plant already debarked by another collector. Under these taboos and beliefs the wild plants were thriving. This finding is also in line with Msuya and Kideghesho (2009) in West Usambara Mountains, Tanzania, who established that areas protected through taboos and beliefs harbour a high number of plant species, most of them with medicinal values.

Spiritually, the elders informed the researcher that the forests were regarded as the home where the souls' of the ancestors were resting. Hence, such forests remained undisturbed as people were respecting them and went there to offer their sacrifices to their gods. The undisturbed forests remained with variety of wild plant species including WMPs. For the case of sacred landscapes, the elders said these were constrained areas for special community activities such as gravesites. Nobody was allowed to harvest either woody or non-woody products from such areas because by doing so meant disrespecting the dead. Although their purpose was not to conserve the plants, they claimed that the gravesites were eventually found with large and health plants which today means conserved plants including WMPs.

However, the elders claimed that before independence in Tanzania the population was small. As such there were no competitions for natural resources including WMPs amongst themselves. Hence, harvesting methods involved the following conservation practices which were not harmful to plants: collection of dead wood for firewood instead of cutting the whole tree; if bark was required for medicine, it was stripped from a known medicinal plant instead of ring debarking the tree and nobody was allowed to strip a bark from a tree

already stripped-off; and after the roots having been extracted for medicinal use, people were encouraged to backfill the dug holes to facilitate the survival of the plant.

4.4 The attitude of the people towards indigenous knowledge for conservation of WMPs

Table 11 presents the results of the Likert-type response categories of the respondents to show their degree of agreement or disagreement on the traditional conservation methods. Results show that about 99% of the respondents from different age groups agree (84) and strongly agree (48) that traditional conservation methods are very useful. This is a positive attitude toward local conservation methods. However, only 1% disagreed with the methods presenting the negative altitude. This implies that people in local areas still rely on their indigenous conservation methods used in conserving plants including the WMPs. The chi-square test indicated significant difference in age groups of the respondents (chi-square value = 20.017, df = 6, p = 0.003). Also, the result implies that older people have accumulated much experience on WMPs traditional conservation methods. This is why their attitude on the traditional conservation methods was high.

Table 11: Percentage distribution of the respondents' age groups and their degree of agreement or disagreement on local conservation methods of WMPs

Variable	Category	Responses by age group of respondents				Total	Chi-square	*p*-value
		<30	30-49	50-69	70+			
Degree of agreement or disagreement on WMPs conservation methods	Disagree	100(1)	nr	nr	nr	100(1)	20.017 (df=6)	0.003
	Agree	25(21)	42(35)	25(21)	8(7)	100(84)		
	Strongly agree	10(5)	25(12)	33(16)	31(15)	100(48)		
Total		20(27)	35(47)	28(37)	17(22)	100(133)		

Note: - nr = no responses

- numbers outside parentheses present percentages while numbers in parentheses present frequency

The result implies that people of Mvomero District still rely on traditional conservation methods for wild medicinal plant though not to a large extent. However, further discussion during focus group revealed that traditional conservation practices is being declining for various reasons. For example, elderly people claimed that a long time ago, some tree species could not be used for firewood but nowadays, literally any tree including WMPs can be used due to population increase with limited trees around. The other problem threatening traditional conservation knowledge was the rising of western cultures which has brought modern conservation systems that focuses mainly on protected areas or areas with endemism species. According to the respondents, they claimed that to them, modern conservation systems affect and erode local cultures because they provide employments to young generation who eventually fail to listen to their elders and ignore their cultures including local traditional conservation methods. However, this claim can be eliminated by integration of local and modern conservation systems and conducting seminars or training the locals as suggested by Kitula (2007). Besides, elders perceive employments to young generation as bribes to them so that they can use them and their natural resources the way they want. This has made the indigenous knowledge to remain mainly by elders in the community. This result concurs with the findings by Otieno and Analo (2012) around Kakamega forest in western Kenya, in their case they found much of indigenous knowledge is still held mainly by a few elderly people.

However, this study does not agree with the perception of the elders and some respondents from the study area against the employments for conservation offered to young generation which is claimed to be a bribe and that modern conservation system is the causative of

much destruction done to the nearby forest reserves. The claims of the elders and some of the respondents may be due to poor law enforcement with restrictions to enter the forests and the undefined fines charged if found collecting any forest product without the concerned authorities' permission. This result is similar to the findings by Kitula (2007) who reported that medicinal plants are often collected from the forest reserve illegally because the forest is closed. Moreover, McGeoch *et al.* (2008) observed that the creation of protected areas may facilitate the conservation of medicinal plant species by reducing habitat loss and, via restrictions on access and extractive use, reduces disturbance and overexploitation.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Majority of the interviewees use and conserve WMPs traditionally. The wide uses of WMPs indicate that people are knowledgeable about the plants with medicinal values, their distribution or source, use, and conservation.

A total of 91 medicinal plant species used by the people in the communities of Mvomero District were identified and documented. Only 10 WMPs out of 91 are cultivated and 81 are harvested from the wild. Majority of the respondents around the study area admitted to harvest WMPs from farms, public land, forest nature reserve, and homesteads. The 10 cultivated WMPs are conserved through cultivation because they are currently not easily found in areas where they were used to be found. This indicates the scarcity of some of WMPs. Plant parts used varied depending on the prevailing requirement. However, the findings in this study show that plant leaves are mostly harvested from the cultivated WMPs compared to other plant parts while roots are normally harvested from WMPs which are growing in the wild. There were no reason given to show why people harvest more leaves from cultivated WMPs and roots from wild-harvested WMPs.

The respondents mentioned nine local indigenous conservation methods commonly used in conservation of plants including WMPs. The methods are domestication, beliefs in sacredness of plants and forests, respect of cultural forests, protection of plants at the burial sites, selective harvesting, secrecy on name, location, collection of deadwood for firewood, and use of energy-saving stoves. These had positive attitude toward plant conservation including WMPs though not all of them practice the methods.

5.2 Recommendations

Based on the results of the study, the following are recommended:

- The study area seems to have high diversity of plants including WMPs. Further studies are therefore necessary in the future to explore more WMPs, identification and documentation to keep a record of these natural resources.
- Since there is no enough land to grow WMPs, people should be encouraged to grow WMPs in their home gardens, live fences and farmlands.
- Indigenous conservation knowledge should be integrated into the formal education system and incorporated into relevant projects whenever possible.
- Communities should be trained the proper propagation techniques in order to encourage the domestication of valuable and threatened medicinal plants.

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APPENDICES

Appendix 1: An interview schedule for focus group discussions

1. Which wild medicinal plant species are used for medical purposes? Mention

Local name	Botanical name	Disease	Habit	Part used
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....

2. Which wild medicinal plant species are cultivated for medical purposes? Mention

Local name	Botanical name	Disease	Habit	Part used
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....

3. Habitat (source) of the plant-where it grows in the study area.
4. Are there threats to the wild medicinal plants?
5. Are there any programs/projects to conserve wild medicinal plants?
6. How is the wild medicinal plant (s) preserved (if any)?
7. How the indigenous knowledge involved in conservation of wild medicinal plant species?
8. How is the indigenous knowledge passed from knowledgeable (elders) to unknowledgeable (younger) in the study area?
9. Are there taboos in the utilization of some medicinal plants in the locality? Yes/No. If *yes*, what are the taboos?
10. Do you have any comment on conservation of wild medicinal plant species?

Appendix 2: Questionnaire for household survey

A: GENERAL INFORMATION

Questionnaire No: |___|___|___|
Interviewer's ID No. |___|___|
Date of interview: |___|___|/|___|___|/2014
Ward: _____ Village_____

B: DEMOGRAPHIC CHARACTERISTICS

No.	Questions and filters	Response	Skip to
1.	*Do not ask this question, circle that apply* Sex of respondent	Male.....1 Female.....2	
2.	How old are you now?	Years old|___|___|	
3.	What is your education level?	No formal education.....1 Primary not finished.....2 Primary finished.....3 Technical/vocational education.....4 Secondary education.....5 College/ university.....6 Other.....96 (*Specify*)_____	
4.	What is your marital status?	Never married.....1 Married.....2 Widowed.....3 Divorced.....4 Separated.....5	
5.	What is your religion?	Christian.....1 Muslim.....2 Tribal.....3 Other.....96 (*Specify*)_____	
6.	Do your religion beliefs influence of WMPs?	Yes.....1 No.....2	
7.	Ethnicity	_____	
8.	How long have you stayed in the community?	.....|____|	
9.	Tick (√) where necessary *Status in medicinal plant usage*	Consumer.....1 Healer.....2 Vendor.....3 Grower.....4 Collector.....5 Other.....96 (*Specify*)_____	

C: SPECIFIC INFORMATION

10.	How did you become a wild medicinal plant species user?	inheritance from elders.....1 Training.....2 inheritance and training.....3 other.....96 (*Specify*)_____	
11.	Which wild medicinal plant species you are using/growing/selling for medical purposes? Mention	Local Name.....1 Botanical name.....2 Disease.....3 Habit.....4 Part used.....5	

	(*use separate sheet for more lists*)		
12.	Where do you obtain the wild medicinal plants?	Collect.....1 Buy.....2 Grow.....3 Other.....96 (*Specify*)_____	→14
13.	Where do you collect the wild medicinal plant species? Mention	Forest reserve.....1 Farm.....2 Homestead.....3 Public land.....4 Other.....96 (*Specify*)_____	
14.	What are the harvesting practices, which you think affect sustainability of wild medicinal plants?	ring barking stems.....1 overharvesting roots.....2 uprooting the plant.....3 Other.....96 (*Specify*)_____	
15.	Which wild medicinal plant species you are growing for medicinal purposes? Mention	Local Name.....1 Botanical name.....2 Disease.....3 Habit.....4 Part used.....5 If no WMPs are grown.....6	→18
16.	What is the status of WMPs mentioned in No 15 in terms of availability?	Very scarce.....1 Scarce.....2 Abundant.....3	
17.	Why wild medicinal plant species mentioned in No 15 above are cultivated?	Not available.....1 Easily grown.....2 Are very important and mostly required.....3 0ther.....4 (*Specify*)_____	
18.	Are there any programs/projects to conserve wild medicinal plants?	Yes.....1 No.....2	→20
19.	If *Yes*, what are the programs/projects to conserve wild medicinal plant species? Mention		
20.	What are the traditional ways to conserve wild medicinal plant species? Mention		
21.	To what extent do you agree or disagree that the methods you have mentioned in question 20 above contribute in WMPs conservation?	Strongly disagree.....1 Disagree.....2 Neutral.....3 Agree.....4 Strongly agree.....5	
22.	Are there any government or community conservation regulations?	Yes.....1 No.....2	→24
23.	If *Yes*, what are the government or community conservation regulations?		

24.	Do you have any comment on conservation of wild medicinal plant species?		

Thank you for your cooperation!

Appendix 3: List of identified and botanical recorded Wild Medicinal Plants (WMPs) used by the community of Mvomero District, Morogoro

S/No.	Scientific name	Vern. Name	Language	Plant form	Part used with disease cured in brackets
1.	*Acacia glaberrima*	Mkingu	Sambaa	Tree	Barks (Chest pain, fever, asthma, malaria), leaves (fever)
2.	*Acacia polyacantha*	Mgunga	Nguu	tree	Roots (stomach pains, snake-bites), barks (chest pain), Leaves (sore on head)
3.	*Acacia tortilis*	Mkongowe	Luguru, Nguu	Tree	roots (stomach pains)
4.	*Acalypha bipartita*	Kifulwe	Zigua	Shrub	Leaves (itching), roots (backache, worms)
5.	*Adenia racemosa*	Gole	Nguu	Liana	Stem (diarrhoea), leaves (chicken pox, mental illness)
6.	*Albizia adianthifolia*	Mkenge	Nguu	Tree	Barks (Stomach pains, diarrhea, chicken pox, mental illness, gonorrhea, bleeding)
7.	*Albizia anthelmintica*	Mfuleta	Nguu	Tree	Barks (skin disease, stomachache, bleeding, impotence)
8.	*Albizia glaberrima*	Mchingu	Zigua	Tree	roots (impotence, fever, malaria, stomachache, sore eyes), barks (stomachache, diabetes, tonsils, asthma, diarrhea), leaves (stomachache, tonsils, pneumonia), pods (skin problems)
9.	*Allanblackia stullmannii*	Msambu	Kaguru	Tree	leaves (asthma, malaria, stomachache, impotence), barks (headache), roots (impotence)
10.	*Allophyulus africanus*	Mbangwe	Nguu	tree	roots (coughs), barks (impotence, pain killer, menstrual cycle), leaves

					(skin diseases, impotence, anus pains), fruits (pain killer)
11.	*Aloe sp*	Kikoli	Nguu	Herb	leaves (venereal diseases, pain killer, menstrual cycle, malaria, headache)
12.	*Annona senegalensis*	Mtomokwe	Nguu	Tree	roots (headache, pneumonia, stomach problem, dysentery, legs pains, paralysis, fresh wounds), barks (malaria), gums (swelling legs, wounds, fresh wounds)
13.	*Asparagus sp*	Mwinikanguru	Zigua	shrub	roots (paralysis, legs pains, wounds)
14.	*Boragnacea*	Sesemnanda	Mmambwe	Liana	leaves (epilepsy), inner bark (epilepsy, veneral diseases)
15.	*Bridelia juvigneaudii*	Kikwindile lema	Zigua	Tree	roots (epilepsy, wounds)
16.	*Bridelia micrantha*	Mwiza	Nguu	Tree	Barks (impotence), roots (impotence, stomachache)
17.	*Cassia abbreviata*	Mkwizingwi	Nguu	tree	roots (STDs, allergy, hernia, stomach pains, malaria), barks (headache, malaria, fever, hernia), leaves (hernia)
18.	*Cassia singueana*	Mhumba	Sambaa	Shrub	leaves (hernia, fever, abdominal pains, malaria, heartburn, convulsions, wounds), roots (hernia, heartburn)
19.	*Cavalhoa campanulata*	Kibarubaru	Nguu	shrub	roots (Convulsions, epilepsy, coughs, stomach problems)
20.	*Cisampelos mucronata*	Msisimkiwa	Nguu	Climber	roots (headache, abdominal pains, pregnancy pains, menstrual

					problems), leaves (headache)
21.	*Cissus cornifolia*	Mkama	Kaguru	Liana	roots (boils, hernia, malaria
22.	*Clausena anisata*	Mdyavikali	Luguru	Tree	leaves (hernia, stomachache, malaria, leprosy, fever), roots (hernia, infertility, madness, fever)
23.	*Combretum collinum*	Mlama mwekundu	Swahili	Tree	leaves (infertility, madness, fever)
24.	*Combretum molle*	Mlama mweusi	Swahili	Tree	roots (headache, epilepsy, pneumonia, stomach pains, infertility, joints pains, fever, dysentery, snake-bites), barks (infertility)
25.	*Combretum zeyheri*	Mlama mweupe	Swahili	Tree	leaves (leprosy, fever, coughs) roots (stomachache)
26.	*Cucumis sp*	Mibungubungu	Nguu	Climber	Fruits (coughs)
27.	*Culcasia scandens*	Luandama	Luguru	Climber	leaves (diarrhea, toothache, stomach pains)
28.	*Cussonia spicata*	Mtindi	Nguu	tree	leaves (stomach pains), roots (stomachache)
29.	*Cyphyostemma njegerre*	Tongotongo	Nguu	Climber	Leaves (headache, ulcers, fever), roots (fever, body pains)
30.	*Cyphyostemma paucidentatum*	Mwengere	Nguu	Liana	leaves (body pains, stomachache, body swelling), roots (body pains)
31.	*Dalbergia melanoxylon*	Mpingo	Swahili	Tree	roots (Stomachache, diarrhea), barks (pneumonia)
32.	*Deinbollia borbonica*	Mbwakabwaka	Mmambwe	shrub	roots (Stomachache, pneumonia, joints pains, legs pains, wound cleanliness), leaves (stomachache

33.	*Diaspyros squarrosa*	Mgoto	Nguu	Tree	Barks (pneumonia, fever), leaves (fever
34.	*Dombeya torrida*	Mnwati	Sambaa	Tree	Barks (snakebites, indigestion), roots (indigestion), leaves (indigestion, fever)
35.	*Ehretia bakeri*	Mkilika	Luguru	tree	roots (stomachache, hernia, body pains), barks (hernia), leaves (gonorrhea)
36.	*Ficus sur*	Mkuyu	Swahili	tree	Barks (hernia), roots (hernia, vomiting, diarrhea, body pains), latex (hernia, chest pain, eye problems)
37.	*Ficus sycomorus*	Mkuyu	Swahili	Tree	roots (Chest pain, diarrhea, body pains), barks (milk activation in human)
38.	*Flueggea virosa*	Mkwamb ekwambe	Nguu	tree	roots (Milk activation in human, stomachache, aneamia, malaria), leaves (stomach disorder, coughs, malaria)
39.	*Gardenia ternifolia*	Kilemela tembo	Zigua	Tree	roots (worms)
40.	*Grewia bicolor*	Mkole	Zigua	Tree	roots (hernia, fever, diarrhoea, impotence)
41.	*Harrisonia abyssinica*	Mkunju	Nguu	Tree	roots (neck stiffness, snake-bites, fever, testicles), leaves (fever)
42.	*Hoslundia opposita*	Molwe	Sambaa	shrub	roots (hernia, stomachache), leaves (vomiting)
43.	*Kigelia africana*	Mwegea	Nguu	Tree	Fruits (Coughs, stomach pains, wounds, pressure), barks (diabetes), leaves (pressure, headache)

44.	*Lannea schweinfurthii*	Mumbu	Zigua	Tree	roots (Diabetes, headache)
45.	*Maesa lanceolata*	Mtandu	Nguu	Tree	roots (malaria, abdominal pains)
46.	*Markhamia zanzibarica*	Myuyu	Nguu	Tree	Barks (abdominal pains), leaves (stomachache)
47.	*Maytenus senegalensis*	Mwamba ngoma	Nguu	tree	roots (stomachache, coughs, throat disease)
48.	*Milicia excelsa*	Mvule	Swahili	tree	Leaves (abdominal pains, diarrhea), barks (chest pain, abdominal pains), roots (diarrhea)
49.	*Morella salicifolia*	Msekesek e	Nguu	Tree	Barks (asthma, heart trouble, female sterility, chest pain, coughs)
50.	*Ochina holstii*	Mkunung u	Nguu	tree	Barks (coughs), roots (coughs)
51.	*Ocimum suave*	Vumbasa	Nguu	shrub	leaves (ulcers, wounds, stomachache)
52.	*Parkia filicoidea*	Mkundi	Kaguru	Tree	Barks (stomachache, toothache, ear troubles, malaria)
53.	*Phyllanthus sp*	Mzalia nje	Nguu	Herb	leaves (malaria)
54.	*Piliostigma thonningii*	Msegese	Nguu	Tree	Barks (malaria, relieve pains, coughs, dry cough)
55.	*Piper capense*	Kidaha mhahi	Nguu	Herb	roots (coughs, prolonged menstruation), leaves (epilepsy)
56.	*Plectranthus sp*	Vuga	Luguru	Herb	Leaves (epilepsy)
57.	*Pseudolachnostylia maproneifolia*	Msolo	Nguu	Tree	roots (epilepsy, induces sleep)
58.	*Psydrax parviflora*	Tulavuha	Nguu	tree	roots (epilepsy, stomachache, diarrhea, headache)
59.	*Pteleopsis myrtifolia*	Mngoji	Sambaa	Tree	roots (legs pains)

60.	*Pterocarpus angolensis*	Mninga jangwa	Swahili	Tree	Barks (headache)
61.	*Rhus natalensis*	Mhungur u	Nguu	shrub	roots (legs pains, headache, venereal diseases, skin problems)
62.	*Rubus pinnatus*	Msega	Nguu	shrub	roots (abdominal pains, coughs)
63.	*Saba comorensis*	Ungo	Zigua	Liana	Plant sap (coughs), roots (coughs)
64.	*Sclerocarya birrea*	Mng'ongo pori	Swahili	Tree	Barks (coughs, chest pain, infertility, rheumatism, toothache)
65.	*Shirakiospis elliptica*	Mkongolo	Nguu	Tree	roots (toothache)
66.	*Senecio sp.*	Hoza	Zigua	Herb	leaves (rheumatism, headache)
67.	*Solanum incanum*	Mtulatula	Luguru	Shrub	Fruits (migraine), roots (pain killer)
68.	*Spirostachys africana*	Mhalaka	Zigua	Tree	Latex (pain killer, wizard antidote) barks (whitlow)
69.	*Steganotaenia araliacea*	Mgola	Sambaa	Tree	leaves (Vomiting, stomachache), roots (stomachache, allergy, diarrhea), barks (diarrhea)
70.	*Sterculia appendiculata*	Mgude	Swahili	tree	Barks (Sore throat, hernia, allergy, impotence, prevents miscarriage), roots (hernia)
71.	*Stereospermum kunithianum*	Mkomang uku	Nguu	Tree	roots (convulsions, paralysis, impotence)
72.	*Strychnos spinosa*	Mtonga	Nguu	Tree	Roots (skin diseases, body lashes, hernia)
73.	*Suregada zanzibariensis*	Mdimu pori	Swahili	tree	roots (stomach pains, backache, STDs, yellow fever, snakebites, paralysis, pneumonia)
74.	*Tabernaemontana ventricosa*	Mhuga	Nguu	tree	roots (hernia), leaves (pneumonia)
75.	*Tamarindus indica*	Mkwaju	Swahili	Tree	leaves (hernia, diarrhea, stomachache, asthma, malaria),

					roots (stomachache, diabetes), barks (diarrhoea, ulcers)
76.	*Trema orientalis*	Msinga	Nguu	Tree	leaves (coughs, diarrhea)
77.	*Vangueria madagascariensis*	Mviru	Mmambwe	tree	roots (malaria, coughs, stomach pains, insane), barks (pneumonia, stomach problems, malaria), leaves (malaria, coughs, insane)
78.	*Vernona subuligera*	Mtugutu	Luguru	Shrub	Leaves (insane, coughs, malaria), roots (STDs, malaria, heartburn)
79.	*Ximenia caffra*	Mtundwi	Luguru	Shrub	roots (malaria, heartburn), leaves (malaria, heartburn)
80.	*Xylopia aethiopica*	Mnahira	Nguu	Tree	Fruits (chest pain, stomachache)
81.	*Zanha africana*	Mdaula	Nguu	tree	leaves (dizziness), barks (stomachache, dizziness), roots (migraine, child birth facilitation, legs pains)