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Water Scarcity and Economic Productivity of Women: A case study of Kibauni Division, Machakos County.

BY
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DECLARATION

I hereby declare that this research project is my original work and has not been submitted for a degree award in this or any other university.

Sign …..……..…… Date …….……...

JACKLINE MUMBUA MWINZI.

C50/66765/2011.

APPROVAL

This research project has been submitted for examination with my approval as the University supervisor.

Sign……. Date……

Prof. Mburugu

Department of sociology,

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DEDICATION

I dedicate this research work to my beloved husband Isaac and son Elvis for their encouragement and standing by my side while working day and night piecing this document together.

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LIST OF ABBREVIATIONS

ADB ---------- African Development Bank

CBOs ---------- Community Based Organizations

CBS ---------- Central Bureau of Statistics

FAO ----------Food and Agriculture Organization

GDP ----------Gross Domestic Product

GoK----------Government of Kenya

IFAD ----------International Fund for Agricultural Development

FAO ---------- Food Agriculture Organization

IWMI----------International Water Management Institute

KFSSG ---------- Kenya Food Security Steering Group

KIHBS ----------Kenya Integrated Household Budget Survey

KNHD ---------- Kenya National Human Development Report

MDGs ----------Millennium Development Goals

MWRMD ----------Monterey Regional Waste Management District

NEMA ----------National Environmental Management Authority

NGOs ----------Non Governmental Organizations

RNF ---------- Rural Non-Farm

SPSS ---------- Statistical package for Social Sciences

SoE ---------- State of Environment Outlook

UNCCD----------United Nations Convention to Combat Desertification

UNDP---------- United Nations Development Programme

UNEP ---------- United Nations Environment Programme

UNIFEM ---------- United Nations Development Fund for Women

UNISDR ---------- United Nations International Strategy for Disaster Reduction

UN---------- United Nations

WRMA ---------- Water Resource Management Authority

WWAP ---------- World Water Assessment Programme

WWF ---------- World Wildlife Fund

ABSTRACT

Water is vital for life and a key catalyst to socio-economic development as well as maintenance of environmental integrity in any region. It is an essential resource for sustaining life as well as central to agriculture and rural development and affects the livelihoods of millions of rural people across the world. Water scarcity is an issue that affects the economy negatively. It affects one in three people on every continent of the globe. The situation is getting worse as needs for water rise along with population growth, urbanization and increases in household and industrial uses. It is among the main problems being faced by many societies and the World in the 21st century. Water scarcity affects all people in the society but women bear the burden most as they are traditionally regarded as the water collectors and majority of them rely on water for their livelihoods.

The purpose of this research study was to find out the impact of water scarcity on the economic productivity of women in Kibauni Division of Machakos County, with a view to answering three research questions namely: What is the water and livelihood situation in Kibauni? How does water scarcity affect economic productivity of women? And finally,What challenges are facing water management and how are they addressed? The study size constituted of 360 respondents selected using systematic random sampling. 2 focus group discussions and 10 key informants were selected though purposive sampling technique. Both quantitative and qualitative data were collected. The mechanism for the data collection involved both primary and secondary sources to ensure triangulation and collection of reliable data. Data was collected using questionnaires, observations, key informant guide, and Focus Group Discussion guide. Quantitative data was analyzed using descriptive statistics through the use of SPSS. Qualitative data was edited, coded, analyzed and interpreted to evaluate the usefulness of the information in answering the research questions.

From the study findings, it was found out that water is a commodity that is vital for development and almost all economic activities undertaken by women in the study area needed water as a catalyst for their products. The study concluded that water scarcity and economic productivity of women are intertwined and almost impossible to separate them. Water scarcity translates to poor access to education, health problems, and increased work load as well as time wastage in search of the rare, basic commodity.

It was also concluded that water scarcity is accelerated by population pressure, land use changes, poor water harvesting methods, sand/gravel harvesting as well as poor agricultural methods. The study recommended that the ministry of agriculture, water irrigation board as well as the donor agencies need to invest in the community to exploit the underground water sources to supplement the available water as this can reduce the problems that women as well as the girls are facing while accessing water. Further, the study concluded that women should equally participate with men in the water management projects and their decisions should be prioritized since they are the major water collectors and managers at the household level and determine how, where and when to collect the water. To achieve this, the study recommended that family and societal support, access to education, access to resources and entrepreneurship training should be enhanced to foster gender equality and economic empowerment of women.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Water is vital for life and a key catalyst to socio-economic development as well as maintenance of environmental integrity and healthy ecosystems in any region. It is an essential resource for sustaining life as well as central to agriculture and rural development, and is intrinsically linked to global challenges of food insecurity and poverty, climate change adaptation and mitigation, as well as degradation and depletion of natural resources that affect the livelihoods of millions of people across the world.

Water is our most precious resource. Humans, plants, and animals are made up of mostly water. According to the World Bank, (2010) report, water is a scarce resource with multiple interwoven uses that range from drinking water, energy, irrigation, manufacturing things, transport of people and goods among others. The report further states that, more than one-sixth of the Worlds' population does not have access to safe drinking water, with 80% living in rural areas thus access to water cannot not be guaranteed globally.

Every day in rural communities and poor urban centers throughout sub-Saharan Africa, hundreds of millions of people suffer from lack of access to clean, safe water. Women and young girls, who are the major role players in accessing and carrying water, are prevented from doing income-generating work or attending school, as the majority of their day is often spent walking miles for their daily water needs. The implications of lack of clean water and access to adequate sanitation are widespread. Young children die from dehydration and malnutrition, results of suffering from diarrheal illnesses that could be prevented by clean water and good hygiene (Metwally et al., 2006).

Women worldwide play a key role in the provision of drinking water and water for other household purposes. Although women's tasks in environmental management vary according to region, age, socio-economic class, caste and vary within families, many women in rural areas have to go far to fetch water. They spend up to a day's task fetching water while many urban women have to wait long queuing for water.

Water scarcity is among the main problems facing many societies and the World in the 21st century. It is defined as the point at which the aggregate impact of all users impinges on the supply or quality of water under prevailing institutional arrangements to the extent that the demand by all sectors, including the environment, cannot be satisfied fully (FAO, 2007).

It occurs when the amount of water withdrawn from lakes, rivers or groundwater is so great that water supplies are no longer adequate to satisfy all human or ecosystem requirements, resulting in increased competition between water users and other demands. Water scarcity is an issue that touches on all aspects of development including health, agricultural productivity, education and opportunities of women and children, stability and peace, as well as economic productivity. All issues are interconnected and experience much overlap, that any improvement to the availability of clean water in Africa has the potential to solve a number of developmental barriers (UN Water, 2006).

Water use has been growing at more than twice the rate of population increase in the last century, and, it is worth noting that an increasing number of regions are chronically short of water. For instance, Sub Saharan Africa accounts for about one-third of the World population without access to improved drinking water suppliers (World Bank, 2006).

There are two dimensions of water scarcity; physical and economic. Physical water scarcity occurs when there is not enough water to meet demand; its symptoms include severe environmental degradation, declining groundwater, and unequal water distribution. Economic water scarcity occurs when there is a lack of investment and proper management to meet the demand of people who do not have the financial means to use existing water sources; the symptoms in this case normally include poor infrastructure (FAO, 2007).

Water scarcity is both a natural and a human-made phenomenon. There is enough freshwater on the planet for seven billion people but it is distributed unevenly and too much of it is wasted, polluted and unsustainably managed (World Water Development Report 4, 2012). It occurs even in areas where there is plenty of rainfall or freshwater. How water is conserved, used and

distributed in communities and the quality of the water available can determine if there is enough to meet the demands of households, farms, industry and the environment.

Scarcity of Water an issue that affects the economy negatively as it affects one in three people on every continent of the globe (UNISDR, 2007). The situation is getting worse as needs for water rise along with population growth, urbanization and increases in household and industrial uses. It hence encourages people to store water in their homes. This also increases the risk of household water contamination and provides breeding grounds for mosquitoes which are carriers of dengue fever, malaria and other diseases.

A lack of water has driven up the use of wastewater for agricultural production in poor urban and rural communities. More than 10% of people worldwide consume foods irrigated by wastewater that can contain chemicals or disease-causing organisms (FAO, 2010). This situation is evident in urban areas and in particular slum areas where people usually farm vegetables along the sewer lines and dumping sites.

Water scarcity underscores the need for better water management. Good water management also reduces breeding sites for such insects like mosquitoes that can transmit diseases and prevents the spread of water-borne infections. It forces people to rely on unsafe sources of drinking water. It also means they cannot bathe or clean their clothes and homes properly and this situation affects women and girls most. It affects all social and economic sectors and threatens the sustainability of the natural resources base while posing great inconveniences and health risk for whole communities, but often with the greatest burden on women and girls. It is directly linked to poverty levels in the society today (IWMI, 2005).

Water scarcity often has its roots in water shortage, and it is in the arid and semi-arid regions affected by droughts and wide climate variability, combined with high population growth and economic development, that the problems of water scarcity are most acute. Its symptoms include severe environmental degradation, declining groundwater levels, and increasing problems of water allocation where some groups win at the expense of others, decreased agricultural production among others.

Millions of people rely in one way or another on water for their daily income or food production. Farmers, small rural enterprises, herders, fishermen among others need water to secure their livelihood. However, as the resources become scarce, an increasing number of them see their sources of income disappear (UNDP, 2006). This has affected the livelihoods of many people with others opting to diversify their economic activities. The end result in some people has been negative with others turning to illegal businesses e.g brewing of illicit drinks, over exploitation of the natural resources e.g sand mining, deforestation, over fishing and carving, logging and charcoal burning. In the majority of rural regions, these activities are majorly undertaken by women since a large number of men have migrated to the urban areas in search for better life.

The availability and functioning of freshwater ecosystems hence have a significant impact on the livelihoods, health and security of the poor (Schuyt, 2005). Water is an essential element in rural economic productivity in terms of food security through rain fed and irrigated crop production, industry needs, domestic processing, aquaculture, livestock, recreation, navigation and transport, and electricity supply. In some countries, for example, in sub-Saharan Africa, women are the main producers of staples and food crops; in others, they work on their family farms or as paid labourers. In yet other countries, particularly countries in the Middle East, women are mostly involved in post-harvest activities and work as unpaid family labourers only during periods of labour shortage. They and often their children suffer the most from water shortages in crop and livestock production, as well as for domestic uses.

Water scarcity already affects every continent. Around 1.2 billion people, or almost one fifth of the world's population, live in areas of physical scarcity and 500 million people are approaching this situation. Another 1.6 billion people, or almost one quarter of the world's population, face economic water shortage (World Water Assessment Programme, WWAP, 2012). The situation is only expected to worsen as a result of the population growth, climate change, investment and management shortfalls, and inefficient use of existing resources restricting the amount of water available to people. It is estimated that by 2025, 1.8 billion people will live in countries or regions with absolute water scarcity, with almost half of the world living in conditions of water stress (WWAP, 2012).

Safe water and sanitation are cardinal to health through potable water supply, safe food preparation, hygiene and better nutrition. Against this background, water access clearly needs to be increased in order to meet people's needs and to help raise their standards of living.

1.2 Problem statement

Most of the world's 1.2 billion poor people, two thirds of whom are women, live in water scarce countries and do not have access to safe and reliable supplies of water for productive and domestic uses (IFAD, 2001). The bulk of these rural poor people are dependent on agriculture for their livelihoods and live in sub-Saharan Africa and South Asia, the regions which are also home to most of the world's water poor.

One third of the world's population is currently experiencing some kind of physical or economic water scarcity. A growing competition for water from different sectors, including industry, agriculture, power generation, domestic use, and the environment, is making it difficult for poor people to access this scarce resource for productive, consumptive and social uses (IFAD, 2007). In water-scarce regions and countries, inequity in access to water resources is increasing because of competition for limited resources, and this particularly affects poor rural people, especially women.

Water scarcity is the current struggle that Kenya faces; to supply clean water to its population. The human population depends heavily on water resources, not only as drinking water but also for crops, agriculture and livestock and fishing (UNEP, 2005). For decades, scarcity of water resources in the country has continued to be a major draw-back in the development sectors such as agriculture, tourism, energy and manufacturing. Currently there is a declining trend in available freshwater attributed to various factors including the uneven distribution of water resources, catchment degradation, water pollution, climate variability and the increasing water demand due to increase in human and livestock populations. The available freshwater resource per capita stands at less than 647 m3, which is much less than the recommended 1000 m3 per capita per annum benchmarked by UN (WRMA, 2009).

Kenya's Vision 2030 is strongly anchored on the crucial role water resources play in championing the socio-economic development of Kenya (WRMA, 2009). The Vision aims at ensuring that all Kenyans have access to adequate water resources and sanitation facilities by 2030 and this would be achieved through implementing programmes and projects on water resources management, water storage and harvesting, water supply and sanitation, and irrigation and drainage. Additionally, access to safe water and sanitation has been recognized as priority targets through the Millennium Development Goals (MDGs). MDG 7, target 10 aims to halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation. However, it is worrying that water scarcity could threaten progress to reach this target (UN, 2009).

Securing water for both productive and domestic uses remains critical in achieving food security and improved rural livelihoods in the country, but particularly in arid and semi-arid areas. However, despite the role that women play in reducing food insecurity through their knowledge of crop production, local biodiversity, soils and local water resources, they are often excluded from decision-making processes in new agricultural water management approaches and other projects and initiatives on natural resource allocation. This means that women have no choice in the kind or location of services they receive (IFAD, 2001).

The current water situation in Kibauni division, Machakos County is wanting. Ground and surface water harvesting and management have not been embraced in the area. Drought has continued to plague the region with majority of people depending on non-agricultural activities and food aid for their livelihoods despite the rich agricultural lands and good climate for horticultural farming. Many youth have migrated to the urban areas in search for better livelihood means leaving behind the elderly and young children who can barely invest in adequate water harvesting methods. The rate of natural resource exploitation in the region is high with a majority of the people earning their livelihoods through small scale rain fed agriculture, charcoal burning, wood carving, sand harvesting and brick making,

The prolonged drought coupled with this appalling state of the major water catchment areas has led to drying up of rivers, springs and other water bodies. This state of affairs has caused crop

failure and decimation of livestock units as well as wild animals thereby creating a state of famine and hopelessness to the residents in this area. With the current consumption rate, this situation will only get worse with the population facing severe water shortage.

Women in the area have very little stake in the in the management of water affairs at community level. Their participation is hampered by them being overloaded with household chores. Girls' education in the rural areas also suffers because they are involved in the search for water at the expense of attending school.

The struggle for access to clean and safe water is an issue faced by nearly all residents in Kibauni division (KFSSG, 2008). Women and girls, the traditional water-collectors and frequently the food producers are being forced to travel distances of up to 8 miles to reach water that is highly contaminated, polluted, or unsafe to drink. This backbreaking work leaves them vulnerable to serious dangers e.g susceptibility to water borne diseases and high time wastage that could have otherwise been utilized fully in more productive activities. Additionally, the time spent commuting to and from the water source has negative health effects not only bodily effects but in mind and spirit (psychological). These women have so much potential in life, yet the majority of their time on Earth is constrained to fetching water. Being in a state of water poverty inhibits young girls who must help draw water instead of continuing with their education.

Providing water security can play a wider role in poverty reduction and improving livelihoods, by reducing uncertainty and releasing resources that can be used to decrease vulnerability. It has been noted that improved domestic water supplies and improved local institutions can enhance food security, strengthen local organizations and build cooperation between people (WWAP, 2012). In addition to the health benefits and the saving of time and energy, providing safe water can also have an influence on school enrolment and attendance.

It is against this background that this research will seek to find out the extent at which water scarcity has influenced the economic productivity of women in Kibauni. The study will also come up with possible measures that need to be implemented to reverse or cope with water scarcity in the region sustainably.

1.3 Research questions

In order to achieve the intended objectives, the study was guided by the following research questions:

1. What is the water and livelihood situation in Kibauni?
2. How does water scarcity affect economic productivity of women?
3. What challenges are facing water management and how are they addressed?

1.4 General objective

To explore the impact of water scarcity on economic productivity of women in Kibauni Division of Machakos County.

1.4.1 Specific objectives

1. To explore the water and livelihood situation in Kibauni.
2. To investigate how water scarcity affects economic productivity of women.
3. To find out the challenges facing water management and how they are addressed.

1.5 Significance of the study

This study is important for two key reasons. First, issues around water availability are of significant concern in many parts of the World and particularly in the Sub-Saharan Africa. It is increasingly recognized that water use (and over-use) has social, environmental and economic impacts. Second, women's role in the society is very critical and is recognized as having an important contribution in assisting communities to become more sustainable and reduce their vulnerability. This study fills a significant research gap by finding out the major sustainable interventions that need to be put in place to enhance the economic productivity of women through sustainable and improved water availability. This will hence help the community to respond adequately to the adversity.

The study will also contribute immensely to the addition of valuable growing body of knowledge and evidence on the importance of ensuring improved water supply to water scarce areas, and on the remaining obstacles of doing so. This information may support the government of Kenya (GoK) and national and International NGOs in their design of effective programmes to better meet the immediate and long-term needs of the locals in the water scarce areas.

1.6 Scope and limitations of the study

The study was carried out in Kibauni Division, Mwala District of Machakos County. It was specifically confined to Kitile, Kibauni and Ikalaasa locations. The researcher sought to establish the extent to which economic productivity of women has been affected by water scarcity in the area and also the interventions that have been put in place to address this condition.

The study findings might not be generalizable or applicable to all areas in Kenya considering the fact that different regions are faced by different challenges and also because water scarcity is caused by a myriad of factors ranging from climatic, environmental, economic to socio-cultural factors.

1.7 Definition of Key terms

Livelihood activities: It is a means of support or subsistence. It includes all capabilities, assets (both material and Social) and the activities required for a means of living. i.e it includes the economic activities that shift people out of poverty.

Sustainable livelihoods: It's a situation in which a livelihood can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable opportunities for the next generation. It contributes net benefits to other livelihoods at the local and global levels and in the short and long term.

Water Stress: It is the inability to access sources of fresh water for use because of depleting resources.

Water shortage: It is a situation that occurs when the water demands exceed the water supplies in an area.

Water supplies: These are sources and deliveries of water to make it available to be economically and socially used by a community or in a region.

Water quality: This is the physical, chemical and biological characteristics of water. It is a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose.

Water infrastructures: These are the physical and organizational structures needed for the operation of water network so that the utility can reach the users reliably and efficiently.

Sustainable use of water: This is the use of water that supports the ability of human society to endure and flourish into the indefinite future without undermining the integrity of the hydrological cycle or the ecological systems that depend on it.

CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Water and Livelihoods

A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living (Robert Chambers and Gordon Conway, 1991). It compromises one or more often several activities. These include farming, herding, hunting, gathering, trading, hawking and even artisan activities like carving, weaving among others. These activities are carried out with an ultimate goal of providing food, cash and satisfying people's needs and demands. Some of the outcomes are usually consumed immediately while others go into short or long term stores for future consumption.

Drawing from Chambers and Conway 1991, adequate and decent livelihoods improve capabilities in the broader sense by providing conditions and opportunities, widening choices, diminishing powerlessness, promoting self-respect, reinforcing cultural and moral values and in other ways by improving quality of living and experience. Livelihood activities can have either positive or negative effects on the available resources. For instance, livelihood activities can accelerate desertification, soil erosion, deforestation and decreased water table. On the other hand, livelihood activities can improve productivity of the land through proper water harvesting and conservation methods, organic soil fertility and in general improve the productivity of the renewable resources like air, water among others (Robert Chambers and Gordon Conway, 1991).

Rural women play pivotal roles in almost every aspect of our society from time immemorial. They have made important contributions in creating access to human, natural, financial, physical and social capital for making their livelihood sustainable (World Bank, 2007). In rural areas, interest of resource poor women in income-generating activities is high and they are involved in various non-farm income activities.

Women play a very important role in socio – economic development of any society. This is so mainly because of their primary career role in the family. However, as revealed by the World Bank (2006), women are more vulnerable than men. For instance, they are more likely to be affected by poverty than men especially because of their unequal access to economic

opportunities which arises from lack of resources including credit facilities, land ownership, lack of access to education, cultural practices, minimal participation in decision making processes, poorly distributed infrastructure, poor health facilities, and high levels of HIV/AIDS infections. One major silent constraint to socio- economic development, which should be fully recognized in many developing countries as a powerful tool and vital resource for development, is water (World Bank, 2006)

Lack of access to, and in fact, ownership of land is also one of the key constraints affecting women's access to water as well as a key reason for the greater poverty of female-headed households (UN Water, 2005). Accessibility to clean water is essential to enable women and girls to pursue education, generate income, and construct and manage water and sanitation facilities which are crucial to providing women with productive resources and enabling economic empowerment.

Women in rural areas are more linked with natural resource use and conservation than men. Additionally, their traditional gender roles bring them in daily contact with natural resources such as land, water, forest and wildlife. They have to use these resources because they are often poor and their livelihood most depends on these resources. When these resources are exploited and ruined, women suffer most. If they are used sustainably women benefit most.

Women play an important role in the productivity increase both directly as workers and indirectly in their role raising children and investing in their communities (IFAD, 2002). Rural women are resourceful economic agents who contribute to the income of families and the growth of communities in a multitude of ways. They work as entrepreneurs, as farm and non-farm labourers, in family businesses, for others and as self-employed; while they take on a disproportionate share of unpaid work at home (UNDP, 2006). However, their contribution is limited by unequal access to resources as well as persistent discrimination and gender norms which need to be addressed to allow the realization of their full potential.

In rural areas, women are working not only in the family but are also involved in different entrepreneurial activities. However, the participation of women in income generation and

domestic tasks are varied by region, religion, and class (Zezza, 2007). They participate in both farming and non-farming activities directly or indirectly with men. The small farmland and homestead area is being used intensively mostly by women (Africa Development Bank, 2004). Livelihood activities of rural women can be divided into two broad categories: agricultural and non-agricultural activities.

2.1.1 Agricultural activities

Agriculture includes both crop and animal husbandry. Global water scarcity has a critical impact on food security. Water is the biggest limiting factor in the world's ability to feed a growing population and the link between food, energy, climate, economic growth, and human security challenges (FAO, 2006).

The most important agricultural activities includes among other activities; homestead vegetables cultivation/kitchen gardening, crop production, post-harvest activities in agriculture farming, poultry rearing, management of livestock, fisheries, bee keeping, sericulture, etc (FAO, 2007). All phases of agricultural activities from seed sowing to harvesting and processing of crops are intimately done by rural women. A decrease in water availability leads to poor crop and animal yield which ultimately affects their income stability and food basket at the household level. The bulk of production is generated by small-scale activities, with exceedingly high levels of participation not only in farming but also in the ancillary activities of processing and marketing. Therefore, water scarcity highly leads to unsustainability of these activities which generally affects the livelihoods of the population in the area.

2.1.2 Non Agricultural activities

The non-farm and off-farm sector activities forms part of the family uplift component that offers a range of economic interventions associated with land, livestock and non-agricultural income generating activities (Lanjouw & Lanjouw, 2001). The role of non-agricultural income generating activities is not to be neglected in enhancing farming and food security status. This is because in the past, the global strategies to solve food problems have mainly aimed at increasing agricultural production at both the household and national levels and ensuring that a portion of the produced food was stored to last through the next harvest (Brown & Kane, 1994). However, these strategies have not been successful in alleviating food problems especially in third world

countries mostly because of declining land sizes, increased water scarcity, stagnated farming technology, poor infrastructure, the demand for cash money and the ever expanding population.

Bryceson, (1996) argues that rural non-agricultural employment is of increasing importance in sub-Saharan Africa. She provides empirical evidence that this region is steadily becoming less agrarian (both as a long-term historical process, and as an integral part of rural households' livelihood strategies). She concludes that, pursuing non-agricultural activities represents a risk minimization strategy to achieve basic household subsistence needs.

The non-agricultural economy involves employment outside the realm of direct soil cultivation and cattle breeding and includes activities such as services, construction, mining, commerce, manufacturing and processing. Such activities are often pursued through self-employment, but there is also a non-agricultural wage labor market, although this market is typically small in the rural sub-Saharan African context. The contribution of these activities to household income in the developing world in general and sub-Saharan Africa in particular is substantial (Haggblade et, al., 1989). He further observes that non-agricultural income contributes between 30 to 45 percent of rural household incomes in the developing world.

RNF activities play a potentially important role in reducing poverty in rural areas. The income enables poor households to overcome credit and risk constraints on agricultural innovation (Ellis, 1998). Ellis, (1998), further adds that the non-agricultural activities help in absorbing surplus labour in rural areas, help farm-based households spread risks, offer more remunerative activities to supplement or replace agricultural income, offer income potential during the agricultural off-season and provide a means to cope or survive when farming fails.

Most non-agricultural activities are divided across commerce, manufacturing and services linked to a household's livelihood. The activities include trade or processing of agricultural products that take place on the farm such as micro processing activities. However, Barrett et al. (2001) suggest a three way classification of the non-agricultural IGAs. This classification is based on the sectoral, functional and spatial components distinguished as primary, secondary and tertiary sector activities.

1. **Primary sector activities**

Primary level economic activities are those involved with the extraction of natural resources or raw materials. They include but are not limited to agriculture, fishing, mining and forestry.

2. **Secondary sector activities**

This sector deals with the processing of raw materials into finished goods. Builders and potters are examples of secondary economic sector workers. Lumber from trees is made into homes and clay from the earth is made into pottery. Brewing, engineering and all types of processing plants are part of the secondary economic sector. In rural areas, women and men engage themselves in several activities including carpentry, fish marketing and laboring. Women are predominantly engaged in labouring, the production and sale of handicrafts and trading farm produce. In addition, brick making for both women and men and the production and sale of alcoholic brew for women were also important livelihood activities.

3. **Tertiary sector activities**

Tertiary economic activities are those activities associated with the distribution of the finished product to the market. These include retailing and wholesaling. This sector has to do with services to businesses and consumers. Dry cleaners, real estate agents and loan officers fall into the category of tertiary economic sector workers. Transportation, banking, tourism and retail stores are all part of the tertiary economic sector.

Women dominate many of the non-farm activities that include food processing and preparation, tailoring, trading and many services. They likewise hold a major interest in many of the declining rural non-farm occupations - basket making, mat making, ceramics and weaving. Consequently, women are key actors in the economic transition of Africa's rural economy. (Haggblade et al., 1989).

Non-farm activities thus play a principal role: directly, by contributing considerably to rural households' income; and indirectly, by influencing agricultural activities with potential implications for sustainability. The scope for rural non-farm employment however is to a large extent determined by the available natural resource base. Pressure on natural resources may be reduced when households have alternative sources of income. Furthermore, investments in the

resource base, such as the use of fertilizer, might be facilitated by cash income from non-farm activities (FAO and World Bank, 2001).

2.2 Effects of water scarcity on the economic productivity of women

Increase in work load, time wastage in search of water, health and sanitation problems, displacement, loss of control over resources and knowledge and limited economic opportunities are few of many problems women face as water resources are diverted, depleted or polluted.

2.2.1 Increase in Work load

As supply of unpolluted drinking water and the sanitary disposal of human wastes are fundamental to human health, lack of convenient water supplies puts great stress on families in our country, where it is the women and children who are mainly responsible for water carrying. Not only this is arduous, back breaking and repetitive work but it also occupies considerable portions of the day of women and children. Women comprise almost 73 percent of the agricultural labour force but have limited access to land and water resources; water allocations are directly proportional to landholdings (FAO, 2006). As a result of this, they have very limited access to the decision making process regarding the land use or the application of water since much of their time and energy is spent looking for their fuel and fodder, leaving them with few hours and still a lot of work to do for their family.

When the members of the household become sick due to the unsafe drinking water in the wells, taps or in the streams, they have to look after the sick ones in addition to their other duties since they are the caretakers of their families (Malmberg, 1994). When males of the family migrate due to the unprofitability of the agriculture, degraded land, diminishing livelihoods and polluted/depleted waters, women are forced to supplement family incomes by depending upon tedious work such as embroidery and casual labour.

2.2.2 Time wastage in search of water

Rural women in low-income countries spend a large part of their working hours transporting water, fodder, and fuel wood. This is especially the case in drought prone areas where these commodities are scarce and become ever scarcer. Studies in Africa have estimated that a typical

woman spends from 1 to 4 hours per day in search of water (WHO/UNICEF, 2010). A study in Ghana found that rural men spent one third of the time and one quarter of the energy that rural women spent on load carrying. Reducing women's transport loads can be an important condition for freeing them to use their time and energy for existing productive activities as well as for new economic undertakings. According to the World Bank (2006), the labour resource released by reducing the transport burden of women it could be of immense benefit if it is reallocated to more beneficial reproductive or productive activities.

2.2.3 Health Problems

In some of the water scarce areas some common health problems reported by the women are diarrhea, tuberculosis, hepatitis, still births, miscarriages, thyroid, skin and eye problems, where most of the women attribute much of their suffering to water (UN Water, 2005). Poor quality of water, social expectations and workload have severe implications on women's reproductive health.

When water scarcity is on the increase, little attention is paid to personal hygiene and sanitation needs, as it means carrying more loads for longer distances. In urban slums most women depend on public water supplies. Poor city dwellers use public facility to bathe, but this is difficult for women where there is no privacy. Waste disposal is a major problem in densely populated areas without latrines. Many women suffer from waiting to find a suitable time and place for excretion. The often have to walk long distances to find a private site or they must attend their needs after dark, with all the personal safety risks that entails (UNDP, 2006).

2.2.4 Displacement

Migration and resettlement caused by the construction of large dams, desertification and loss of livelihood in itself is a traumatic experience. When combined with the new social and climatic conditions, it leaves women with no other options but to confine to their cramped houses and with little opportunity for better education and employment. Disruption of family and low social status are few of many consequences these migrant face (Ritcher et al., 2010).

2.2.5 Limited Economic Opportunities

Agriculture is the prime user of the water supplies and employs 52 percent of total labour force out of which 73 percent are women and seventy percent of these women are farm labourers (FAO, 2006). With the deteriorating environment the work load of women increases considerably along with the necessity to earn to supplement household income. The males of the household migrate but the social responsibility of the females make them practically immobile and they are left with limited economic choices and prone to exploitation and forced to work at extremely low wages.

Fifty five percent of drinking water is drawn from surface and forty five percent from the ground. Both these sources are affected by industrial and municipal pollution (UN Water, 2005). Most of the diseases are caused by drinking this polluted water and to attend the sick ones the women cannot leave their homes to pursue their jobs and careers as a result they are forced to accept some low wage job for long hours to supplement the household incomes. When they themselves suffer from the sickness caused by the polluted water or malnutrition, it leaves them weak. Because they lack stamina to work for long hours for long period of time, they find themselves out of job frequently (Rosegrant et al., 2002). Lack of water hence means poor health and personal hygiene, poor education and poor living conditions for the women since their livelihoods is entirely dependent on the scarce resource. The picture is not so bleak all over, there are some positive cases too where women have changed not only the health scenario of the households but also helped in healing the environment by conserving the water and land and help in gearing the economic development of the communities too.

2.3 Challenges to water management and their solutions

Water is a critical resource. It supports human life and culture, ecological functions and economic activities. However, in many developed nations the demand for water is increasing at rates which are outstripping the supply sources thus challenging its availability for food production and putting global food security at risk. This is leading to a crisis of water management in many locations (United Nations 2001; 2003).

The number of countries facing the problem of water scarcity and insufficient water supply has sharply increased over the last decade. At the global level, while per capita water availability is declining, withdrawals are projected to increase more rapidly, especially in developing countries (Rosegrant et al., 2002). This is attributed by the following:

2.3.1 Population pressure

The demand for the world's scarce water supply is rapidly increasing, challenging its availability for food production and putting global food security at risk. Agriculture, upon which the majority of the world's population depends, is competing with industrial, domestic and environmental uses for the scarce water supply (Rosegrant et al., 2002). With increasing population growth and the need to increase agricultural production, the demand for the world's water resources is raising a growing concern about increasing the efficiency of water use.

Current projections indicate that world population will increase from 6.9 billion people to 9.1 billion in 2050 (UN, 2012). In addition, economic progress, notably in the emerging countries, translates into increased demand for food and diversified diets. World food demand and production is projected to increase by 70 percent in the world and by 100 percent in the developing countries (FAO, 2012). Given the present levels of resource consumption and population growth rate it is projected that two thirds of the global population will lack water in the near future. By 2025, it is estimated that 1.8 billion people will be living in water stress areas while 1.4 billion will be living in river basins where their water uses will exceed minimum recharge levels, leading to drying up of rivers and depletion of groundwater (UN, 2012). Increasing water demand attributed by the high population, coupled with adverse effects of climate change means that the future of water supply is not secure.

2.3.2 Land use changes

Land-use changes and water diversions for agriculture have been major drivers of the degradation and loss of ecosystems. Greater food production has come at the expense of biodiversity and ecosystem services that are often important to poor people's livelihoods (NEMA, 2011).

Increasing population densities and land use pressures such as legal and illegal logging, extensive cattle grazing, forest fires and cultivation are responsible for much of tropical deforestation. Traditionally, people have exploited natural resources for socio-economic benefits. However, unsustainable exploitation of self-regulating ecosystems leads to gradual loss of services it provides resulting in changes in biodiversity composition, structure and numbers. For instance, agriculture expansion into forestland triggers natural habitat destruction, water catchment interference, faunal and floral species decline, interference of nesting and breeding grounds of birds and thereby deteriorating the services that people are depended upon (NEMA, 2011)

To better manage the competing demands for the environment, agricultural and land policies will have to make water efficiency a priority. Additionally, acknowledging customary laws and informal institutions can also facilitate and encourage local management of water and other natural resources (FAO, 2012).

2.3.3 Increasing costs of water Management

New sources of water are increasingly expensive to exploit, limiting the potential for expansion in new water supplies. In Africa, irrigation construction costs are even higher than in Asia because of numerous physical and technical constraints. The average investment cost for medium and large-scale irrigation with full water control was estimated to be $8,300 per hectare (FAO, 1992).

In addition to the ever-increasing financial costs of building new irrigation and dams, the development of new dams often imposes high environmental and human resettlement costs. Dam building can have extensive negative impacts on ecosystems including loss of habitat, species, and aquatic diversity. It is estimated that 40–80million people have been displaced by dam projects (Ritcher et al., 2010). For instance, the controversy over the Narmada Valley Development Program in western India starkly illustrates the issues to be resolved if large-scale irrigation projects are to play a role in future water development. The projects are designed to bring irrigation to almost two million hectares of arid land. They promise drinking water for 30 million people in drought-prone areas, and 1,200 million watts of electricity for agriculture, cities, and industry. But they require resettlement of more than 140,000 people, mostly poor

tribal villagers, in the areas to be flooded by the Sardar Sarovar dam and displaced by the building of canals. The projects also may have negative environmental consequences. Upstream effects may include siltation, salination, and deforestation; downstream effects are more difficult to assess because they are generally less immediate and visible, but could involve water quality and temperature changes, depleted fish stocks, effects on wetlands, and reduction in silt carried out to the estuary and the sea (World Bank, 1995).

Spurred by the rapidly escalating costs of building new dams and the increasingly apparent environmental and human resettlement costs, developing countries should undertake a comprehensive reassessment of reservoir construction plans involving both new analysis of the costs and benefits of proposed projects including environmental externalities and consultation with multiple stakeholders including potential beneficiaries such as farmers who would receive new irrigation water, potential flood control beneficiaries, and those who could be adversely affected by new dams such as persons who would have to be relocated and environmental advocacy groups (World Bank, 1995).

2.3.4 Sand/Gravel Harvesting

Sand mining impacts include bed degradation, bed coarsening, lowered water tables near the streambed, and channel instability. These physical impacts may lead to the undermining of bridges and other structures. Continued extraction may also cause the entire streambed to degrade to the depth of excavation. The magnitude of the impact basically depends on the magnitudes of the extraction relative to bed load sediment supply and transport through the reach (E.A.G, 2001). According the National Coalition of Mining Report in Ghana (2006), sand mining frequently generates land use conflicts in populated areas due to its negative externalities including noise, dust, truck traffic, pollution and visually unpleasant landscapes. It also can represent a conflict with competing land uses such as farming, especially in areas where high-value farmland is scarce and where post-mining restoration may not be feasible.

In order to control gravel/sand harvesting, great improvement in the legal environment of Planning and Construction Law that encourages the rational and efficient utilization of land and natural resources should be adopted. This ensures the preservation of natural and cultural values

and prevents environmental damage and over-exploitation, based on the principles of sustainable development (IWMI, 2005).

2.3.5 Inefficient irrigation systems

Roughly, a liter of water is required to produce every calorie, so an adequate daily diet requires more than 2,000 liters of water to produce enough food for one person. Of this, 40 percent on global average can come from irrigated agriculture (IWMI, 2005).

The success of irrigation in ensuring food security and improving rural welfare has been impressive, but past experiences also indicate that inappropriate management of irrigation has contributed to environmental problems including excessive water depletion, water quality reduction, water logging, and salinization. In some basins, excessive diversion of river water has led to environmental and ecological disasters for downstream areas, and pumping groundwater at unsustainable rates has contributed to the lowering of groundwater tables and to saltwater intrusion in some coastal areas. Many water quality problems have also been created or aggravated by changes in stream flows associated with water withdrawals for agriculture. Moreover, poor irrigation practices accompanied by inadequate drainage have often damaged soils through oversaturation and salt build-up (FAO, 2007). If we continue to apply current water management practices, by 2050 the global agricultural sector will need to double the amount of water used to feed the world (IWMI, 2005). With finite freshwater resources on the one hand, and increasing demand, both in quantity and variety of uses it causes for the need for water resources protection and management to meet the challenge.

More efficient ways to irrigate land if practiced will save tremendous amounts of water. Modern irrigation systems – water saving technologies can drastically reduce the amount of water used in farming by efficiently delivering water directly to plants. This reduces the amount of water lost through surface evaporation by 30 to 70 percent depending on crop and weather conditions (IWMI, 2005).

2.3.6 Poor Agricultural methods

Agriculture utilizes on average 70 percent of the world's available fresh water. But this is higher in areas such as the Middle East and northern Africa, where up to 90 percent of freshwater withdrawals are used to irrigate crops (FAO, 2007).

Agriculture has been highly successful in capturing the bulk of the world's freshwater resources but with little accountability. This has placed an unprecedented pressure on water supplies, particularly in arid regions. FAO (2007) further reports that agriculture's role in generating water scarcity and degrading high quality surface and groundwater for marginal output is not disputed. "What is often ignored, however, is the potential of sound management of agricultural water use to open up more options for reallocation."

Better water conservation methods through better farming, destocking water harvesting has the potential to contribute substantially to increased food production, in water-scarce regions (FAO, 2010). Maximizing crop yield per unit of land also helps maximize yield per unit of water use. Additionally, research and advancement in genetic modifications such as transgenic plants, microbes and animals show potential for developing stress-tolerant materials that can possibly address water scarcity, salination and ground water contamination.

2.3.7 Improper ground water policies

Groundwater policies usually involve licenses and other regulatory instruments. But illegal groundwater pumping is difficult to observe or control and remains a major challenge for the sustainability of farming.

The rapidly increasing cost of groundwater pumping, together with the decline in water tables, and increasing degradation of over drafted aquifers induces a significant change in policy toward groundwater extraction. A combination of market based approaches that assign water rights to groundwater based on annual withdrawals and the renewable stock of groundwater together with the passage of stricter regulations and better enforcement of these regulations results in a phasing-out of all groundwater over drafting in excess of natural recharge.

2.4 Theoretical Framework

2.4.1 Feminist theory

Feminist theory comprise of a group of theories that seek to describe, analyse and explain women's and men's oppression in society and prescribe the kind of action that should be taken to address the situation. This theory sees patriarchy as inhibiting full potential of human being, women and men. Feminist theorists feel that the patriarchal philosophy emphasizes the need to dominate and control unruly females and the unruly wilderness (Linda, 2010).

Feminists fight for women empowerment in that men and women should be equal politically, economically and socially and that opportunities and resources should be shared equally. The theory is one of the major contemporary sociological theories, which analyzes the status of women and men in society with the purpose of using that knowledge to better women's lives. Feminist theory is most concerned with giving a voice to women and highlighting the various ways women have contributed to society (Griffin, C. 2009).

Feminist theories combine various types of feminism. These include religious feminism, Marxist feminism, Socialist feminism, cultural feminism, liberal feminism, political ecology feminism, eco-feminism, individualistic feminism among others. These theories are an outgrowth of the general movement to empower women worldwide since historically women have been subordinate to men. Its goals are to demonstrate the importance of women and bring gender equity. This research will be based on the feminist political ecology theory.

2.4.2 Feminist Political Ecology

Political ecology is an analytical approach which is concerned with social justice and the impact of global economic and political processes on local environments. The approach is dominated by four narratives; environmental conflict, conservation and control, degradation and marginalization as well as environmental identity and social movements. It focuses on the difficulties of resource access and control. In Kibauni, there is definitely a struggle over the access and control over water.

Feminist political ecology is a framework of analysis of ecological, economic and political power relations through a feminist perspective (Rocheleau D. and Wangari E, 1996). It addresses gender issues in resource based conflicts, either in rural or in industrial urban environments. Feminist political ecology is in some ways associated with ecofeminism. However, the latter equates female oppression with the domination of the environment and thereby essentializes women, while feminist political ecology rather explores gender as a factor in political, ecological and the relations of economic production (Hovorka, 2006).

The theory introduces a broad range of organizational situations in which women are increasingly being involved. These include; formal and informal networks, registered and unregistered movements and may operate on local, regional and international context. These feminists focus on a range of issues including health, resources, development, livelihoods, and environmental protection among others. Supporters of this theory hence collectively resist in defense of the resources that underpin their livelihoods (Agarwal, 1997).

The contribution of this theory is to emphasize the need for an understanding, both of how gender interacts with the use and management of natural resources, and how social relations can impact women's use of environmental resources, compared to men's. Borrowing from feminist political ecology, this study will view gender as a social construction which plays an important role in the shaping of access to and control over resources (Rocheleau D. and Wangari E., 1996). In this study, the environmental, natural resource will be represented by water. The theory is hence the basis for investigating the role of women and their place in the political and ecological landscape, as well as the reproduction of family life.

Feminist political ecology helps to provide some key variables that might influence the access to safe water in Kibauni. Gender is an integral variable of this study as men and women are both affected by decreased water accessibility, possibly in different ways. The micro politics of households and communities, the increasing water scarcity, the lack of women in water policy making and the patriarchal structures are some of the key factors of this study that are likely to affect women’s access to water in Kibauni.

Feminist political ecology helps to identify factors that help to centralize women's responsibilities and relative influence or not over different water management activities and use. According to feminist political ecology women often have the responsibility of financially less attractive aspects of environmental resources, while men often participate in the lucrative market linked activities.

The political ecology literature tells us that the distribution of responsibilities between men and women is often imbalanced (Rocheleau D. and Wangari E., 1996). Women carry the majority of responsibilities, yet they have disproportionately few rights to participate in determining future resource availability and quality. This is caused by limited economic and political means to participate. Being able to participate includes participating and influencing resource use planning, resource use change, structure of homes, neighborhoods and landscape design. It also includes having access to and not being excluded from 'the corridors of power'; environmental decisions in government, industry, and mainstream environmentalist groups.

Bina Agarwal in "The Gender and Environment Debate, Feminist Studies, 1992, p.1" has recommended that in order to change gender inequalities, feminist environmentalists should strive to transform ideas about propertied resources and the actual division of work between men and women. Water is certainly a propertied resource which is often accompanied by an uneven division of work between men and women. Therefore, this study on women's role in accessing safe water could contribute to challenging the existing dominant ideas of some of the relationships between nature and people, as well as ownership.

In conclusion, the aspects of feminist political ecology provide the thesis with a framework in addressing current gender imbalance between responsibilities and rights in water management, hereby addressing the issue of water as it impacts on women.

2.5 Conceptual Framework

The conceptual model for this study is based on the assumption that there is a linkage between scarce water supply and diminishing economic productivity of women, which in return affects their domestic and managerial tasks. It employs the anti-poverty approach which stresses on the contributions that women make to the family income, and what that means for them, their husbands, and children. This approach assumes that when women's economic position changes, their empowerment, welfare and gender relations also improve automatically.

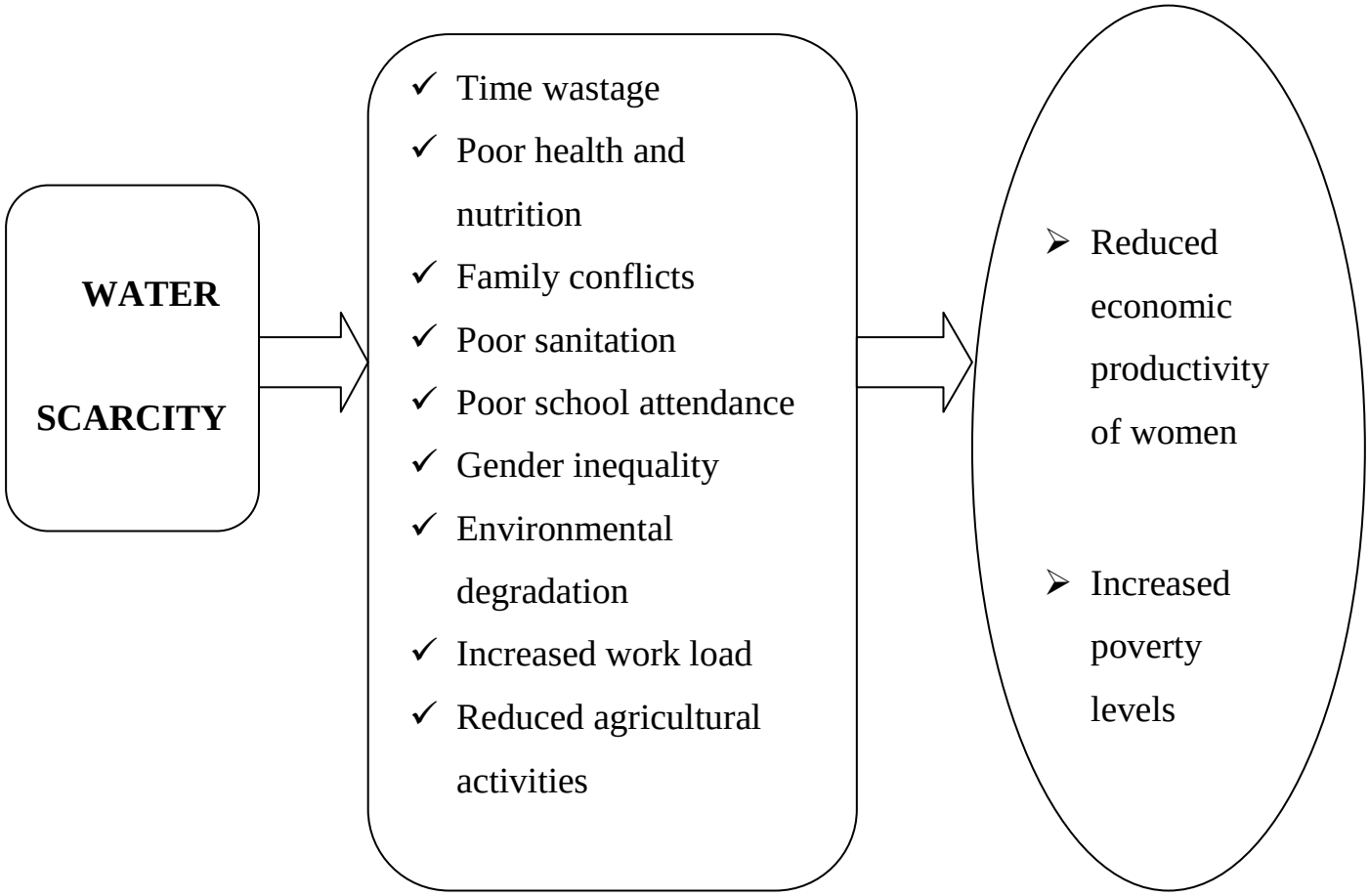
Improved and reliable water supply aims at providing drinking water to households in areas with poor water supply conditions. Although the major aim is water for domestic use, the water can sustainably be used to increase general social welfare, and to generate specific social benefits and economic returns. These benefits include positive impacts on 'women's welfare issues' such as relieving women's drudgery and giving them more time and water for domestic use. It is generally expected that women will use these gains to improve personal and domestic hygiene and spend more time on cooking, childcare, and other domestic work. The benefits from this domestic work have a positive effect on the welfare and health status of the whole family. As domestic managers, women are centrally involved in the collection and use of water and hence water should be availed to them to enhance their productivity.

Water scarcity has both short-term, medium term and long-term effects. Being the water collectors, women have to spend a lot of time in search of water. This time used in search of water could productively be invested to new economic undertakings as well as other domestic duties. Water scarcity means poor personal and family hygiene, unhealthy child care as well as family conflicts in the struggle to access the scarce resource. Additionally, it leads to poor nutrition as the family's economic base can really be affected for instance in the agricultural farming and other non-farm activities. Scarce water supply hinders women from a wide array of both farm and non-farm activities e.g. vegetable gardening, animal husbandry, the processing and sale of food and drinks, women's small scale production enterprises, etc. Depending on culture, it also denies them the chance to seek outside work to diversify their livelihoods and supply. The resulting primary impact for this is lack of small and medium enterprises which increases their income. This economic effect may in turn bring secondary effects in the context

of an overall increase of poverty, fragile gender relations in the families due to unstable families, poor participation and access to social services e.g. credit, health and education services. It also reduces their morbidity and awareness through their frequent interaction with other traders, jeopardize their control over their income use as well as increasing their vulnerability.

The long term impact of the unreliable access to water supply is that it leads to poor disaster preparedness, increased vulnerability due to limited livelihood activities and sustained increase in poverty levels.

Figure 1*: Conceptual model of the study*



CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methodologies which were used in the study. The chapter presents the site selection and description, research design, target population, sample size and sampling procedure, research instruments, data collection, ethical consideration and data analysis.

3.1.1 Site selection and description

Kibauni Division lies within the semi-arid areas of Kenya. It is located in Eastern part of Kenya with an estimated terrain elevation of 1175 metres above sea level. It lies at latitude **S01º37'0.01"** and longitude **E037º42'00''.** The region is characterized by a topography comprising of undulating hills and seasonal rivers. Rainwater harvested through water dams provide very temporary alternative sources in many areas but most dry up in dry spells. Most parts of the district lack reliable water supply, except areas along River Athi that have sufficient water for domestic and livestock use as well as irrigating nearby farms.

The population significantly relies on rain-fed agriculture in which human labour is the main if not the sole input for the cultivation of the main crops majorly done by the women. Distance to markets and a water supply is a major factor influencing household welfare. Food production in the entire district is limited and variable due to unreliable weather patterns. The region is a net importer of food and has poorly developed transport network. Rainfall amounts and distribution rarely meet crop water requirements and hence the area has been faced by a continuous low agricultural and economic productivity. Kibauni division has three locations; Kibauni, Kitile and Ikalaasa locations.

3.2 Research design

Research design is the plan structure of investigation conceived with a view to obtain answers to research questions. It is an overall scheme or programme of the research. It includes an outline of what the investigator wants to do from writing the hypotheses to analysis of the data collected (it determines whether the research will involve experiments, interviews, observations, content analysis, simulations or a combination of this). Therefore, the research design expresses both the

structure and the plan of investigation to obtain empirical evidence on relations of the problems (Cooper and Schindler, 2003. P146).

For the purpose of this study, the researcher employed exploratory research design. The design is concerned with the discovery of ideas and insights by allowing the study to be flexible enough in order to provide an opportunity for considering the different aspects of the problem under study (Bryman 2008). The design helps in describing the state of affairs as they exist without manipulation of the variables which is the ultimate goal of this study.

3.3 Target population

Target population is the researcher's population of interest. It is that population to which the researcher wants to generalize the results of the study (Mugenda and Mugenda 2003). The target population was the household heads within Kibauni location, Kitile location and Ikalaasa location of Kibauni division. The division has 3592 households and 360 household heads were targeted (CBS, 2009).

3.3.1 Sample size and sampling procedure

The overall goal of sampling was to find out true facts about the sample that would also be true of the population. In order for the sample to truly reflect the population, the researcher needed to have a sample that is representative of the population (Mugenda and Mugenda 2003). Kibauni Division has a population of 17,974, with a total of 3592 households (CBS, 2009).

Table 3.1: Sampling frame

Location	**No. of households**	**Sample size**
Kibauni	1,312	143
Kitile	993	104
Ikalaasa	1288	113
Total	**3592**	**360**

To get the sample size of 360 out of 3592 households the following formula was used. For this study, the sample was obtained by calculating the sample size from the target population by applying by Cooper and Schindler, (2003).

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

Where: n= Sample size, N= Population size e= Level of Precision.

At 95% level of confidence and P=5

n= 3592/1+3592 $(0.05)^2$

n= 360

In order to achieve the intended objective, the researcher used several sampling methods. The area was clustered into three locations namely Kibauni, Kitile and Ikalaasa. Proportionate sampling was used to get the sample size in each location. To allocate the household heads, systematic sampling was used where every 5^{th} household was interviewed (in case the researcher did not find a head in the intended household, the preceding household was considered for the interview). To enhance representativeness of the entire division, Kibauni Secondary school, Nthwanguu market and Komu dam were used as the land marks for Kibauni, Kitile and Ikalaasa locations respectively. From the landmark, the researcher with the help of three research assistants moved from north-east-south-west directions where every 5^{th} household was sampled.

The two focus group discussions comprising of 12 members were selected by the use of purposive sampling. The researcher identified two self-help groups within the study area from where the FGD members were selected. The groups identified were involved in economic empowerment programmes and where experienced and willing to provide the required information.

Finally, 10 key informants who were considered knowledgeable on water management were sampled through purposive sampling technique. These comprised of the County officer (1), Assistant County Officer (1), Chiefs (3), Water Officers (3) and employees from German Agro-Action (2) in the study area. The process of sampling in this case involved identification of the informants, and arranging time for meeting them.

3.3.2 Unit of analysis and observation

The unit of analysis refers to the major entity that is being examined in order to create a summary description of the universe. It is that unit that we initially describe for the purpose of aggregating their characteristics in order to describe some larger group. Similarly, unit of observation is the subject, object, item or entity from which we obtain the data required for the study. In majority of studies, the unit of observation is also the unit of analysis (Mugenda and Mugenda 2003).

The study's unit of observation was the household heads with specific emphasis on women residing in the study area. The unit of analysis was the household head's economic activities including their access to water resources, how they utilize the water/economic gain of the available water and the challenges they face in water management.

3.4 Methods and Tools of Data collection

3.4.1 Introduction

Data collection involves gathering data from the sample so that the research questions can be answered and it is a key point to any research work (Bryman, 2008).The researcher employed the mixed model approach which is a combination of the qualitative and quantitative research approaches to collect data. Quantitative research relies on the collection of qualitative data e.g in-depth interviews, FGDs, participant observation, field notes and open-ended questionnaires. "It is an inquiry process of understanding based on distinct methodological traditions of inquiry that explores a social or human problem. The researcher builds a complex, holistic picture, analyzes words, reports detailed views of the informants and conducts the study in a natural setting" defines Creswell, 1998.

On the other hand, quantitative research relies mostly on the collection of quantifiable data based on precise measurement using structured and validated data collection instruments. The reason for employing the mixed model approach is to complement one set of results for the other and hence discover and seek explanations that would have been missed if only one approach had been used. The following methods and tools were used to collect data:

3.4.2 Household Interviews

These are structured face-to-face verbal communication between a researcher and the respondent that provides the researcher with the main source of data. Structured questionnaires with both open questions (to enhance maximum data collection and generation of quantitative and qualitative data) and closed questions (to enhance uniformity) were used. The questionnaires were also administered to the respondents by the researcher with the help the research assistants. The questionnaire was divided in different sections covering all aspects of the research problem and was kept short and simple to encourage participation (Appendix I).

3.4.3 Focus Group Discussions

FGD is a form of group interview involving people with knowledge and interest in a particular topic and facilitator (Schindler and Donald, 2005). FGDs consist of approximately 6-12 persons guided by a moderator during which the group members discuss freely about a topic under focus. The purpose of FGDs is to obtain in-depth information on concepts, perceptions and ideas of the members from the group. A free discussion in recognition of diversity of members was allowed to enhance collection of reliable information.

Two FGDs were conducted during the data collection exercise each with 12 participants. They helped in clarifying issues in the study as well as generating additional and supplementary information alongside verifying what was collected from other sources. A FGD guide was used as a tool to guide this (Appendix II).

3.4.4 Key Informant Interviews

10 Key informant interviews were carried out. This comprised of the County officer (1), Assistant County Officer (1), Chiefs (3), Water Officers (3) and employees from German Agro-Action (2) in the study area. To guide this, a key informant guide was developed. The Key informant guide consisted of open ended questions to elicit responses from the key respondents (Appendix III).

3.4.5 Observation

Direct observation by the researcher was used as a crosscutting method throughout the field work. This was employed to determine the factors and conditions responsible for water scarcity

as well as how it has affected livelihoods in the area. The technique helped in acquiring useful and fast hand information through direct contact with the environment and hence it was valuable for checking the difference between what interviewees expressed and what was happening; in as far as water scarcity and livelihoods were concerned.

3.4.6 Secondary data review

The researcher reviewed the existing information of the study problem. These included both published and unpublished information. The sources included government publications, literature/reports from the study area on the research topic or from reports from other agencies dealing with the research problem.

3.5 Data analysis techniques

Data collected was analyzed using either qualitative or quantitative data analysis methods accordingly.

3.5.1 Quantitative analysis

Quantitative data generated from the household questionnaires was keyed in and analyzed using descriptive statistics with the aid of SPSS in order to address the research questions. Results were presented in tables using percentages and frequencies to facilitate comparisons and further analysis.

3.5.2 Qualitative data analysis

Qualitative data obtained from key informant interviews, FGDs and observation first was edited to detect and correct errors and omissions in the questionnaires and hence ensure completeness in each question, accuracy of every answer and uniformity in interpreting the questions. Secondly, the data was classified and coded in order to have meaningful categories so as to bring a clear essential pattern of the responses. Finally, the data was tabulated which involves summarizing raw data and displaying them on compact statistical tables for further analysis (Mugenda and Mugenda, 2003). The information finally was analyzed and interpreted to evaluate its usefulness in answering the research questions.

3.6 Ethical issues

The researcher sought permission from the relevant authorities before conducting the research. Utmost caution was exercised while administering questionnaires and conducting the interviews to avoid any mistrust between the respondents and the researcher. The researcher also assured the respondents that the study was meant for academic purposes only and that their responses would be treated with utmost confidentiality.

CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents analysis, interpretation and presentation of the study findings. The study sought to answer the following research questions: What is the water and livelihood situation in Kibauni? How does water scarcity affect economic productivity of women? And finally, What challenges are facing water management and how are they addressed? The results have been presented in tables, figures and content delivery to highlight the major findings. They have also been presented sequentially according to the research questions of the study. Mean scores and standard deviations analysis has also been used to analyze the data collected. The raw data was coded, evaluated and tabulated to depict clearly the impact of water scarcity on economic productivity of women in Kibauni Division of Machakos County. The findings were discussed and interpreted in relation to the objectives of the study.

4.2 Response Return Rate

The interview schedules were administered by the researcher, assisted by the research assistants directly to the respondents through conducting face to face oral interviews. The research assistants were first taken through a training of the questionnaire by the researcher to ensure that they adequately understood the significance and the requirements of the data collection and that they were prepared for the exercise.

Table 4.1: Response Return Rate

Location	**Sample size**	**Response rate**
Kibauni	143	129
Kitile	104	93
Ikalaasa	113	102
Total	**360**	**324**

The study targeted 360 household heads, 10 key informants and 2 focus group discussions out of which 324 household heads, 10 key informants and 2 FGDs responded to the study as required. This constituted a response rate of 90% for the household respondents, 100% for the key informants and 100% for the FGDs. This response rates were sufficient, representative and

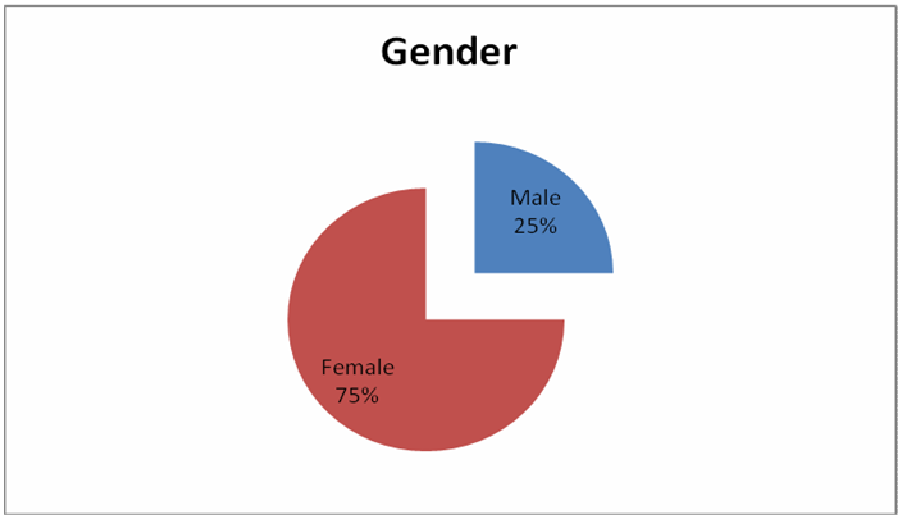
conforms to Mugenda and Mugenda (1999), where a response rate of more than 80% is sufficient enough for the study. To maximize the response rate, the researcher ensured that a good rapport with the respondents was maintained, guaranteed confidentiality of their responses and explained the purpose of the study.

4.3 Demographic Characteristics

4.3.1 Gender of the respondents

Female respondents were more than the male respondents since the females were 75 percent while males were 25 percent as shown in figure 4.1 below. This indicates that the information collected provided a true reflection of how women handle water scarcity challenges together with other livelihood situations as well as the challenges that they face for survival.

Figure 4.1 Percentage distribution of respondents by gender

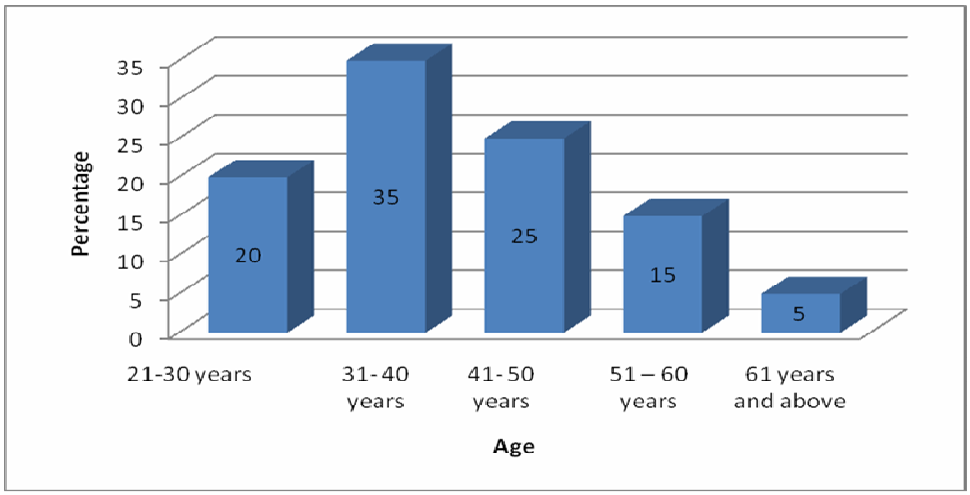


4.3.2 Age group of respondents

The respondents were asked to disclose their age. The figure below shows the study findings on the distribution of the age of the respondents.

From the figure below, it is evident that a large proportion (35% of the respondents) was aged between 31 to 40 years. This was followed by a significant percentage (25% of the respondents) aged between 41-50 years while 20% of the respondents were aged between 21-30 years. 15% of the respondents were those aged 51-60 years and 5% were those aged 61 years and above.

Figure 4.2: Percentage distribution of respondents by age

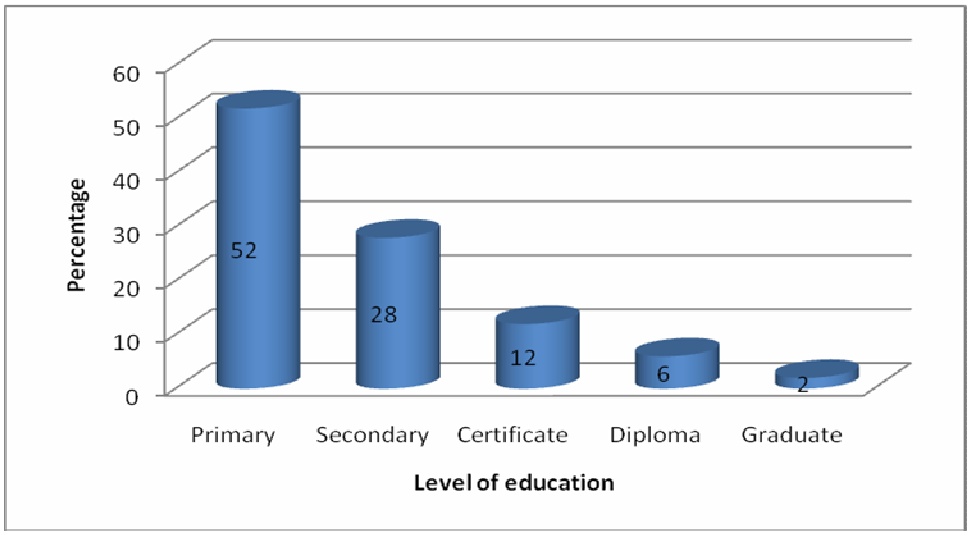


This indicates that majority of the household heads (60%) are between 31-50 years and hence were experienced and knowledgeable enough to give adequate and reliable information during the study.

4.3.3 Level of Education

The study sought to establish the level of education of the respondents within Kibauni division.

Figure 4.3: Percentage distribution of respondents by level of education



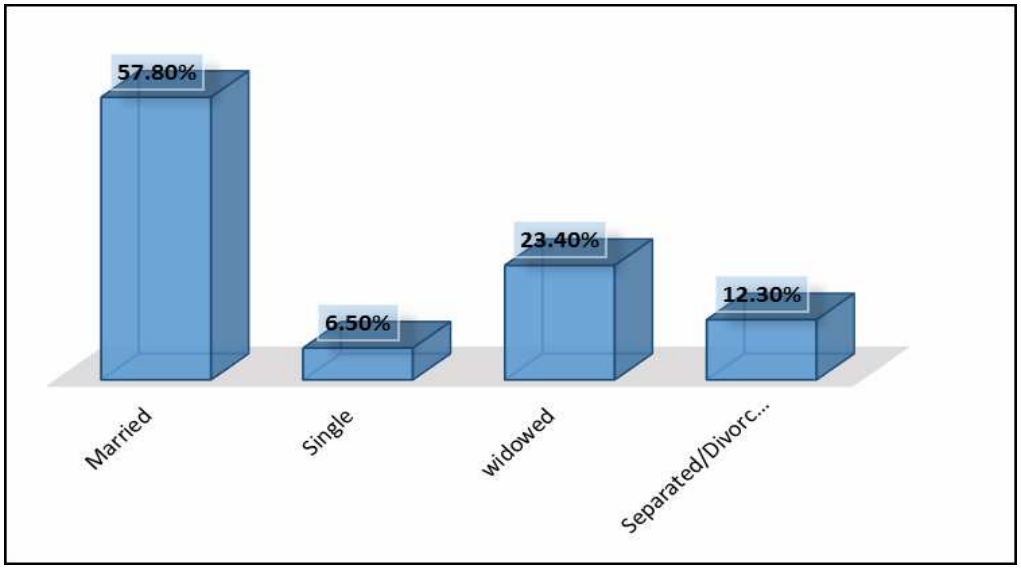
From the figure above, majority of the respondents (52%) indicated they had attained education up to primary level, followed by 28% who had attained education up to the secondary school level. 12% had attained education up to certificate level, 6% were diploma holders while 2% were graduates. The results depict that majority of the household heads in Kibauni division had

attained education up to primary school level. However, during the key informant interviews it was pointed out that majority of the educated youth had migrated to urban areas in search of well-paying jobs and that they were supporting their dependants. During the FGDs, it was further emphasized that the low economic opportunities in the area which are accelerated by water scarcity were making the educated people to migrate to other towns/areas in search of better economic opportunities.

4.3.4 Marital Status

Marital status has an implication on the choice and extent of participation in livelihood activities. Majority of the respondents, constituting approximately 57.8 percent who participated in this study indicated that they were married followed by those who were widowed at 23.4 percent whilst divorced/separated formed 12.3 percent and the least number was the single who represented 6.5% of the respondents. This depicts that majority of the respondents were married and therefore majority of them had diversified productive economic activities with their partners compared to those not married, divorced or widowed.

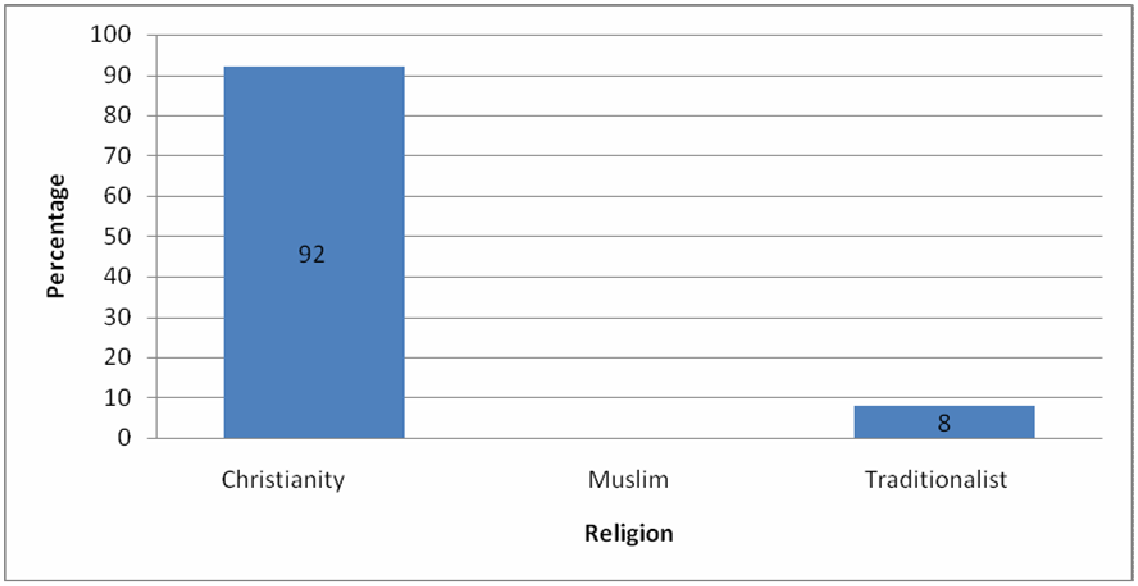
Figure 4.4: Percentage distribution of the respondents by marital Status



4.3.5 Religion

The respondents were asked about their religion. 92% of the respondents indicated that they were Christians while 8% were traditionalists. The researcher did not encounter any Muslim respondent and therefore they were not represented in the study.

Figure 4.5: Percentage distribution of the respondents by religion

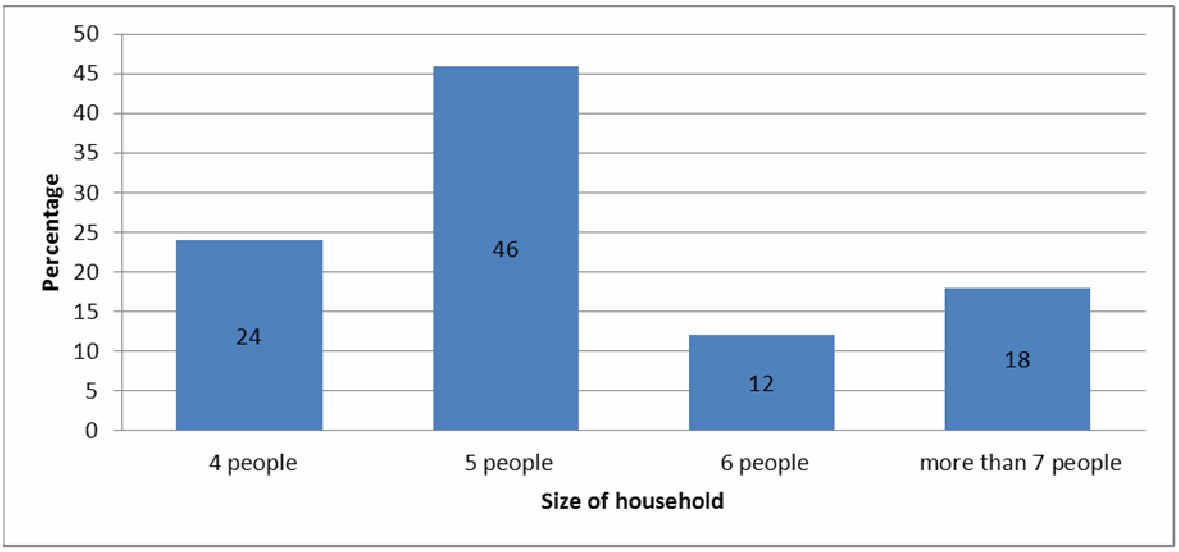


4.3.6 Family size

When asked about the size of the family, 46% of the respondents indicated they were more than 5 members, 24% indicated they were family size 4, 18% indicated that they were more than 7 members while 12% indicated that they were family size 6. This implies that majority of the households have at least 5 family members and the higher the family size, the higher the demand/competition for the scarce available resources. The same was also pointed during the focus group discussions. The key informants further clarified that big family sizes translated to increased population in the area and hence increased demand for the available natural resources like land and water as well as living a life of hand-to- mouth and hence development was a challenge within the households.

The results of the analysis are presented in figure 4.6.

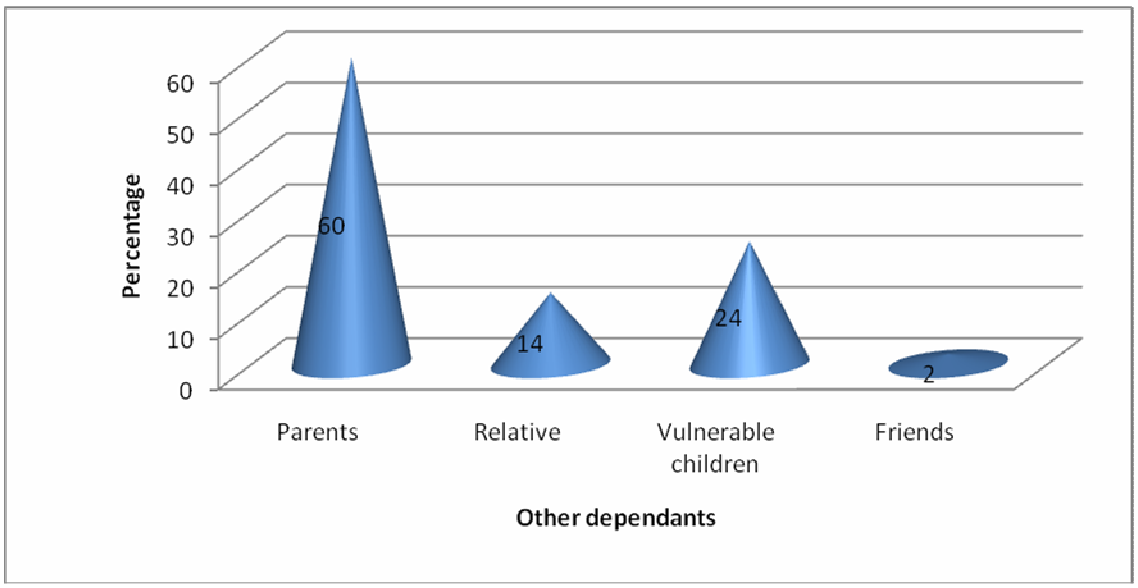
Figure 4.6 : Percentage distribution of the respondents by family size



4.3.7 Other dependants

The respondents were asked to indicate other dependants relying on them. 60% of the respondents indicated that their parents depended on them, followed by those who indicated vulnerable children at 24%, those who indicated relatives were 14% while 2% indicated friends. This indicates that majority of the people in the area support their parents due to old age and also support vulnerable children who need their support and care.

Figure 4.7: Percentage distribution of respondents by the number of dependants



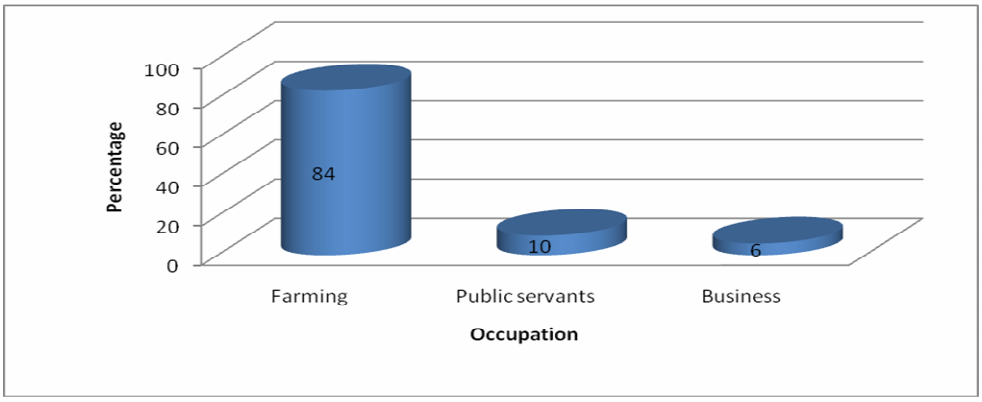
4.4 Water and Livelihood situation in Kibauni

The study sought to find out the water and livelihood situation in Kibauni. Below is the analysis of the findings.

4.4.1 Occupation

The respondents were asked to indicate their occupation.

Figure 4.8: Percentage distribution of respondents by occupation



The results show that 84% of the respondents indicated that they were farmers, followed by10% of those who were categorized as public servants and 6% were business people. The results were clarified during the FGDs and key informant interviews that almost all residents relied on farming for their sustenance.

4.4.2 Other livelihood activities undertaken

The respondents were requested to disclose other livelihood activities they were involved in to supplement their income and daily needs. Majority of them indicated that they were involved in agriculture as it is the main economic activity particularly subsistence farming. Some of the crops grown include maize, beans, sorghum, millet, vegetables, mangoes and pulses. Others were involved in livestock farming which includes keeping of zebu cows, sheep and goats as well as donkeys that are used for transport and labor. The animals are majorly kept on small scale.

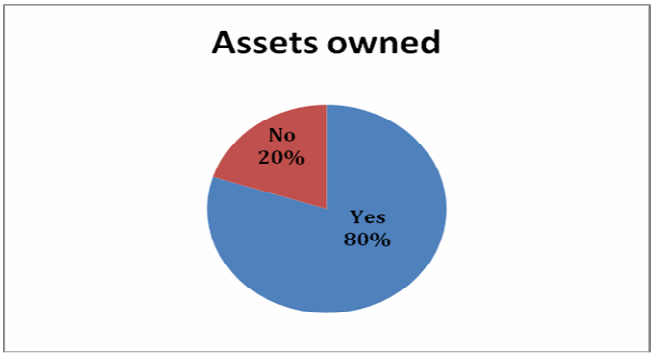
A large group of the respondents also indicated that they were involved in charcoal burning, wood carving, sand harvesting, brick making, casual labour and water vending. These activities translate to exploitation of resources, increasing water scarcity. This came out clearly during the key informant interviews that many people in the area were involved in charcoal burning/selling

and others in wood carving due to the nearby market in Wamunyu town for their carvings. These people were hence reported to target the indigenous species in the forest catchment area and it was a real threat to the water situation although it was helping them in earning their living.

4.4.3 Assets Owned

The respondents were asked to indicate whether their family owned any assets.

Figure 4.9: Percentage distribution of respondents by assets owned



The results show that majority (80%) indicated that they own assets while 20% indicate they do not own assets. Those who indicated that they owned assets were asked to mention them. Majority indicated that they owned land which they use for agriculture and settlement, others owned buildings, and others owned household assets like carts, bicycles, ploughs and livestock. The results were verified by the key informants and also during the FGDs that almost every household own some assets but the problem is that most of the families are patriarchal and the female are only allowed to possess but not to own properties and hence have less control over those resources.

4.4.4 Major sources of water for the community

The major sources of water for the community are seasonal rivers and streams. The area is served by only one permanent river, R. Athi. Community boreholes as well as hand-dug wells along the streams/rivers also provide alternative source of water. The community also gets water from several dams that have been built to provide them with water. During the key informant interviews, it was indicated that Ikalaasa location originally had water springs that provided fresh and reliable water to the community but with time, the spring dried up (1990's). They further emphasized that the major source of water is rivers. They however pointed out that underground water has not been fully exploited and can be a reliable supply of water for the residents.

4.4.5 Major uses of the water in the household

The respondents were asked to indicate the major uses of water in their homes.

Table 4.2: Water usage in the households

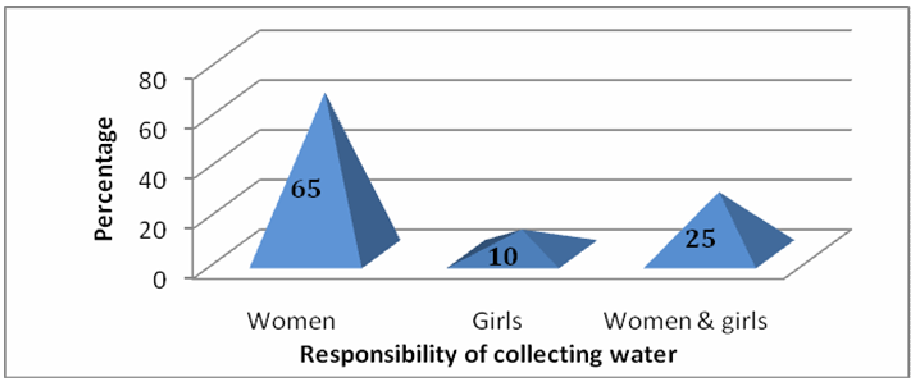
Description	N	Mean	Std Deviation	Percentage
Washing	324	4.3452	0.6653	100
Cleaning	324	4.0987	0.8688	100
Irrigation	324	3.3265	0.7541	100
Cooking	324	4.5653	0.6857	100
Kitchen garden	324	3.2430	0.6648	100
Drinking	324	4.6753	0.3246	100

From the above analysis, it is evident that majority of the respondents indicated that water is majorly used for drinking with a mean of 4.6753, followed by those who indicated that it was used for cooking m=4.5653. This was followed by washing m=4.3452 and cleaning m=4.0987 and they moderately agreed that water was used for Irrigation m=3.3265 and kitchen gardening m=3.243. It was observed during the survey that, irrigation and also kitchen gardening was not highly embraced due to the competing needs of the available water.

4.4.6 Responsibility to collect the water

The respondents were asked to indicate who were responsible for collecting water for household uses. The figure below represents the analysis of the findings.

Figure 4.10 Responsibility of collecting water

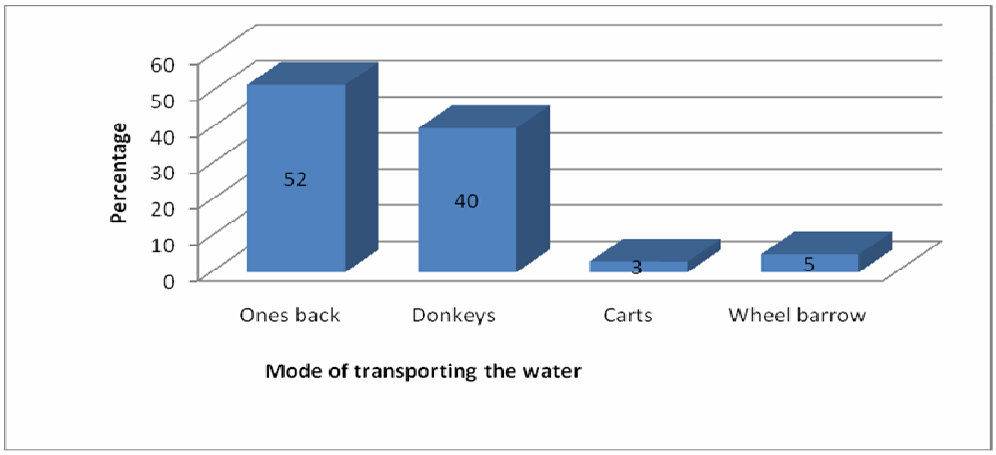


As illustrated in the above chart, majority (65%) indicated that women were responsible for collecting water followed by 10% who indicated girls while 25% indicated that both women and girls are responsible for collecting water. The same was also pointed out by the key informants that women are the major collectors of water and in other cases girls also help them. During the FGDs, it was indicated that during the dry season girls miss classes in order to help their mothers to find water for the family. Additionally, the key informants pointed out that women were being overburdened with all household chores as well as water collection which consumed a lot of time that could otherwise have been invested in income generating work.

4.4.7 Mode of transporting the water

Respondents were further required to indicate the mode of transport used to carry the water to their household. The results are presented in the figure below.

Figure 4.11: Percentage distribution of respondents by mode of water transport



The results show that 52% of the respondents indicated that the mode of transport used was ones back. 40% indicated that they used donkeys, 5% indicated wheel barrows, while 3% indicated carts were used to transport water. During the FGDs it was pointed out that many households have very little income with majority living a 'hand-to-mouth life'. Therefore majority of the residents cannot afford to buy donkeys or carts to aid in water transport. This hence leaves the burden of transporting the water to the women which highly affects their health and time as they have to fetch the water for several trips.

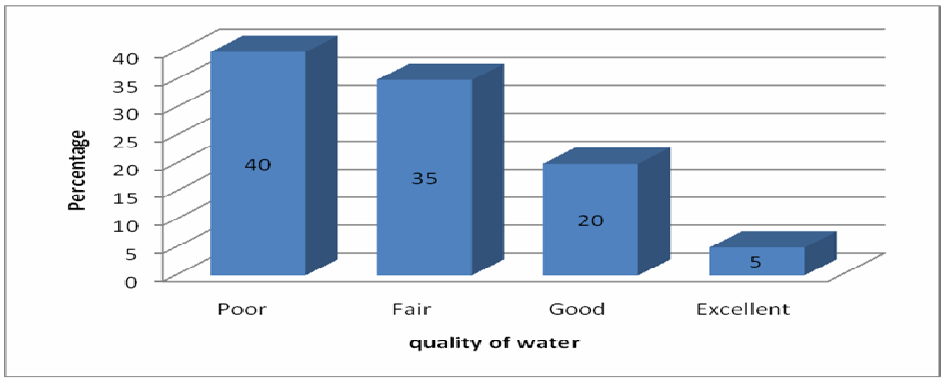
4.5 Effects of water scarcity on economic productivity of women

The second objective of the study was to investigate how water scarcity affects the economic productivity of women in the study area. In order to achieve this objective, the study set out to examine the quality and quantity of the water available for the household, the nature of the impact of the available water, family obligations they are involved in as well as the strategies that they use to handle those family obligations together with income generating activities. The results of the finding are presented below.

4.5.1 Quality of water received in the area

The study sought to establish the quality of the water in the area. The findings are hereby represented in the figure below.

Figure 4.12: Quality of water received in the area



The results show that the quality of water received in the area is poor as indicated by 40% of the respondents, 35% indicated that the quality was fair, 20% indicated that the quality was good while 5% indicated that the quality was excellent. From observation and also through the FGDs, it was confirmed that the available water from the boreholes, wells and rivers is usually salty and untreated. The wells are usually not covered and hence contamination rate was reported to be very high.

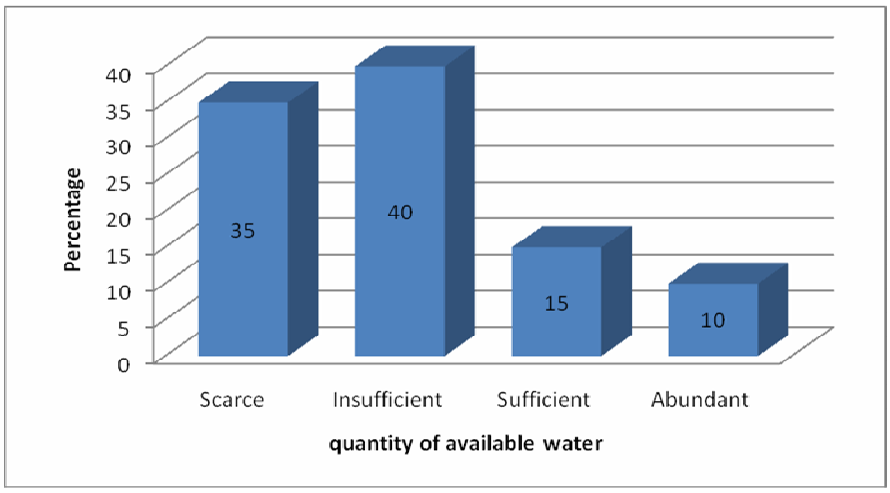
4.5.2 Quantity of the available water

The respondents were further required to rate the quantity of the available water that they received in their area.

From the analysis, 40% of the respondents indicated that the water was insufficient, 35% indicated that the water was scarce, 15% indicated it was sufficient while 5% indicated it was

abundant. This is an indication that water is a challenge in the area. The figure below shows the results of the analysis.

Figure 4.13: Quantity of the available water

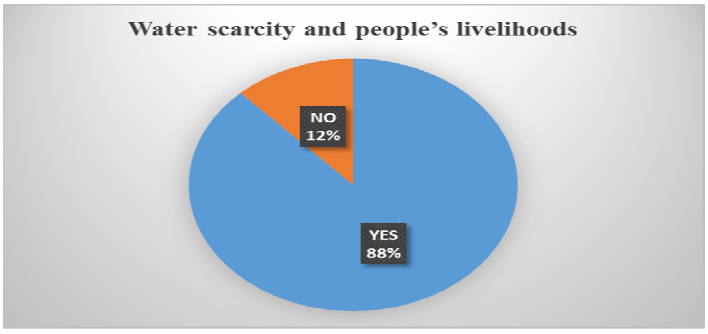


4.5.3 Water scarcity and people's livelihoods

The study sought to find out whether the respondents felt that water scarcity affected people's livelihoods. The results show that water scarcity affects people's livelihoods as indicated by majority which is 88% of the respondents. 12% indicated that Scarcity of water does not affect people's livelihoods.

The results of their response are indicated in the chart below.

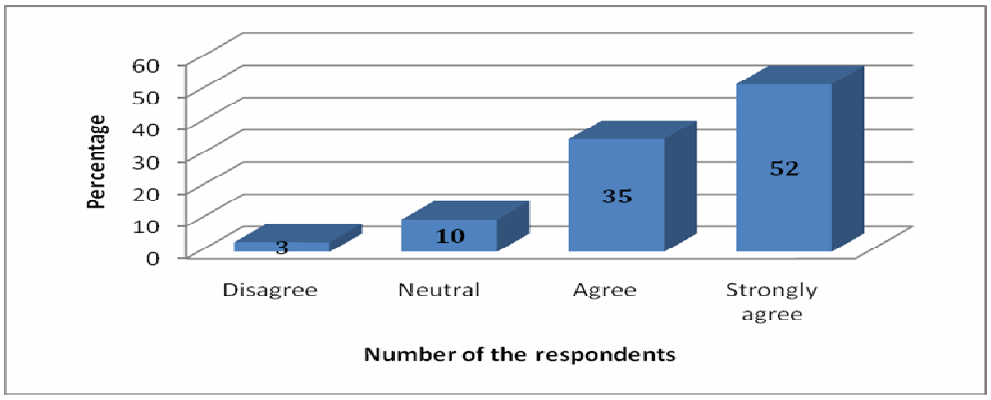
Figure 4.14: Water scarcity and people's livelihoods



4.5.4 Does water scarcity affect the economic productivity of women?

The respondents were asked to rate their perception of whether water scarcity affects economic productivity of women in their area in a scale of 1-5.

Figure 4.15: Perception of the impact of water scarcity on economic productivity of women



The results show that majority 52% of the respondents strongly agreed that water scarcity affects economic productivity. 35% agreed, 10% were neutral while 3% disagreed that water scarcity affects economic productivity of women in their area. During the interviews, some of the key informants pointed out that water is the backbone of almost all livelihood activities in the area since majority of the residents depended on subsistence agriculture which was high affected by water scarcity due to poor rains received in the area.

4.5.5 Effects of the available water on the economic productivity of women

The study sought to find out the nature and extent of effects of water scarcity on the economic productivity women. The results of the finding are illustrated in table 4.3.

Table 4.3: Effects of water on the economic productivity of women

Description	N	Mean	Standard deviation	percentage
Increased work load	324	4.1544	0.7548	100
Time wastage in search of water	324	4.2651	0.3271	100
Health problems	324	4.3257	0.4567	100
Displacement	324	3.1779	0.8655	100
Limited economic opportunities	324	4.6355	0.71645	100
Family break-down	324	4.5766	0.76262	100
Education	324	4.8977	0.80879	100

The results depict that majority of the respondents strongly agreed that education was greatly affected by scarcity of water with a mean of 4.8977 followed by family break-down m=4.5766. Also indicated was health problems m=4.3257, time wastage in search of water m=4.2651 and increased work load m=4.1544. The respondents moderately agreed that scarcity of water affected them in terms of displacement m=3.1779. Information obtained from the key informants and focus group discussion indicated that health problems and time wastage in search of the scarce commodity was greatly affecting economic activities of the women. They also pointed out that girl child education was also being affected as they were being forced to miss their classes to look for the valuable commodity.

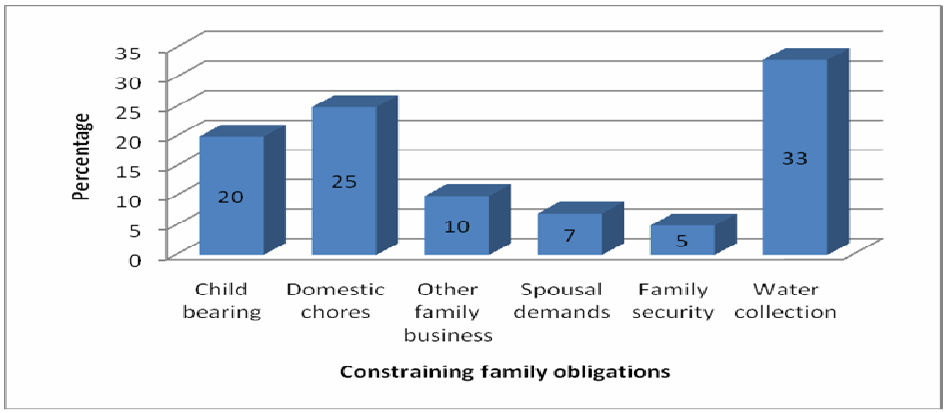
4.5.6 Family obligations

The respondents indicated that they handle family obligations together with income generating activities by employing house helps who assist them in doing the home tasks as they do other activities. Others indicated that they do house chores early in the morning before proceeding to the other activities. Alternatively, others delegate the responsibility to other family members while for others, they reduce their number of working hours so that they can have time to do other household chores.

4.5.7 Constraining family obligations

The respondents were asked to indicate what constraining family obligations they thought women faced while pursuing their livelihood activities. The results of the finding are indicated in the chart below.

Figure 4.16: Constraining family obligations



The figure above shows that water collection at 33% was indicated as the major obligation constraining women while pursuing their livelihood activities. 25% of the respondents indicated domestic chores, 23% indicated water collection, 20% indicated child bearing, 10% indicated other family business, 5% indicated family security while 7% indicated spousal demands. This depicts that water collection highly affects the livelihoods of the women in the area.

4.6 Challenges facing water management and ways of addressing them

The third objective was to find out the challenges facing water management and how they are addressed. To achieve this objective, the study sought to find out whether the respondents understood what water management is, who were responsible for maintaining the water points at the community level, making decisions as well as owning the water projects. It further explored the extent at which the people felt water management was a challenge to them, whether they practiced water harvesting and what means they use as well as suggesting the possible ways of addressing the situation.

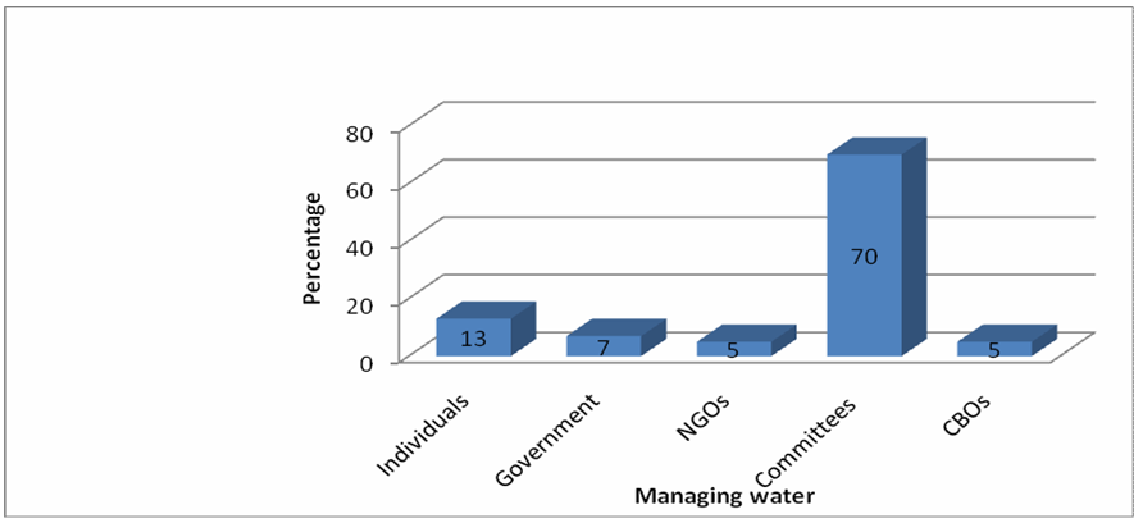
4.6.1 Water management

The study sought to establish whether the respondents understood what water management is. 93.4% indicated that they had heard about water management while 6.6% indicated that they have never heard about same. This indicates that majority understood what water management entails and its importance to the entire society. It was pointed out during the FGDs that German Agro-Action, an international NGO working in the area had been training the residents on water management and harvesting.

4.6.2 Management of water points/supply in the community

The respondents were asked to indicate who manages water points/supply from their community. The results of the analysis are presented below.

Figure 4.17: Management of water points/supply in the community



The figure above shows that majority (70%) of the respondents indicated that water was managed by committees, 13% of the respondents indicated that water was managed by individuals, committees, 7% of the respondents indicated that water was managed by government, 5% of the respondents indicated that water was managed by NGOs while another 5% of the respondents indicated that water was managed by CBOs. During the FGDs, it was pointed out that water sector in the community is male-dominated. They clarified that water points were being managed by village committees and that female had very little position in the committees.

4.6.3 Key decision makers of water projects in the community

A great percentage of the respondents indicated that the key decision maker of the water projects was the Ministry of Water and Irrigation (MWI). They also revealed that village committees composed mainly of the men are handed over the projects by the MWI to run and maintain them.

4.6.4 Challenges to water management

The respondents were asked to rate some challenges that were affecting water management in their area. The table below shows the results.

Table 4.4: Challenges to water management

Description	N	Mean	Standard deviation	Percent
Population pressure	324	3.6524	0.8651	100
Land use changes	324	4.0625	0.3265	100
Increasing costs of water management	324	4.6741	0.5554	100
Sand/gravel harvesting	324	4.3873	0.4124	100
Inefficient irrigation systems	324	4.3651	0.8647	100
Poor agricultural methods	324	4.4133	0.6305	100
Improper water policies	324	4.3883	0.6386	100
Mismanagement of the projects	324	4.0338	0.6437	100
Climate pattern changes	324	4.0384	0.6588	100
Poor government policies	324	3.8342	0.6639	100
Forest/catchment degradation	324	3.9844	0.6729	100

The results show that the majority of the respondents strongly agreed that there was increasing costs of water management with a mean of 4.6741. The respondents further agreed that other major challenges to water management included Sand/gravel harvesting m=4.3873, inefficient irrigation systems m=4.3651 and poor agricultural methods m=4.4133. Other factors that they also agreed on include Land use changes m=4.0625, there was Mismanagement of the projects m=4.0338, Climate pattern changes m=4.0384, Forest/catchment degradation=3.9844, Poor government policies m=3.8342 and Population pressure m=3.6524.

4.6.5 Rain water harvesting

The respondents were asked to indicate whether they practiced rain water harvesting. The results are shown in the table below.

Table 4.5: Rain water harvesting

Harvesting water	Frequency	Percentage
Yes	301	93
No	23	7
Total	**324**	**100**

93% of the respondents indicated that they practiced rain water harvesting while 7% indicated that they did not. Those who indicated that they practiced water harvesting gave a list of the methods that they used ranging from roof harvesting using water tanks to surface/run-off water harvesting using dams, ponds and terraces. The 7% who indicated that they did not practice water harvesting said that it was expensive and also that rain water-harvesting and storage was associated with the spread of malaria.

4.6.6 Perception towards improved water supply/availability

The respondents indicated that if water was sufficient then there would be increased food security in the area as more farmers would be able to invest much in agriculture as well as enhanced economic opportunities. They further revealed that there would be increased enrolment and decreased drop-out rates in education and especially for girls who were mainly affected. Sanitation in the area would also be improved if there was enough supply of water. With safe, adequate and reliable water supply, the key informants pointed out that, women would be free to pursue diverse economic opportunities and improve their family lives since time and energy spent walking distant places in search for water would be invested productively and their health problems would be minimized.

4.6.7 Measures employed in the community to address water scarcity

The respondents indicated that the measures that have been employed to address the situation included building of gabions, dams, drilling of boreholes and digging of wells. The key informants and focus group discussions further pointed out that the community had received training on proper water management from the German Agro-Action. The training embraced on proper farming methods as well as recycling of water for a variety of uses. The respondents

further revealed out that destocking was being encouraged as well as keeping of cross-bred livestock due to their high productivity.

4.6.8 Other strategies for addressing water management challenges

The following are some of the strategies that were suggested during the survey, discussions and interview process as possible solutions to address the water management challenges; Tree planting along the water catchment areas, exploitation of the underground water, proper government policies to control sand/gravel harvesting as well as logging for carving and charcoal burning. Donor funding to aid in land reclamation as well as exploiting new water sources was also pointed out as a key strategy.

Water can play a key role as part of strategies for achieving most of the community goals, including hunger reduction, universal education, empowerment of women, improved health and combating diseases, environmental sustainability, and advancing a global partnership for development.

CHAPTER FIVE: SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The research study was conducted with the aim of assessing the impact of water scarcity on the economic productivity of women. This is in recognition of the fact that water is a vital resource for livelihoods and affects mostly the women who traditionally are termed as the water collectors and managers.

The study sought to answer three key research questions namely: What is the water and livelihood situation in Kibauni? How does water scarcity affect economic productivity of women? What challenges are facing water management and how are they addressed?

5.2 Summary of the findings

5.2.1 Water and livelihood situation in Kibauni division

From the findings, it was established that water is a very scarce commodity in Kibauni division. The residents obtain water from the nearby seasonal rivers/streams, seasonal wells and during the dry season they walk long distances to get water from river Athi. Kiaka and Wamuya water projects supplying piped and treated water from river Athi also provide water to the locals but at a cost of Ksh.20/gallon. They have four public water points at Kwa Komu, Nthwanguu market, Mukaa market and Ikalaasa market. Additionally, they connect the water to households who can bear the costs of the project initiation and maintenance costs. Residents who are financially stable have also dug their own wells along river banks.

The geographical terrain of the area is very rugged and hence water from the source is collected majorly by women and girls and carried by ones back. Women are the major water collectors and also girls usually help them. The mode of transport of the water differs from one household to another depending on the available assets. From the study it was observed that the most commonly used mode of transporting water is either one's back or use of the donkeys. Carts and bicycles are hard to use in the area since the terrain of the area is very hilly with many gullies. This back breaking work for the women has led to increased complaints of back pains, chest

pains as well as headaches since the exercise is a tedious one and in most cases the weather is hot and sunny worsening the situation.

The study also revealed that the livelihood situation of the residents in Kibauni is dynamic. During rainy season, women invest in their lands where they grow a variety of drought resistant crops like sorghum, Katumani/DH4 maize, beans, cow peas, pigeon peas, green grams and millet. Currently, they have been receiving seeds (peas) through the District Agricultural Office to plant and they get ready market of the same from the Ministry of Agriculture. This has seen livelihoods of many people improve. The residents also keep livestock (cows, goats and sheep) chicken which is done on small scale. When they get their harvest, majority of them sell their products to the local market at extremely low prices while in other cases the women preserve some of their harvest using chemicals or traditional method s of drying and smoking for future consumption.

During the dry season, residents are usually involved in off-farm/non-agricultural activities. This include brick making, charcoal burning, sand harvesting and selling, casual laboring, tilling and preparing their land among other things. Majority of the women are involved in hard labour activities like brick making, vegetable growing (along R.Athi), water vending, charcoal burning among others.

The study established that water vending is a common livelihood activity for the women living near R. Athi or among the individuals who have personal wells/boreholes. This is because R. Athi is very far for majority of the residents although it is a source of fresh water. Additionally, water from the available water projects is not highly reliable during dry season as the wells dry up while others provide very muddy and salty water. Therefore water vending was mentioned as one of the seasonal economic activities mostly during the dry season. It is practiced majorly by women who either own or rent donkeys or use their backs for transporting the water.

Agricultural production is usually very low due to the low rainfall received in the area. This makes majority of the poor residents to depend partially on food aid which targets mostly the poor women, orphans and vulnerable children. The study also found out that most of the women live in the rural areas but their husbands have migrated to the urban areas to look for better economic activities to substitute their income. For others, their husbands engage themselves in

casual labour but after they get their wages they indulge themselves in drinking illicit brews which worries many women.

The livelihoods of women along R. Athi which is the major source of water are much stable due to the availability of water throughout the year. People farm along the river banks while others practice irrigation on either large or small scale. They plant maize, beans and even vegetables. Water availability hence was found out to be a very valuable commodity for the sustainability of the livelihoods of women.

5.2.2 Impact of water scarcity on the economic productivity of women

The participation of women in economic activities differs from that of men as they are governed by different sets of socio-cultural, environmental, economic and political aspects. Their ability to participate in development activities is greatly influenced by their cultural values which in many cases men are the key decision-makers. This therefore shows that women are voiceless or have very little influence in key decision making as well as project participation. Their ability to exploit the available resources and economic opportunities is largely dependent of their freedom of ownership and control of land and other resources.

The study established that water availability forms the basis of women's sustainable livelihoods either through farm or non-farm activities. Poor water quality and insufficient quantity was reported to be the major cause of health problems like malnutrition, diarrhea and typhoid among others. Many women complained that they experienced back pains after carrying the water on their backs (majority carry the 20 – 25 liter gallon of water) as well as fetching water to the donkeys.

The study also found out that women and young girls often walk as far as ten miles to collect water from rivers or polluted, dirty, hand-dug wells, which in most cases are full of parasites and bacteria for domestic use. These wells are also structurally dangerous and often collapse when they get very deep. It was hence observed that they spend a lot of time that could otherwise been have invested in more productive economic activities. The waste of time in search of water hence was reported to be a major factor towards their low economic productivity.

The study revealed that water scarcity translates in to increased work-load for majority of the women since they have to spend a lot of time fetching water at the expense of other domestic obligations. The study found out that during the dry season, women have to wake up as early as 1 a.m (at night) to go and get water from the wells and nearby seasonal rivers since during the day the hot sun increases the evaporation and also there is excess demand from people and livestock. It was also observed that groups and individuals have their specific portions along the rivers where they scoop the sand to get the water and fence round the well using thorny branches during the dry season. At night every well is guarded by the owner so that people don't steal their precious scarce commodity; water. Water scarcity was connected to enmity and conflicts among households in the study area.

From the study findings, it is very clear that water and economic productivity are intertwined and it is almost impossible to divorce them from each other. Water scarcity leads to diminished economic opportunities as well as poor health and sanitation and the end result is family break downs. The study also established that water scarcity greatly affects education and in most cases, the girl child education. The study also revealed in smaller rates that water scarcity causes displacement and migration as people move from the less productive zones to the more productive areas in search of food, pasture for their animals as well as economic opportunities for better livelihoods.

5.2.3 Challenges to water management and ways of addressing them

The final research question focused on identifying the challenges facing water management and how they are being addressed. The study revealed that water management projects was entirely men's work with women having little stake in them. This is because the society feels that women being faced by numerous family obligations and other duties, they tend to mismanage the projects due to lack of commitment.

The study found out that population pressure is a major challenge to water management. From the findings, it was found out that majority of the households have at least five family members. The overall population in the division was also found out to be approximately, 17994 people. The higher the population/family size, the higher the need for the scarce resources and hence exploitation of the available scarce resources is bound to happen.

Land use change was also revealed as another major challenge to water management. The study established that economic activities like charcoal burning, brick making, logging among others were degrading the water catchment areas. Additionally, diversion of some streams and rivers had been accompanied by decreased water availability downstream. Discussions with key informants and FGD members pointed out that proper land policies need to be implemented on the sustainable use of land and its resources.

Water management in the study area was observed to be a real challenge. The study established that water harvesting is key to improved access to better economic activities. The study revealed that majority of the households practiced water harvesting in small scale. This was done through roof harvesting, terracing, and building of gabions and sand dams as well as improved agricultural practices. It was also observed that German-Agro Action (GAA), an international Non-governmental organization working within the division was helping the residents in investing in water harvesting for improved economic opportunities. The study indicated that there is a strong need for more improved and expanded water harvesting systems to address the water scarcity situation within their area.

The findings of the study further indicated that sand/gravel harvesting have accelerated water scarcity. This is because they have made the water table to be so deep that during the dry season it is impossible to get water from those sites. The situation has also been pointed out to be one of the major causes of water erosion in the area. In order to address the situation the population feels that proper policies in regard to sand/gravel harvesting need to be put in place.

Also revealed in the study was the use of poor agricultural methods, inefficient irrigation systems as well as improper ground water policies as being a challenge to water management. Key informants pointed out that, ground water has not been fully exploited and hence there is a need to have proper underground water policies. Additionally, there is also a great need to plant drought resistant crops and practice new farming methods to improve on crop yields.

During the study, it was observed that some households that invest in proper water harvesting methods like the use of water tanks and dams, their economic base is stable as they sell the water to the locals and others practice drip irrigation in their farms to improve on their yield.

5.3 Conclusions

The study concludes that water and economic productivity of women are intertwined and almost impossible to separate them. This is because in almost the entire livelihood activities observed to be done by women, water is the major commodity used as a catalyst to get their products and boost their income. Additionally, water scarcity to women translates to increased work load, prolonged time in search for the commodity, poor health problems, displacement and more so, diminished economic opportunities. The study concludes that, with improved and reliable water supply, economic productivity of women can really be increased.

Additionally, the study concludes that the major threat affecting water management is the land use changes as many people are really exploiting the forest reserves and catchment areas in pursuit of their livelihood activities like charcoal burning, logging, cutting thorn-branches for fencing land among others. Population growth which translates to increased demand for the land resources is also a challenge to water management.

In order to address the challenges faced in water management, the study concludes that few measures have been put in place ranging from water harvesting, efficient irrigation methods (drip-irrigation) to proper policies of controlled sand /gravel harvesting. Similarly, the study concludes that ground water has not been fully exploited and can provide a reliable source of water for the populace.

5.4 Recommendations

The study recommends various key approaches and actions to address water scarcity and improve on the economic productivity of the women. These include the following:

- **Access to resources**

Policies should be formulated to enhance women's access and control over resources. This majorly includes land which houses almost all the natural resources like water, soil, forests and even minerals. This will ensure that they can adequately participate in decision making processes in their community as well as gain control over the projects initiated in their areas.

Discriminatory and customary laws that tend to demine the women and support patriarchy should be abandoned to give way to the gender sensitive approach in accessing, implementing and participating in community projects.

- **Family and societal support**

The society needs to embrace the changing role of women in the community. Research shows that support or lack of support of men influences the decision of women to enter into income generating activities, how to enter, participate and perform at what level (African Development Bank, 2004). Gender mainstreaming in all trainings should therefore be enhanced as a societal exercise.

- **Education**

Education should be viewed as an investment. It is central to women's economic development. Whether formal or informal, education provides the knowledge and skills as well as enhancing promotion of women's social and economic participation since more education is linked to greater access to resources. Additionally, there should be genuine political will to ensure that girls are given equal access to education especially in rural areas. Water availability which is directly linked to health and sanitation should be increased to reduce the drop-out rates among the teenage girls.

- **Entrepreneurship training**

Effective entrepreneurship training for capacity building should be organized for women. The trainings should focus on equipping women with the necessary knowhow and skills of sustainable use of water, proper water harvesting and investing in viable economic activities. These trainings can hence develop women's knowledge base and raise their awareness on how they can engage profitably in their economic activities.

The trainings can also be targeted to the entire society to sensitize the community on the need to protecting and restoring the ecosystems that naturally capture, filter, store and release water, such as rivers, wetlands, forests and soils, as they are crucial to increasing the availability good quality.

5.5 Recommendations for further studies

The following are the recommendations for further study:

i. More studies be done to explore the impact of water scarcity on; education drop-out rates among girls, family break-downs, household conflicts as well as on women's health.

ii. A similar study be done in a different environmental setting to allow for comparison and hence allow for generalization.

iii. More studies be done to establish the extent of participation of women in the water sector.

iv. Comparison study on men and women in their access to resources

v. Studies advocating for women's access to resources.

vi. Studies exploring how women manage water effectively.

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APPENDICES

Appendix I: HOUSEHOLDS QUESTIONNAIRE

Introduction

My name is Jackline Mumbua Mwinzi, a student at the University of Nairobi pursuing a Master of Arts degree in Sociology. As a requirement for the fulfillment of the Masters degree, I intend to carry out a project research on **"Water scarcity and economic productivity of women: A case Study of Kibauni division, Machakos County".**

You have been selected to assist in providing the required information as your views and ideas are considered important to this study. This questionnaire is therefore specifically for the purpose of the academic research only and the information collected will be treated with utmost confidentiality. Please answer all the questions provided as honestly as possible, to the best of your knowledge. Do I have your consent to continue? Yes……No……

Division …… Location ……..

Section A: Background Information

1. Sex: Male ( ) Female ( )

2. Age: a) Below 20 years b) 21-30 years c) 31- 40 years
   d) 41- 50 years e) 51 – 60 years f) 61 years and above
3. What is your highest level of education?
   a) Primary b) Secondary c) Certificate
   d) Diploma e) Graduate f) Masters
   g) Other (specify)……..
4. What is your marital status?
   a) Married b) Single
   c) Widowed d) Divorced/Separated
5. What is your religion?
   a) Christianity ☐ b) Muslim ☐ c) Traditionalist ☐
   d) Other (specify)…….

6. Family size ……

7. Other dependants

Relationship	**Tick**	**Number**
Parents		
Relative		
Vulnerable children		
Friends		

Section B: Water and Livelihood situation in Kibauni

8. What is your occupation? .....

9. What other livelihood activities are you involved in to supplement your income and daily needs?

   i. ...…….....
   ii. …….....
   iii. …….....
   iv. …….....

10. Does your family own any assets? Yes ☐ No ☐

If yes, what assets do you own? .....

.....

.....

11. What are the major sources of water for the community? Give options

    i. .....
    .....

ii. .....

iii. .....

12. What are the major uses of the water in your household? (*Tick all that apply)*

Water Use	**Tick**
Washing	
Cleaning	
Irrigation	
Cooking	
Kitchen garden	
Drinking	
Other (Specify)	

13. Who collects the water?

a) Women
b) Girls
c) Women & girls
d) Men
e) Boys
f) Boys & girls
g) Boys & men
h) All

14. What mode of transport do you use to collect the water?

a) Ones back
b) Bicycles
c) Carts
d) Wheel barrow
e) Donkeys
f) Other *(specify*)

Section C: Effects of water scarcity on economic productivity of women

15. How do you rate the quality of water that you receive in your area?

Poor	Fair	Good	Excellent

16. How is the quantity of the available water?

Scarce	Insufficient	Sufficient	Abundant

17. a) Do you think that water scarcity affects people's livelihoods?

Yes [ ] No [ ]

b) If yes, does water scarcity affect economic productivity of women in your area?

Use a scale of 1-5 where 1- strongly disagree 2- disagree, 3- Neutral, 4- Agree 5-Strongly agree

Scale	1	2	3	4	5
Tick					

18. Kindly rate the effect of the available water on the economic productivity of women using the table below. (Use the scale of 1-5, where 1- strongly disagree, 2-disagree, 3-Neutral, 4 – agree and 5- strongly agree).

Effect	**1**	**2**	**3**	**4**	**5**
Increased work load					
Time wastage in search of water					
Health problems					

Displacement					
Limited economic opportunities					
Family break-down					
Education					
Other (specify)					

19. How do you handle your family obligations together with income generating activities?
    .....
    .....

20. What constraining family obligations do you think women face while pursuing their livelihood activities? *(Tick all that apply).*

Activity	**Tick**
Child bearing	
Domestic chores	
Other family business	
Spousal demands	
Family security	
Water collection	
Others (*specify).*……	

SECTION D: Challenges facing water management and ways of addressing them

21. What is your understanding on water management? .....
    .....
    .....

22. Who manages the water points/supply from your community?

a) Individuals c) NGOs e) CBOs

b) Government d) Committees f) Other (specify)

23. Who are the key decision makers of water projects in the community? .....

.....

24. Who owns the water projects? …….

25. a) Do you feel that water management in your area is a challenge? Yes ☐ No ☐

b) If Yes, kindly rate the nature of the problem in the scale of 1-5, where 1- strongly disagree, 2-disagree, 3- Neutral, 4 – agree and 5- strongly agree.

Challenge	**1**	**2**	**3**	**4**	**5**
Population pressure					
Land use changes					
Increasing costs of water management					
Sand/gravel harvesting					
Inefficient irrigation systems					
Poor agricultural methods					
Improper water policies					
Mismanagement of the projects					
Climate patterns					
Poor government policies					
Forest/catchment degradation					
Other (specify)					

26. Do you practice rain water harvesting? Yes ☐ No ☐

If yes, what methods do you use? (*Give options*)

i. .....
ii. .....
iii. .....
iv. .....

If No, why? .....

.....

27. What is your perception towards improved water supply/availability in your area?
.....
.....
.....
.....
.....

28. What measures are being employed in your community to address water scarcity?

i. .....
ii. .....
iii. .....
iv. .....
v. …….....

29. In your opinion, what other strategies do you feel should be put in place to address water management challenges in your area?

i. .....
ii. .....
iii. .....
iv. .....

Thank you for your response.

Appendix II: FOCUS GROUP DISCUSSION GUIDE

Introduction

My name is Jackline Mumbua Mwinzi, a student at the University of Nairobi pursuing a Master of Arts degree in Sociology. As a requirement for the fulfillment of the Masters degree, I intend to carry out a project research on **"Water scarcity and economic productivity of women: A case Study of Kibauni division, Machakos County".**

The questions in this guide are therefore specifically for the purpose of the academic research only and the information collected will be treated with utmost confidentiality. Please answer all the questions provided as honestly as possible, to the best of your knowledge.

Section A: (to be completed by the interviewer)

i. Number of members in the group .....

ii. Area where the FGD was held .....

Section B: Water and Livelihood situation in Kibauni Division

1. a) What are the livelihoods activities that the residents in the area are involved in?

.....

.....

b) Do women in the area participate in livelihood activities? Yes ( ) No ( )

If yes, what livelihood activities are women engaged in this area?

i. ……

ii. ……

iii. ……

iv. .....

c) Are these activities sustainable and effective? Yes ( ) No ( )

Give reasons for your answer above...……

……

……...

2. What is your view on the extent of participation of women in;
   i. Agricultural activities

……

……

…….....

   ii. Non-Agricultural Activities

……

……

……

   iii. Water management activities

……

……

……

3. a) What are the major sources of water for the community? .....
   b) Who collects the water for the family? …….
   c) What mode of transport is commonly used in majority of the households?.....

.....

4. What are the economic benefits of the available water among the women in the area?

.....

.....

Section C: Effects of water scarcity on economic productivity of women

5. How do women handle their family obligations together with income generating activities? .....

…….

6. To what extent is water scarcity a challenge to women in this area? …….

……

……

.....

.....

7. How does water scarcity affect women in relation to the following;

   i. Increased workload

……

……

…….....

   ii. Displacement

……

……

…….

   iii. Limited economic opportunities

……

……

……

   iv. Education

……

……

…….

   v. Health problems

……

……

…….

   vi. Time wastage in search of water

……

……

……..

SECTION D: Challenges facing water management and ways of addressing them

8. What is your understanding on water management? …….....

……

……..

.....

9. What are the challenges facing water management in the area?
    i. .....
    ii. .....
    iii. .....
    iv. .....
    v. .....
    .

10. What is your perception towards improved water supply/availability in your area? .....
.....
.....

11. What measures are being employed in your community to address water scarcity?
    i. .....
    ii. .....
    iii. .....
    iv. .....

12. In your opinion, what other strategies do you feel should be put in place to address water management challenges in your area?
    i. .....
    ii. .....
    iii. .....
    iv. .....

13. What other factors do you think affect the economic productivity of women? List them in order of priority.
    i. .....
    ii. .....
    iii. .....
    iv. .....

Thank you for your response.

Appendix III: KEY INFORMANT GUIDE
Introduction

My name is Jackline Mumbua Mwinzi, a student at the University of Nairobi pursuing a Master of Arts degree in Sociology. As a requirement for the fulfillment of the Masters degree, I intend to carry out a project research on **"Water scarcity and economic productivity of women: A case Study of Kibauni division, Machakos County".**

You have been selected to assist in providing the required information as your views and ideas are considered important to this study. The questions in this guide are therefore specifically for the purpose of the academic research only and the information collected will be treated with utmost confidentiality. Please answer all the questions provided as honestly as possible, to the best of your knowledge. Do I have your consent to continue? Yes…… No……

Division …… Location ……..

Section A: (to be completed by the interviewer)

1. Name of the interviewee ……
2. Occupation …….
3. Sex: Male ( ) Female ( )

Section B: Water and Livelihood situation in Kibauni Division

4. a) What livelihood activities are women engaged in this area?
   i. ……
   ii. ……
   iii. ……
   iv. ……

5. Are these activities sustainable and effective? Yes ( ) No ( )
   Give reasons for your answer above, ……
   ……
   ……...

6. What is your view on the extent of participation of women in;

   iv. Agricultural activities

……

……

……

   v. Non-Agricultural Activities

……

……

……

   vi. Water management activities

……

……

……

7. a) What are the major sources of water for the community? .....

   b) Who collects the water for the family? ……

   c) What mode of transport is commonly used in majority of the households?.....

……

8. What are the economic benefits of the available among women in the area?

   .....

   .....

Section C: Effects of water scarcity on economic productivity of women

9. How do women handle their family obligations together with income generating activities? .....

……

10. To what extent is water scarcity a challenge to women in this area? …….

……

……

……

11. How does water scarcity affect women in relation to the following;

i. Increased workload

……

……

…….....

ii. Displacement

……

……

…….

iii. Limited economic opportunities

……

……

……

iv. Education

……

……

…….

v. Health problems

……

……

…….

vi. Time wastage in search of water

……

……

……..

SECTION D: Challenges facing water management and ways of addressing them

12. What is your understanding on water management? …….....

……

…….....

.....

13. Which livelihood activities are being undertaken by women that are affected by water scarcity?
    i. …...……
    ii. ……
    iii. ……
14. What are the challenges facing water management in the area?
    i. .....
    ii. .....
    iii. .....
    iv. .....
15. What is your perception towards improved water supply/availability in your area? .....
.....

16. What measures are being employed in your community to address water scarcity?
    i. .....
    ii. .....
    iii. .....
    iv. .....

17. In your opinion, what other strategies do you feel should be put in place to address water management challenges in your area?
    i. .....
    ii. .....
    iii. .....
    iv. .....
18. What other factors do you think affect the economic productivity of women? List them in order of priority.
    i. .....
    ii. .....
    iii. .....

Thank you for your response.