CHALLENGES AND PROSPECTS FOR EFFECTIVE WATER CONSERVATION IN MWINGI NORTH DISTRICT, KITUI COUNTY, KENYA

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Research Project submitted in partial fulfillment of the requirement for the Degree of Bachelor of Environmental Planning and Management of Kenyatta University.

DECLARATION

I Wachira .N. Shelmith declare that this project report is my original work and it has never been submitted to any department in any institution or university for examination or an award.

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APPROVAL

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

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Mr. Wilson Nyaoro

DEDICATION

I dedicate this project to my parents, Mr. and Mrs. Wachira.

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ABSTRACT

Water conservation involves the strategies and activities that are used to manage water resources, especially fresh water as a sustainable resource. Conservation aims at protecting the water environment and its resources from negative impacts in order to make them to be able to meet current and future demands, making them sustainable. Water is faced with a lot of challenges from human demand, this including the population, household size and growth. Environmental challenges include climate change and environmental degradation.

Water is a basic necessity to human survival. With the current environment, due to climate change and degradation, water has been a challenge to the community especially those living in the ASAL areas. These challenges affect the community negatively in all sectors, economically, socially and politically. Without water the community and country's development is affected. Efforts to conserve and protect water are also affected as the resources become scarce and hence survivals for the fittest tactics are employed, thus implementing the measures of conservation is affected. This project is aimed at providing and coming up with the challenges that face water conservation in Mwingi constituency in Kitui County.

Chapter one helps to discuss the problem as it is in the region and the world. It gives the problem statement, justification and significance of the study. Research questions, objectives and premises are also raised. The objectives are clearly identified to help and guide this study. In chapter two, literature from different scholars is used to further define the problem of the study. This helps to know the contribution made by scholars and researchers in the issue of challenges facing water conservation in the world and other regions. It focuses in water conservation and the challenge of implementing it globally, regionally and locally. The third chapter helps use to get familiar with the study area, defining the area in terms of its physical, economic and social set up. The fourth chapter helps us to identify the research design that is used in the study. The nature and sources of data and the data collection instruments are discussed in this chapter. In chapter five, it deals with analyzing the data collected. Data analysis was based on the information obtained from questionnaires, interviews with the government offices and household information, personal observations and the interviews from the people in the area. Household characteristics such as household size, income and water conservation practices where analyzed.

ABBREVIATIONS

ASAL	– Arid and Semi-Arid Areas
CWI	– Community Water Initiative
EIA	– Environmental Impact Assessment
IWRM	– Integrated Water Resource Management
KWS	– Kenya Wildlife Service
MCA	– Meru Conservancy Area
UNDP	– United Nations Development Programme
UNEP	–United Nations Environmental Programme

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1 CHAPTER 1

1.0 Introduction

1.1 Background to the problem

Water is one of the most important necessity in the human life, it is used for different activities in their day to day activities, hence the need for it. Activities involve such as drinking, washing clothes and the household materials, for building purposes, for animal care both drinking and hygiene, for agricultural activities such as irrigation and crop growth etc. there is nowhere in the world that water is not important. Water covers about 71% of the earth's surface. Out of this percentage of water, only 2.5% of the Earth's water is fresh water, and 98.8% of that water is in ice and groundwater. Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere, and an even smaller amount of the Earth's freshwater (0.003%) is contained within biological bodies and manufactured products (Wikipedia).

Dry lands are areas in which annual evapotranspiration exceeds rainfall and in which agricultural productivity is limited by poor availability of moisture. They occur throughout the world and comprise not less than 40% of the global surface landmass (6.4 billion ha) and are found in about 100 countries the world over. They are home to about 1.2 billion people and 350 000 plant species, of which 3000 are known to be useful to mankind. In Africa, dry lands cover 1.96 billion ha in 25 countries (65% of continental landmass). Nearly 400 million Africans live in the arid and semiarid lands of the continent. With the dry land population increasing at the rate of 3% a year, the natural resources of Africa's dry lands must feed an additional 12 million people every year; this is despite degradation of the dry land natural resource base (Jamal et al,2005).

Water conservation and management is one of the main problems facing dry lands in the world today. This is due to water shortages and scarcity caused by the natural physical factors in these regions and lack of creation of awareness on the conservation of the available water resources in the region. Around the world, water conservation and management is has been made difficult due to water scarcity, different places in the world face this similar problem, most of which they are not necessarily in dry lands. Water scarcity affects every continent and around 2.8 billion people around the world at least one month out of every year. It is estimated by the UN that by 2025 up to 1.8 billion people could face water scarcity (Wikipedia).

Water shortage problems are expected to continue since growing populations, increasing demands, water pollution, and governance problems continue to strain water supply systems in several regions of the world. Without considering the effects of climate change, projections show that 2.9 – 3.3 billion people could be living in water stressed watersheds by 2025. Most of these people will be from developing countries, especially in Africa and Asia. Being a common problem around the world, water shortages are likely to be a growing concern in many regions during the 21st century. An estimated 1.1 billion people in developing countries (16% of the world population) lack access to adequate supplies of quality water, and 2.6 billion people (39% of the world population) lack access to adequate sanitation. The result of these water problems would be a greater number of people will find it increasingly difficult to meet their basic water needs. This has the potential for increasing water stress on people and the environment, as well as conflicts between water users that share aquifers, streams, and other water sources. As demands increase, people will increase struggling to secure their fair share of water (UNDP, 2010).

In china, water is a major problem affecting the country, the northern part of china is already a water scarce region and china as a whole will soon join the group of water stressed countries if the issue is not well managed. The scarce water resources in the region are poorly managed predominantly through inefficient and unsustainable practices. Inefficient water policies and weak institutional capacity and implementation are the leading sources (World Bank, 2005).

India is also another country where water conservation is a crisis. This is due to poor management, unclear laws, corrupt government and increased industrial and human waste. Climate change and increase in population growth has also exacerbated this crisis in the country. The most affected in this crisis are the Indian villages and communities at the lower class. Women and children also suffer most as they have to walk long distances to get water for domestic use. In western states of Gujarati and Maharashtra, rainfall during the last two monsoons has been less than 50% of the average compared with 93% in 2001. If this crisis is not conserved and managed, India is vulnerable to future water stress. The implications of this water crisis extend beyond agricultural and industrial challenges; the social dynamics of Indian villages changing (Times of India magazine, 2013 and glowingblue.com).

Botswana is a semi-arid and drought prone country. Only about 10% is cultivable land (FAO 1995), the rest is dominated by the Kalahari Desert. Apart from the perennial rivers and wetlands in the north (Zambezi and the Okavango) and the east (the Limpopo), the country suffers from lack of surface water and development relies heavily on groundwater. Water is a scarce resource in Botswana. This undoubtedly requires good planning which should take into consideration both short and long-term effects of water use. The country is already experiencing 'water stress' (UNEP 1999) and it not only suffers from a lack of surface water, but also the major surface resources are located far from the areas of the demand, imposing high costs on the exploitation of existing surface water resources. At the current rates of abstraction, it is estimated that Botswana's water reserves will be exhausted between 2028 and 2035 (Strzepek et al. 1998).Thus, water forms a serious constraint for the nature and size of human activities in Botswana, making it necessary to conserve it. Botswana is currently working to change attitudes towards its scarce water resources in order to ensure sufficient water in the future for a growing population. "Save water, save life, save money" is one of the key slogans used by the utility (Water Utility Corporation 2010). Despite the campaign, some residents act as if the country has an unlimited supply of water for one can see leaking water pumps and pipes, and toilets where the water runs all day and night (Pendley, 2010).

In Kenya, a country of about 40 billion people struggles with a staggering population growth rate of 26% per year (by comparison, US population growth rate of 0.899% and India population growth rate of 1.31%) this high population had pushed the country's natural resources to the blink of destruction. Much of the country suffers from severe arid climate, with only few areas enjoying rain and access of water resources (Wikipedia). Deforestation and soil degradation have made the available surface water typically highly polluted. Areas that are highly affected by water scarcity include the North Eastern part of the country and the Eastern part of the country. This has led to low agricultural production on the areas, livestock and human death due to droughts and famine, gender is highly affected in their way of living, migration of people, among others. With the country have only five water towers which are faced with severe degradation due to anthropogenic activities. Without their protection and conservation the ecosystem services and water security in the country would worsen having a negative effect on the economic development of Kenya and the living conditions of its population (Baur& Woodhouse, 2010).

1.2 Statement of the problem

Water conservation and management is a problem that is faced throughout the world. This is mainly through lack of enough water and depletion of water resources which is a major concern to the communities living in the ASAL areas. Mwingi North district being a semi-arid area the weather is dry and hot almost all through the year. The area experiences the problem of inadequate water supply in terms of quantity, for the community utilization. Water as a resource is scarce in the area, and like any other ASAL area, challenges faced affect the performance of the community. The communities living in Mwingi are less productive in comparison to the other counties, they have very low agricultural production activities and in terms of livestock, which is their main economic activity, production is also low. The district is faced with recurrent drought periods during the dry seasons in the country. During these periods, there is a lot of reported human and animal deaths due to starvation and lack of water, disease, malnutrition and dehydration. It has become a major concern to the government to manage disaster management, but tee are challenges at the grassroots levels to implement.

The government tried to alleviate this problem by digging pans and drilling boreholes, but failed due to salinity of the underground water and poor management of the pans. A number of challenges have affected the efforts to manage the water challenge. These include lack of community participation in management, high poverty levels leading to inability to pay for water, political influence and socio cultural beliefs in household's water provision. This are challenges have faced the community based water supply projects in semi-arid regions of Kenya making it difficult to solve the water conservation problem.

Water scarcity is one of the contributors to lack of conservation and management. It involves, water stress, water shortage and water crisis. Most affected by water scarcity in a country are mainly the local communities in the rural areas than the people living in urban areas. This is mainly because the local people have few or no knowledge on water conservation and management; they rely on the government and the indigenous knowledge to survive. Creating awareness to the local people plays a major role in helping to eradicate this crisis in the world.

1.3 Research Questions

a) What are the existing water conservation initiatives that have taken place in the region?
b) What is the role of stakeholders in water conservation?
c) What problems do constrain the realization of water conservation and management goals in Mwingi North District?

1.4 Research objectives

The main objective of this study is to come up with the challenges facing the community to conserve and manage water resources for sustainable growth in Mwingi North District.

1.5 Specific Objectives

a) To evaluate the existing water conservation initiatives in terms of their strengths and weaknesses.
b) To examine the role of stakeholders in water conservation.
c) To examine problems constraining the realization of water conservation goals.
d) To prepare an action plan for effective water conservation in Mwingi North District.

1.6 Research Premises

a) The existing water conservation initiatives are characterized by several weaknesses and are therefore not effective.
b) Stakeholders have specific roles to play for effective water conservation.
c) There are a number of problems constraining the realization of water conservation goals.

1.7 Justification of the study

Water conservation is one of the main problems facing the societies today. The use of water has been growing at more than twice the rate of population growth. Although there is no global scarcity as such, an increasing number of regions are chronically short of water. Dry lands are the most affected since they do not have the right infrastructure to deal with this issue. Water scarcity and other challenges go hand in hand with poverty most of the times and eradicating this issue will lead to the improvement of poverty levels in the society (UN, 2012).

Mwingi North District, being in the eastern part of the country, hosting the Kamba and Somali community, it is county that needs development and growth because it has a lot to offer in the economic sector. It boarders the Garissa County which makes Mwingi actively involved with domestic market, where the largest domestic animals market takes place and they are also sent to

the capital city for sale. The county has also been recently been discovered to host a coal resource, which is a project that is underway for coal mining. This gives the county potential for growth and thus the need for water as a resource to be conserved and managed to promote sustainable development.

The district has high levels of poverty and the local community does not have the available infrastructure to access to enough water. The area is located on a dry land and thus water scarcity is majorly witnessed by the community. The community lacks enough knowledge due to the literacy levels of the people on good measures to conserve and manage the water as a problem. They create stress to the available water resources such as rivers, due to activities such as sand harvesting. They also over use water in the boreholes and there are no practices of water harvesting which could help during rainy seasons.

Addressing the water scarcity issue can contribute highly to the success of attaining the MDG's. This will contribute adversely to the development and growth of the Mwingi community sustainably. Access to water for domestic and productive uses has direct impact on poverty and food security. Access to water in particular conditions of scarce resources has important gender related implications which affects the social economic capital of women in terms of leadership, earnings and networking opportunities.

1.8 Significance of the study

The purpose of carrying out this study is to come up with the various challenges that contribute towards lack of effective water conservation practices by the local communities. These challenges also lead to the depletion and degradation of water resources. The study helps to manage and mitigate this challenges leading to better conservation water and the available resources.

The study also focuses to help create awareness on water conservation to the local community and make them have various skills that they can use to manage and conserve water in their day to day livelihood. These mostly help development in the home area and give proper planning and guidance towards water conservation.

The study is also meant to bring the various stakeholders together and integrate them with the local people in order to promote cooperation and coordination in water conservation. This also

contributes towards the sharing of new ideas and thoughts in water management which help in the mitigation and control of some problems.

The study also helps in the realization that it is important to manage the environment to promote sustainable development. This is important because it considers the future generation and their needs. Ithelps in the realization of effective actions to take on environmental issues that affect water resources. This study also helps in the formulation of an action plan for sustainable water management and conservation.

1.9 Limitations of the study

During this study, there were a number of limitations to achieving the desired objective, they include;

- Financial constrains due to travelling costs to collect data.
- The illiterate nature of the village residents made it hard to communicate and understand one another freely.
- Language barrier from the villagers.
- Some officials were absent and others uncooperative during data collection.
- The area being neighbors to Garissa County, there were many insecurity alerts in the field work since sometimes the Kamba fought with the Somali communities over grazing land disputes.

1.10 Scope of the study

The study is designed to cover Mwingi North constituency. The constituency lies in Kitui County. Kitui county has a population of 1,012,709 domiciled in an area of approximately 20,402 km² of which 690.3 km² is occupied by the Tsavo National Park (Source: 2009 Population Census). Mwingi North, which is categorized as an Arid and Semi-Arid Land (ASAL) is mostly hot and dry throughout the year. It covers an area of 4,769.60 km². The area is located along the Nairobi/Thika – Garissa Highway. The study was carried in Mwingi town, Tseikuru, Ngomeni and Kyuso.

The study provides the context of the study by examining water conservation challenges in Mwingi North constituency. The study also provides for the evaluation of the existing water conservation initiatives in terms of their strengths and weaknesses that have been introduced in

the area. The role of stakeholder in water conservation is analysed. The problems constraining the realization of the goals in water conservation are also examined.

1.11 Operational definitions

- **Water conservation** – Encompasses the policies, strategies and activities to manage fresh water as a sustainable resource, to protect the water environment, and to meet current and future human demand.
- **Water scarcity -** It is the lack of sufficient available water resources to meet the demands of water usage within a region.
- **Water stress –** This is a situation where obtaining sources of fresh water for use during a period of time and may result in further depletion and deterioration of available water resources.
- **Water shortage –** This is a situation that may be caused by climate change, such as altered weather patterns including droughts or floods, increased pollution and increase in human population demand and over use of water.
- **Water crisis –** A situation where the available potable, unpolluted water within a region is less than that region's demand.

2 CHAPTER 2

2.0 Literature Review

2.1 Water conservation initiatives

Water conservation initiatives are important as they help mitigate water issues that occur in a given area. The initiatives involve activities that help to solve the water challenges that face the region, mostly include the activities at the grassroots level. Some of the initiatives that have been discussed by other scholars include;

2.1.1 Rain water harvesting

Rain water harvesting is one of the common water harvesting tactics used by people. This is done through gutter collection to the water tanks. Despite the fact that rainfall is minimal in the ASAL regions, when the long rains occur, water harvesting should take place.

According to (Baur& woodhouse, 2010) they give an example of Mwala District in Machakos County. They say that despite the fact that rainfall amounts and distribution rarely meet crop water requirements; rain fed agriculture constitutes 70% of rural employment and economic activities. The greatest challenge to sustainable crop production remains how to cope with recurrent droughts and prolonged dry spells. Moreover, the problem of water scarcity in the district is exacerbated by salinity of ground water, distant location and contamination of surface sources. Thus, he sees the need for small scale rainwater harvesting technologies for household water and for supplementary irrigation was identified as suitable interventions to boost food security as well as standards of living

Fredrick (1999) states that water-short societies and many countries have attempted both to move water from where it occurs in nature to where people wanted it and also to store water for future use. Human efforts to change the water cycle date back to ancient times. Primitive societies tried to bring rain through prayer, rain dances, human and animal sacrifices and other rituals. According to (Helweg, 2000) Persians constructed hundreds of Karize’s, tunnels used to bring water from an underground source in the mountainous area down to the foothills. This method of irrigation spread over the Middle East into North Africa over the centuries and is still used today. The ancient Egyptian economy was centered round the annual flood pattern of the Nile. (Mays, 1996) describes how the Egyptians built thousands of canals and irrigation ditches to capture the Nile's waters in order to grow crops.

One of the key water control structures is that of the dam. According to (McCartney, 1999) and (Cosgrove, 2000) there are around 40,000 large dams, higher than 15 meters and more than 800,000 smaller ones worldwide. Most of them were built in the last 50 years with a combined capacity of 6000 km^3. They offer development benefits through hydropower, drinking water supplies, flood control and recreation opportunities. Although dams help ensure a steady water supply especially during dry seasons they often endanger aquatic ecosystems (plant and animal life) by disrupting flood cycles, blocking river channels, altering water flows in rivers, floodplains, deltas and other natural wetlands.

2.1.2 Integrated land and water resource management

In low rainfall and drought-prone areas, over-grazing by cattle beyond carrying capacity and shifting cultivation by increasing encroachment of marginal lands continue to undermine the already fragile ecological balance. Over the past three decades, semi-arid lands have come under pressure of people and livestock at a rate considerably faster than the more fertile areas (Hudson, 1987). Consequently, conditions of hunger and even famine are increasingly becoming evident in these areas as is the occurrence of drought. This has set in motion endemic poverty and degradation of land and water resources. There is therefore need to develop simple on-farm techniques to control soil loss, improve rainwater utilization for crop and livestock production and to enhance soil fertility.

According to (Donkor et al, 1997) there is need to plan for an integrated usage of land and water, it is important to assess the biophysical interaction particularly land degradation caused by land use change such as the effects of farming, deforestation and increase in human population, livestock or wildlife. The writers also suggest that IWRM should include: Integrated planning of water resources which should involve socio-economic, environmental and technical aspects into a decision-making framework. Almost all activities which take place in a catchment area that could adversely affect the conditions of aquatic ecosystems in terms of water quality and quantity, biological communities and the integrity of aquatic ecosystems should be subjected to an environmental impact assessment (EIA). Participatory approach that is; involving users, planners and policy-makers at all levels. It involves raising awareness of the importance of water among policy-makers and the general public. Decisions at all levels should be through full public consultation and involvement of users in the planning and implementation of water projects.

Revising the role of women in water issues through positive policies to equip and empower women to participate at all levels in water resources programmes. Recognition of the economic value of water is stated as important in order to reduce wastefulness and environmentally damaging uses of these resources. Decentralization of water management plays a key role in the process of integrated water management; the lowest possible unit of management should be fostered. This requires the establishment of a permanent framework for the local populations to vent their problems and needs, assume their environmental responsibilities, and acquire the knowledge and skills required to make decisions and launch initiatives. The structure of this framework should correspond to local socio-cultural, ecological and economic conditions. Local participation should be backed by close cooperation at higher institutional levels: between the departments or ministries that administer water, forests, the environment, agriculture etc. (Donkor et al, 1997)

2.1.3 Community-based water management

Community-based water management involves being in collaboration with the area community in water resource management and conservation. These approaches have been widely adopted to meet this dual challenge of market and government failures. However, it is well-known that communities may also fail to provide services effectively due to problems such as elite capture and limited capacity.

According to a report by (community water initiatives, 2013), they look at the opportunities and challenges of community-based rural drinking water supplies. The writers express the need of community based water management. Using Ghana as an example, the writers were aimed to assess the potential benefits and challenges of community-based water management. Ghana is a largely agricultural country with a population of about 20 million people. It is estimated that one-half of the population has access to safe water resources. Ghanaian populations living in rural areas have very limited access to pipe water. The country is faced budget constraints, low revenues, and shortfalls in operation and maintenance, which has resulted in insufficient expansion of the system and failure to satisfy rural water needs. In Ghana, district assemblies have gradually assumed more responsibilities, these has transformed the structure of its rural water supply and transferred responsibilities for water management both to the district assemblies and to community-based organizations that operate outside the local government

structure. Ghana was one of the first countries to introduce a community-based approach to rural water supply on a large scale (Kleemeier, 2000). Its approach is in line with current drinking water policies in many countries, which are based on the paradigm that rural drinking-water supply facilities, such as improved hand-dug wells or hand pump–fitted boreholes, are best managed by local water users. This paradigm also entails the principle of "treating water as an economic good," which assumes that water users are willing to pay for water services if appropriate management approaches are used Communities were encouraged to take responsibility for their own water supply. Nongovernmental organizations and the private sector are usually the providers for the design, construction, and maintenance of water supplies. The district assemblies in rural Ghana play a significant role in planning water facilities and allocating funds for this purpose, the private sector had become active in drilling and other water supply services, and communities had been assigned the full responsibility for maintaining their supply facilities (Sun, Asante, &Birner, September, 2010)

Using survey data from Sri Lanka and India, Isham and Kahkonen, (2002) found that well-designed and well-constructed water services are two significant factors for effective community-based approaches. The authors found that it is important to involve household members in the design process and in the final decision about the type of system to build. Likewise, systems work better if the households' contribution to construction (for example, cash or labor) is monitored. Social capital was found to be associated with the above two factors. In communities with higher levels of social capital (for example, with more active community groups), community members were more likely to engage in design as well as monitoring.

Analyzing the performance of water systemsKatz and Sara, (1997) found that the community-based approach significantly increased sustainability. The authors established a strong linkage between participation of the household members and sustainability of the projects. The most important factors contributing to success can be summarized as information accessible to the households, capacity building at all levels, training in operations and maintenance, control over funds, and good quality construction. The study also observed that the approach did not work consistently well among the communities. In some cases, the projects were supply driven (for example, not offering communities different options). In other cases, community representatives failed to consider the demands of disadvantaged groups.

Writers also suggested some factors that are important for the success of community-based approaches to effective water conservation; the involvement of the communities in design, construction, evaluation, operation, and maintenance of the water projects; household contributions to water projects in the form of cash and labor; social capital and local leadership; and provisions to ensure women's participation (Sun, Asante, &Birner, September, 2010).

2.1.4 Gender involvement in water conservation

Gender refers to the socially constructed roles, responsibilities, rights power, needs and constraints of men and women within a given society FAO, (2010). This involves including all people in terms of sex in water conservation projects. Gender being a sensitive subject in the African communities, it is a sector that needs complete attention in order to sensitize people. It is believed that women and children should be the ones in charge of household affairs. Doing gender sensitization will play a major role in managing water conservation.

Gender plays a major role in the management of resources. According to Cecile, (1992), the writer gives an example of the importance of gender involvement in water conservation. Mali, a country in North Africa is an arid area and thus there are many water projects involved. There are Community-Managed Wells which are drilled by the government. However, one case showed how an initiative can fail if women are not involved in planning. The Macina Wells project failed to incorporate an understanding of gender roles and inequalities in project planning. Management of the wells was handed over to (male) community leaders without consulting women in the planning of the new resource or its continued management. Women were allocated cleaning tasks. The systems and equipment set up were impractical for women, though they were the ones primarily responsible for collecting water from the well. As a result, at peak times, women dismantled the equipment and went back to their old ways of collecting water. Moreover, the men who were involved as caretakers failed to adequately fulfill their roles since water and sanitation were seen as a women's domain.

According to Margreet, (1994), she talks about involving gender issues in all sectors. She states that "women and men should be involved in equal activities thus promoting development." In the water sector, conservation should be gender involved so that everybody in the community should have a responsibility towards conservation and management. Sensitization on relevant water issues should be done and through gender involvement, in community water based projects and

also household responsibilities, degradation of resources and overuse will be mitigated and half the problem on water challenges solved

2.2 Role of stakeholders in water conservation

Stakeholder involvement is very important in any given project. They usually play a major role in a project. According to Quentin &Karen, (2011) they talk about water being an increasingly critical issue at the forefront of global policy change, management and planning. There are growing concerns about water as a renewable resource, its availability for a wide range of users, aquatic ecosystem health, and global issues relating to climate change, water security, water trading and water ethics. They bring together multiple disciplines to understand and help resolve problems of water quality and scarcity from a global perspective.They also talk about stakeholder involvement, where they state that there are varying stakeholders' engagements for any water resource situation. Stakeholders help in a lot of issues; they are always informed and planned over emerging issues that are coming up. They play roles such as; they inform, in some situations, stakeholders provide accurate and timely information which help people understand the issues at hand. Stakeholders also act as consultants. They involve an active way of communication where the public and other agencies can be engaged in understanding the background information of the problem. They influence the decision making process through their inputs. Stakeholders also give a collaboration platform, where they make sure that all sectors are fully represented, determining the issues and questions addressed. They generally act as problem solvers with a genuine sense of empowerment (Quentin and Karen (2011).

2.3 Problems constraining the realization of water conservation goals

2.3.1 Poverty levels

Poverty is a major issue affecting different communities in the world today. It highly affects development in a country and the normal functioning of a community. Poverty is about more than a shortfalling income or calorie intake. It is about the denial of opportunities and choices that are widely regarded as essential to lead a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-esteem and the respect of others (UNEP, 2000). According to the UNEP (2000), problems of poverty are inextricably linked with those of water. Introducing methods like rainwater harvesting improves water availability, its proximity, its quantity and its quality. Improving the access of poor people to water has the potential to make a

major contribution towards poverty eradication. The collection of rainwater for supplementary irrigation has proved extremely valuable to deal with rainfall variability particularly at household and community level. This has led to improved agricultural production, enhanced food security and poverty reduction.

2.3.2 Illiteracy levels

Illiteracy levels are common among the communities in the ASALs. In many of the semi-arid and arid areas of the Kenya, pastoralists have very little formal education. The low literacy levels, particularly among women and girls, adversely affect development; they exacerbate the limited access to and analysis of information, and reduce opportunities for influencing political decision-making processes at local and national level.

The North Eastern Province suffers from chronic water shortages, and relies heavily on water trucking. Persistent droughts have led to rampant food insecurity. According to Dida and Mohammed (2000) the situation is worst in the Western Mandera District, where there is not a single permanent water source.This adds to the risk of dehydration, which threatens the inhabitants' lives.Water shortages generate poor hygienic conditions and water borne diseases. They state that, Thirty percent of all hospital admissions and fifty percent of childhood morbidity in the area is related to water, sanitation and hygiene.The writers say that illiteracy is one of the major problems facing the community that is to be blamed for the water challenges. They rate illiteracy levels at 92% North Eastern Province. Many women in particular have never had an opportunity to go to school. There is need for addressing this severe problem by establishing a literacy center, offering literacy training and other adult education specifically designed to meet the needs of women.They also state that literacy is a key asset in improving the living conditions of women in this area. Knowledge of reading for these women is essential in earning a living, and in supporting themselves and their children. In addition, literacy reduces child mortality and improves family health. Women who are able to read are also empowered to oppose oppression, domestic violence and Female Genital Mutilation (Dida and Mohammed, 2000).

2.3.3 Lack of creating awareness in water conservation

Creating awareness is one of the most important steps to take from the grassroots level. It involves giving civic education on the problem. The community is given small skills and know how on what to do within given problem or challenge and also ways of preventing or mitigating

negative outcomes. Creating awareness on Climate adaptability and environmentally sustainable approach is important according to a publication by the "Community Water Initiatives" who have adopted a distinctive perspective that considers environmental sustainability of the water supply activities. For example, CWI promotes the use of solar energy for water pumping, and integrates water supply activities with conservation of water sources, reforestation, and water resource management. In Mauritania, a strategy to promote carbon-neutral water services has been implemented, combining an environmental approach with development practices (Community Water Initiatives, 2013).

Newman et al, (2002) reviewed rural water projects in two regions in Bolivia and found that community-level training (for example, on cleaning water tanks, repairing water tubes, and managing user fees) was critical for improving water quality. He advocates toward creating awareness to the communities as a way to help in initiating water conservation projects.

In a study of Zimbabwe, Cleaver (1999) found that the empowerment and long-term effectiveness of participation approaches was rather complex. He identified limitations of communities in mobilizing the necessary resources, either through collecting funds from community members or lobbying government officials. These problems prevailed even where communities were well motivated and organized. Mobilization and community sensitization through awareness is important as it helps in the realization of initiatives used in water conservation.

2.3.4 Population increase.

Increase in population is a major problem in facing the water sector. Population increases in a high rate that leads to the over use of the water resource .According to Gleick (2000) he indicates that there are five major drivers demanding a huge expansion of water resources in the 20th century: population growth, industrial development, expansion of irrigated agriculture, massive urbanization and rising standards of living. He gives an example of the water scarcity issues in the Middle East and predicts that population increase alone will push all of the Middle East into water scarcity over the next two decades.

Population increase mostly occurs in big cities due to rural-urban migration. Some of the world's biggest cities, including Beijing, Buenos Aires, Dhaka, Lima and Mexico City, depend heavily

on groundwater for their water supply. The heavy population in this cities lead to overuse of water which is not sustainable, because it takes many years to fill aquifers. A research by UNEP gave that groundwater from aquifers under or close to Mexico City, for example, provides it with more than 3.2 million m3 per day, but already water shortage occurs in many parts of the capital. A related effect is that Mexico City has sunk more than 10 m over the past 70 years. Bangkok, similarly depleting its aquifer for drinking and sanitation, is also slowly sinking. Most of the world's megacities are located on coast lines, where aquifer depletion leads to saltwater intrusion and the contamination of freshwater, (UNEP, 2000 and Cosgrove, 2000).

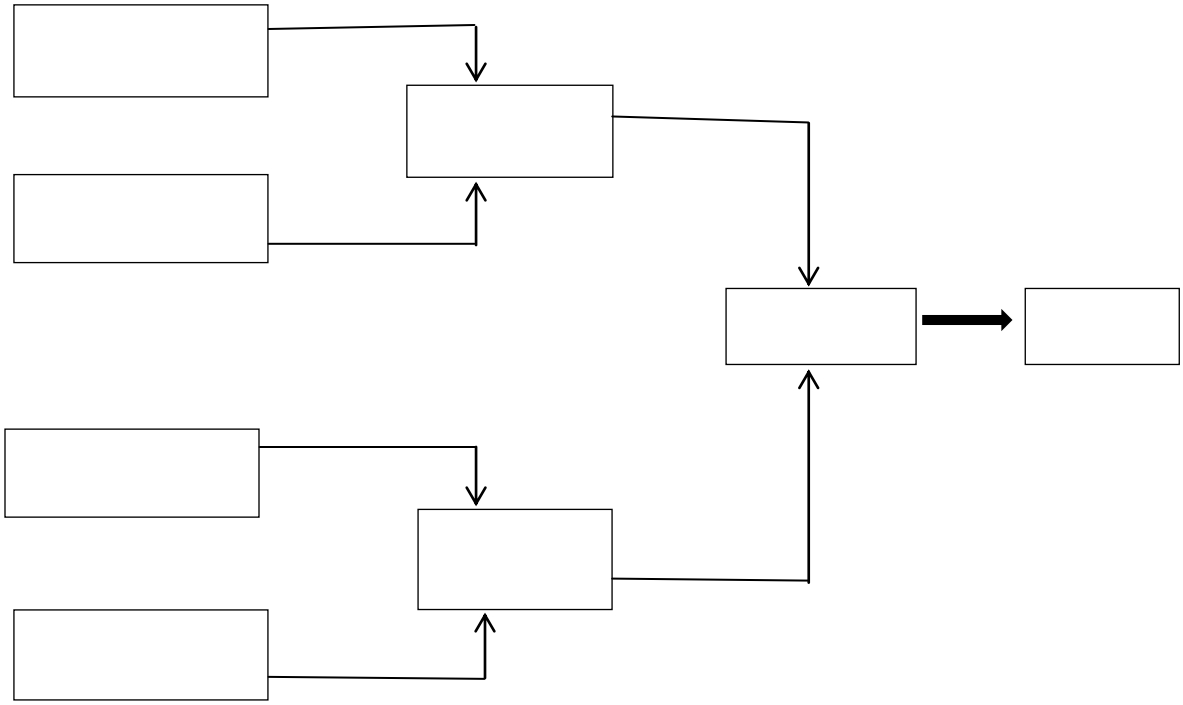
2.4 Theoretical framework

Theories are formulated to explain, predict and understand certain phenomena and also to challenge and extend existing knowledge within the limits of the critical bounding assumptions. A theoretical framework is a structure that can be used to support the research study. It introduces and describes a theory which explains why the research problem under the study exists.

A theory that can be used to explain this study include; the Theory of Reasoned Action which is based on the assumption that human behavior is a result of rational thinking. Its roots come from a number of conceptual developments in the field of social psychology seeking, among other things, to explain how and why attitude impacts behavior. The theory identifies two conceptually independent determinants of intention. The first one is a personal factor called attitude and refers to the degree to which a person has a positive or negative evaluation of the specific behavior in question. The second predictor of intention is a social factor, subjective norms; it refers to a person's perception of the social pressure exerted upon her/his to perform or not perform the behavior being contemplated. Intention is the cognitive representation of a person's readiness to perform a given behavior and is considered to be the immediate antecedent of behavior. Behavior is the translation of intention to action. The main contribution of the Theory of Reasoned Action is the proposition that attitude does not determine behavior directly; instead attitude is seen as one of two antecedent factors, attitudes and subjective norms, that determine intention, which in turn determines behavior (Ajzen and Madden 1986).

This theory translates to water conservation through the act of changing the attitude and norms of a community and this will convince their intension towards water and resource conservation, thus influencing their behavioral approach to water use and consumption promoting conservation and management.

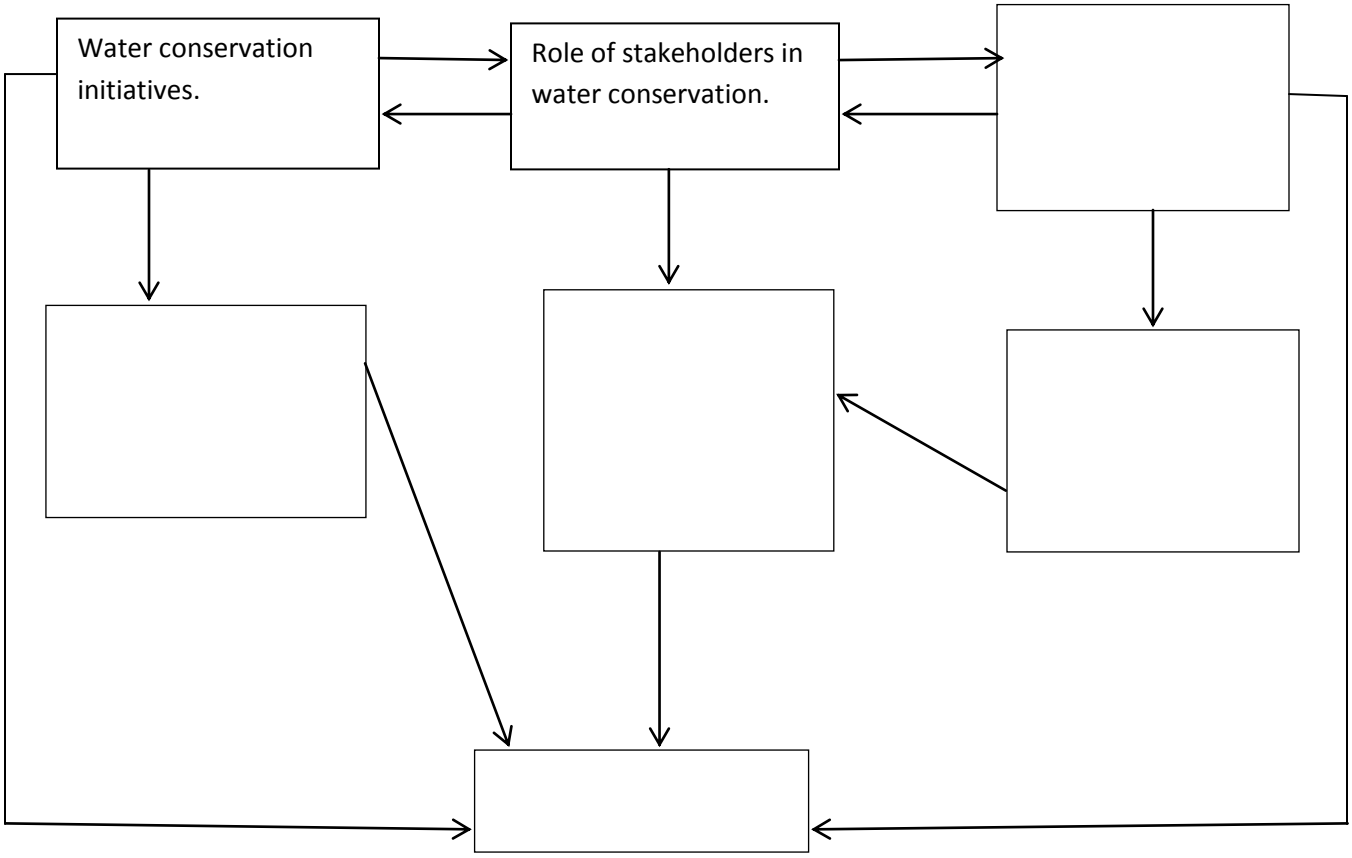
Figure 2: Theoretical model



Source: Ajzen and Madden 1986

2.5 Conceptual framework

Figure 1: Conceptual model



Source: Researcher 2014

This conceptual framework helps in the realization that all actors are important in water conservation. The water conservation initiatives rely on stakeholders in order to be successful and initiated through new ideas from the stakeholders. The stakeholders need to be present for the water initiatives to be successful. Problems of water conservation can be triggered by the stakeholders and they also need to be solved through stakeholder involvement. The community play a major role since they are directly involved with the stakeholders. The community is introduced to the water initiatives and they cause a barrier to the realization of water conservation goals through their problems that they face. An action plan is important for the whole sector as it provides the guidance and way forward for water conservation to be successful.

3 CHAPTER 3

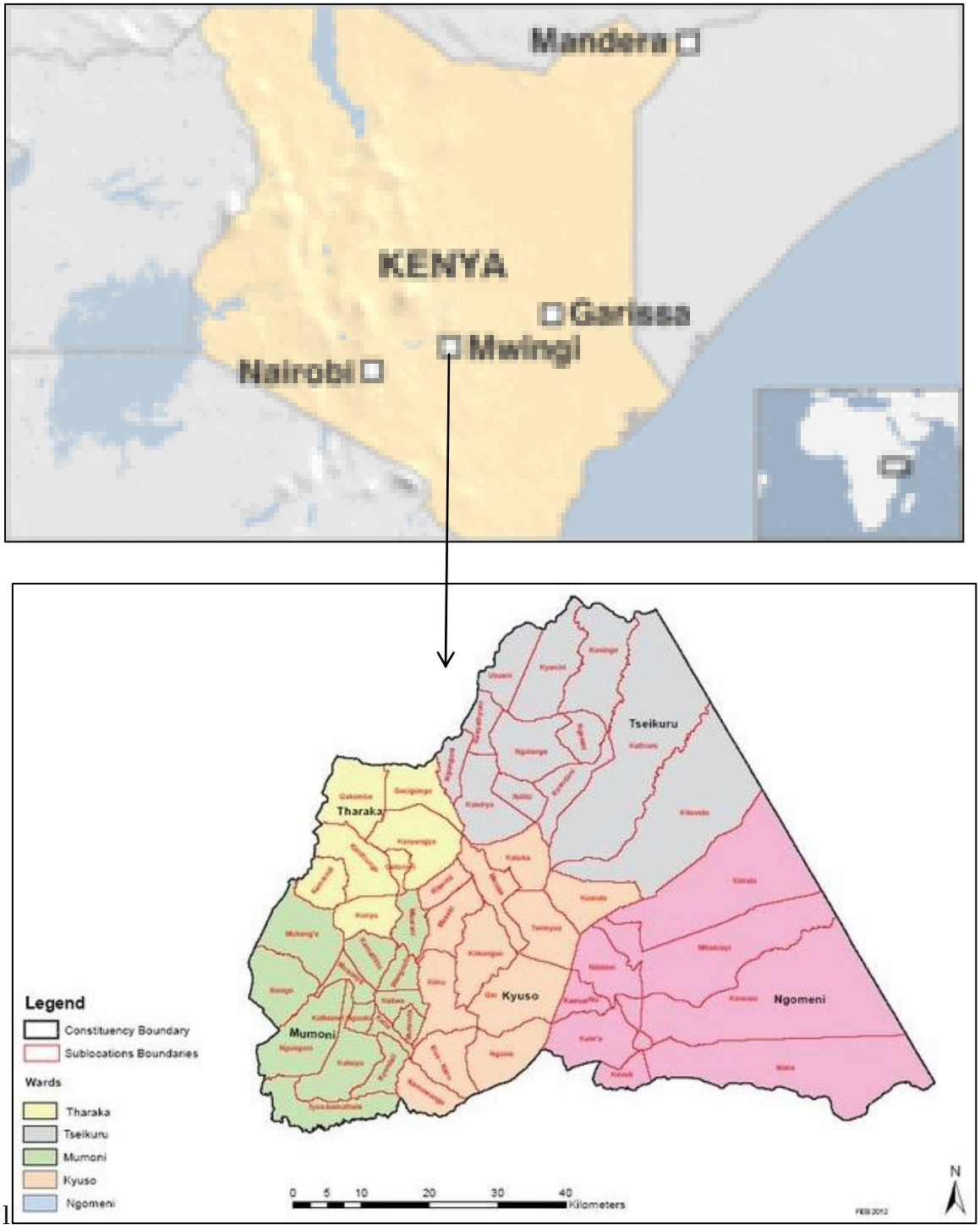
3.0 Area of Study

3.1 Physical set up

3.1.1 Location and extent

Mwingi District is one of thirteen districts in Eastern Province. It borders Kitui District to the south, Machakos District to the west, Mbeere and Meru South District to the North and Tana River District to the East. The district lies between latitude 0º 03´ and 1º 12´ South and Longitudes 37º 47´ and 38º 57´ east of GMT. The constituency covers an area of 4,769.60km². Mwingi North has 5 Wards including Ngomeni, Kyuso, Mumoni, Tseikuru and Tharaka. There are also two Local Authorities, i.e. Mwingi County Council with 28 wards and Mwingi Town Council with 6 wards (figure 3).

Figure 3: The location of the study area.



Source: Google maps & The Mwingi District Development Plan 2002-2008

3.1.2 Topography and drainage

Mwingi district is generally plain with a few isolated rock outcrops in Mumoni, Nuu and Migwani divisions. The highest point of the district is Mumoni Hills, with an altitude of 1,747m above sea level. The landscape is generally flat, with a plain that gently rolls down towards the east and northeast where altitude are as low as 400m.

Topography of the district affects communication within the district and other districts. This is especially the case for the southern and northern parts of the district where Nuu, Mui and Mumoni are not easily accessible because of the hills.

The highlands namely Migwani, Mumoni, Central and Mui receive more rainfall compared to the lowlands Nguni, Kyuso and Tseikuru. The drier areas experience severe droughts, which have led to livestock deaths and food shortages whenever there is a drought.

3.1.3 Geology and Soils

The district has red sandy soils, loamy sand soils and patches of black cotton soils. River valleys have saline alluvial soils of moderate to sometimes high fertility. Otherwise, soils are of low fertility and prone to erosion. Most hills are covered by shallow and stony soils unsuitable for crop farming.

3.1.4 Climate

Climate of the district is hot and dry for the greater part of the year. It is an arid and semi-arid area with very erratic and unreliable rainfall. Most of the areas are generally hot and dry leading to high rate of evaporation. The maximum mean annual temperature ranges between 24º C and 26º C. The minimum mean annual temperatures in the district vary between 14º C and 22º C. Average annual temperature is 24º C. The district has two rainy seasons, i.e. March, May (long rains) and October- December (short rains). The erratic rainfall ranges between 400mm and 800mm per year. The short rains are more reliable than the long rains in the district making the district peculiar to the rest of the country.

3.2 Ecological set up

3.2.1 Vegetation Cover

The district has a rich diversity of plants and animal species most of the tree and shrub species are concentrated on hilltops especially Muumoni and Nuu hills. Along the river beds some of the indigenous species such *as Ficusspp,* and *Meliavolkensi*are being wiped-out in search for timber. Those that fall on private lands are threatened due to harvesting for timber and charcoal production. Hill top cultivation is also a threat to conservation of biological biodiversity. According to the Mwingi Environmental Action Plan, over half of Mwingi is occupied by pastures & woodlands that are not distinguishable from each other. About one third is dedicated to agriculture. This is only an approximation of the reality, as shifting cultivation is a dynamic process. Woodlands & pastures are mostly areas that are changing from trust land status towards freehold, and will be subject to agriculture in the future. Forests & Hills are gazette areas, or set aside for forestry (some hills are plain rock outcrops).

3.2.2 Wildlife

Mwingi North constituency has the Mwingi National Reserve which is one of four protected and contiguous areas, it boarders the Meru Conservational Area (MCA). The other three are Meru National Park, Bisanadi National Reserve and Kora National Park. Mwingi borders all three and is the least accessible. Mwingi has been designated a Wilderness Activity Zone by Kenya Wildlife Service (KWS) which allows for fly camping, camel and horseback safaris as opportunities for traditional game viewing are extremely limited.

The wildlife sector in Mwingi is faced with different challenges, one of them being lack of enough water in the area. Accessibility is also a challenge but efforts are underway to improve the area's road access. The reserve is administered by Mwingi County Council. Wildlife populations are low, but there are hippo, crocodile, buffalo, caracal, elephant, leopard, lion, warthog and several antelope species among others. Areas of the reserve have been encroached by settlements and permanent agriculture.

3.2.3 Agro-ecological zones

The vegetation usually consists of more than 10 meter tall trees with interlocking canopy cover of between 80% and 100%. The high forests occur on top of Mumoni hill which is above 1700 Masl. There exist plantations of exotic and indigenous species with few naturally occurring trees and shrubs. The plantations of exotic species are mainly Cupressuslusitanica, pinuspatula and eucalyptus tereticornis among others. Cypress and pine do not do well because of drought and currently many are dying. Mumoni forest is dominated by scattered trees and shrubs on the lower slopes. The main species are Acacia tortilis, A. mellifera, Balanitesaegyptica, Terminalia brownie, and a few Meliavolkensii. On the upper elevations, small patches of rainforest are found, dominated by Cordiaabysinica, Croton megalocarpus, Albiziagummifera and Markhamialutea. Perennial grasses grow on the slopes. Nuu hill has a steep terrain and is covered by shallow soils. The main tree species are Acacia spp., Balanitesaegyptica, Terminalia brownie and baobab. On upper slopes and along the water catchment courses, broad leaf species are found like Ficus, Croton megalocarpus and Sterculia Africana.

3.3 Economic set up

3.3.1 Industries, trade and commerce.

The industrial sector in the district poorly developed with only one food-processing factory that is Kitui millers which produce and process maize flour and Mwingi honey industries which processes honey from the community. The types of trade within the district are mainly wholesale l2and retail Supermarkets, open air markets and hardware stores. Livestock trade, agricultural produce, timber production and charcoal production are some of the area's growing respectively. There are few entrepreneurs who have invested in the service industry (Garages, chemists, printing computer bureaus, saloons, boutiques, bookshops, tailoring and businesses). However, there is still an opportunity in the service industry for a district that is growing fast even to invest in enterprises that can offer various consultancy services. Water challenges are obviously a barrier to the growth of this sector.

3.3.2 Tourism in the area

The constituency has a number of tourist attraction sites but the problem is that they have not been developed at all, mainly due the lack of enough water resources to maintain the sites and the habitats, poor road network, and inadequate finances. If these attractions are developed for eco-tourism, the constituency can earn a lot of foreign exchange.

Some of tourist attraction areas include;

- Areas bordering Meru National Park, Kola National Reserve.
- Mwingi National Reserve
- Mumoni hills scenery.
- Ngomeni rock catchments
- Nuu springs

3.3.3 Agricultural practice

Over 90% of the district population is engaged in activities in the agriculture and livestock production sub-sectors, making the sector the largest employer and by extension the largest contributor to household incomes. In Migwani, Central and Mui divisions, crop farming is more prominent than livestock keeping because of higher amounts of rainfall received. The County has no known cash crops and the vast majority of its economy is exclusively depended rain-fed subsistence farming. The climatic conditions of the area are characterized by sporadic rainfall, cyclical droughts and widespread poverty, a situation which has further been embellished by poor land use practices including clearing of indigenous forests to give way to subsistence farming and human settlement. However, owing to the harsh climatic conditions found in most parts of the County, farming as a way of life has thus proven to be extremely challenging and completely unsustainable.

As a result of population pressure, felling of trees for construction and energy (firewood and charcoal), irresponsible sand harvesting and cultivation along river beds, cultivation down slope, overstocking and overgrazing, there has been massive land degradation characterized by extensive soil erosion, low soil fertility; drying up of hitherto permanent water sources (especially rivers), low land productivity (both crops and livestock perennial famine) and the associated increment in human and animal diseases, leading to extreme poverty and the shared hopelessness. All these are characteristics of climate change which is now a reality in the county

3.3.4 Transport and communication

Transport and communication in Mwingi is very underdeveloped. There is poor road network and communication is also very at times. The roads are mostly ruined by the frequent flooding that occurs during seasons. Poor road infrastructure is a factor that constrained district development efforts during the Plan period. The poor roads condition and network did made transport and communication in the district difficult especially during rainy seasons. Further, the implementation capacity of development stakeholders was reduced considerably especially as a result of high rate of wear and tear of vehicles. Inadequate transport facilities also impacted negatively on district development. During the last five years, there has been a significant improvement in roads infrastructure in the district. This has been with regard to construction of drifts, installation of culverts and other routine maintenance works on existing roads. Little though was achieved with regard to improving the road network in the district since virtually no new roads were opened up.

3.4 Social set up

The Larger Mwingi district is a homogeneous district inhabited mainly by Kambas. There is also a bit of migration and settlements from the Somali community from the neighboring Garissa County, where they have set up businesses and also intermarriages and cultural and religious exchange has taken place. The district has a current population of 384,948 based on 2009 population. It has an average population density of 38 persons per km^2.

3.4.1 Population

Mwingi North has a total population of 139,967 and comprises of 5 wards. This include Ngomeni, with a population of 18,447, Kyuso with a total population of 40,375, Mumoni with a population of 32,171, Tseikuru with a population of 35,890 and Tharaka with a population of 20,890 people.

4 CHAPTER 4

4.0 Research Design and Methodology

4.1 Research design

The study has adopted an explanatory research design. This is because it has to gain information about the involvement of the state actors and the non-state actors in water conservation. The report requires the collection of quantifiable information from the sample. The information obtained must be able to describe the research problem by asking individuals about their opinion and attitude in the involvement of the government and relevant actors in water conservation.

4.2 Nature and sources of data

Here, both primary and secondary data sources have to be applied in order to achieve the set objectives. Primary data is made up of the first-hand information concerning the issue of water conservation. It includes local views, opinions and perceptions related to water conservation and the challenges faced. The primary data will be obtained through households' visits, field observations and face to face interviews from officials in charge of the water sector and its resources. This information will be gathered through the administration of questionnaires, observation, oral interviews and photographs to get more information on the area of study and project.

Secondary data is consisted of published and unpublished information about the measures taken by the government officials and others actors towards mitigating the challenges facing water conservation. Secondary data was obtained from previous studies that were carried out on challenges facing water conservation at the global level, regional level and the local level. Relevant publications like Millennium Development Goals, Water Act were other data sources used to relate to the study. Published reports like journals, books and reports also helped to provide information.

4.3 Sampling procedures

The sample size was not as large, with the sample units being households and institutions. A total of 30 households were sampled from medium and low income residential being well represented. The ministry of environment and water resources, water department and the ministry of agricultural production, livestock and fisheries, livestock department offices being the most

focused institutions had a lot to offer in terms of response. Sampling techniques were used in this study to ensure a truthful representative sample and adequate coverage of the area of study.

Simple random sampling method was used to select households to visit. The households were chosen at random from the neighborhood, given that the area residents live very far from each other in the rural areas. In the urban areas, the sampling was randomly chosen from the middle class to the low class. There were no high class residents in the area of study. Neighbors were also chosen randomly.

Purposive sampling was used to select the government institutions and other actors in the water sector. This was used to get their views, opinions and suggestions, current situations and what they have currently done to control the challenge of water conservation in Mwingi North Constituency.

4.4 Data collection instruments

This discusses the methods used to collect data. They included questionnaires, oral interviews, photography, field observation and review of literature.

4.4.1 Questionnaire

Questionnaires were administered to the selected respondents and they helped by filling them respectively. They were administered through face to face response, where the respondents were asked questions and the researcher recorded the response in the questionnaire. This gave more information as any other direct questions were asked.

4.4.2 Field observations

Observation that involved walking around the area were made and recorded. This helped to gain information that is not readily available in the literatures and internet. It provides first-hand information about the area to the researcher and gives a clear view on the current situation and relevant predictions about the area. This helped to identify the existing gaps.

4.4.3 Face to face interviews

These are one on one sessions with the researcher and respondent. They provide an open platform for the household and neighborhood to give their views on the issue at hand. Current situation is expressed; more ideas and issues are raised from the information from the grassroots level.

4.4.4 Photography

Pictures were taken to capture and evidently show the situation of the area. Water points and dry seasonal rivers were shown to bring the actual picture of the area of study and the challenge of water that they face.

4.5 Data analysis and presentation

Data collected was analyzed and presented using descriptive statistics. The data collected was analyzed and presented by use of statistics and other quantitative methods such as percentages. Use of graphs and pie charts was also used.

5 CHAPTER 5

5.0 Data Analysis and Discussion

5.1 Water conservation initiatives.

5.1.1 Water harvesting

Water harvesting initiatives have been introduced in the area, mainly by the ministry of water and the ministry of livestock production. The most common water initiative for conservation is water harvesting through rock catchment method. This is a major project in the Ngomeni Division, where there is the Ngomeni Rock Catchment project. Water is collected from the big rocks and the run off is directed to a catchment area where the community can access (plate 1). Due to major pollution from the villagers, water was later pumped using a generator (plate 2) and syphoned to a tap where the villagers can access without wastage of too much water and to prevent animal and human pollution of the catchment (plates 3 and 4).

Plate 1: Ngomeni Rock Catchment project

Source: Field survey 2014

Plate 2: Generator to pump water to the tap.

Source: Field Survey 2014

Plate 3: Women fetching water from a tap.

Source: Field Survey 2014

Plate 4: Animals drinking from a trench with a tap.

Source: Field survey 2014

Water harvesting is also done through sand water harvesting. This involves directing water run off to a sand water small dam, where water can be dug out of the sand during dry seasons. This is important to the community as they can access water for livestock and also for their individual use during dry seasons (plate 5). This method has its own disadvantages since contributes towards environmental degradation.

Plate 5: Woman fetching water from sand water harvesting.

Source: Field survey 2014

Water conservation initiatives have also been introduces through the digging of shallow wells. These wells are important to the community as they provide water for the community. Digging of these shallow wells ids done by the government, where the community is given the responsibility to take care of the wells. The government provides the necessary facilities to conserve the wells (plate 6).

Plate 6: A shallow well.

Source: Field survey 2014

5.2 Role of stakeholders in water conservation

5.2.1 Creating awareness

Creation of awareness in the region is done mostly by the government ministries. The ministry, department of livestock is mostly involved in this process. Ministry, department of water also plays a major role in the creation of awareness. This is mostly done through environmental education of water groups formed under supervision of the ministries and also educating the community as a whole. Water committees are formed in the area so that they can be responsible of the water conservation initiatives that are introduces through projects. Meetings are held monthly as stated in the questionnaire in order to motivate the water users towards conservation (plates 7 and 8).

Plate 7: Community being educated on water conservation by an officer.

Source: Field survey 2014

Plate 8: A community water committee monthly meeting.

Source: Field survey 2014

5.2.3 Introduction better farming education

The stakeholders also introduce education to the community on the involvement of small scale farming of vegetables to help boost the food supplies of the community. Farmers are given the civic education and knowhow of how to manage farming in water scarce areas. They are provided with the necessary facilities and resources by the government to manage the small scale farming (plate 9).

Plate 9: Small scale farming of vegetables.

Source: Field survey 2014

5.3 Problems constraining the realization of water conservation goals.

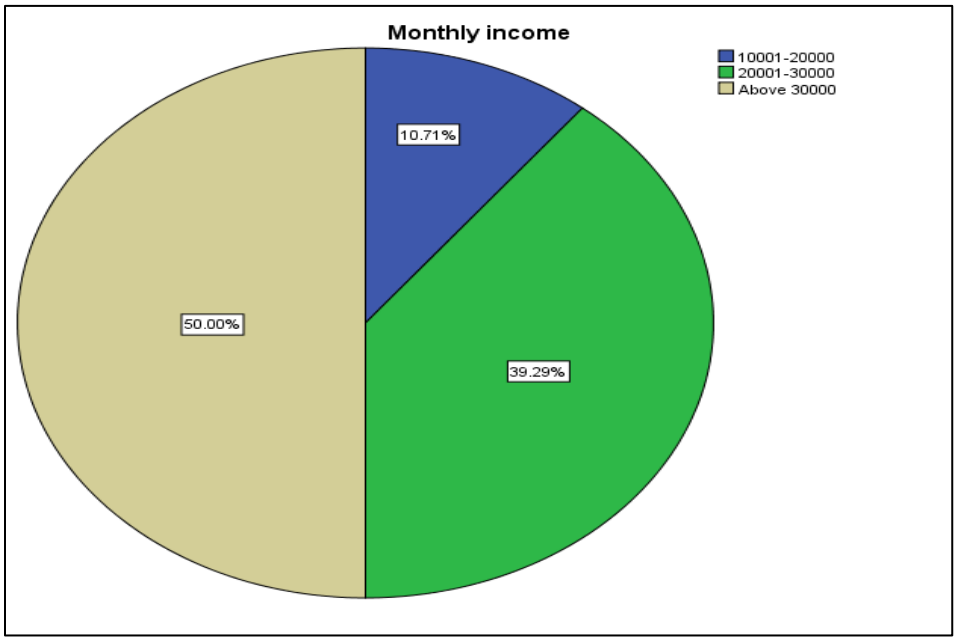
Water being a problem in the region due to the position of the county in Kenya, climate change and environmental degradation, there were other problems that faced the realization of water conservation in the region.

5.3.1 Poverty Levels

Poverty is one of the major issues affecting the region. Most people in the village are of low class levels. There is no major development in the area, thus the county is underdeveloped. This was evident as the people in the area live in mud houses (plate 8). According to the information gathered from the questionnaire, the level of income from the people is also low. This made evident that poverty exists in the area (figure 4) as there were people of percentage 10.17% who earned less as ranges of 10,000-20,000 shillings, 39.29% of others earned 20,000-30,000

shillings and 50% others earned above 30,000 shillings. The 50% were mostly the people living in the urban areas, who were mostly employed by the government and other institutions. The rest were gathered in the rural areas, where they lived far from the town center and mostly survived on livestock keeping. Water conservation is challenge to them as they have no necessary facilities to conserve water such as tanks for storage, water harvesting materials among others. The chart below represents the level of income in the region according to the 30 households that were visited as respondents to the questionnaire.

Figure 4: Monthly income



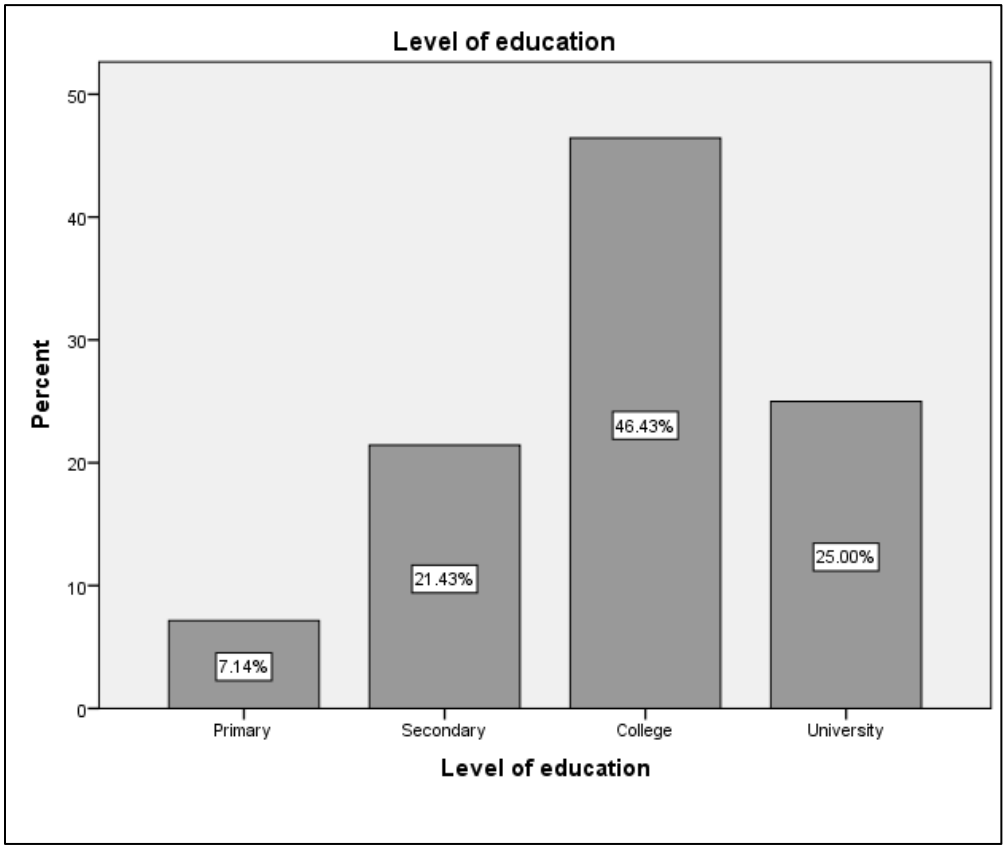
Source: Field data 2014

5.3.2 Level of education

Education being a key necessity in the society is more provided in the urban sector than the rural areas. In the rural areas, schools are very far away from the people and they are in very poor conditions. The graph below (figure 5) shows the level of education in the region. 7.14% represents the people who have schooled up to primary school only. 21.43% have studies until secondary school. Most of the percentage, 46.43% have studied in colleges, this involved training institutes and tertiary institution. The rest of the percentage which is 25% have studied in universities, most of this percentage included those who worked in in the employment by the government. This being evident that the level of education in the area is poor; it brought up a

challenge in water conservation as people do not have the knowledge on water conservation. There is a lot of illiteracy by the people in the community which makes it difficult to implement the some water conservation initiatives.

Figure 5 Level of education in the area



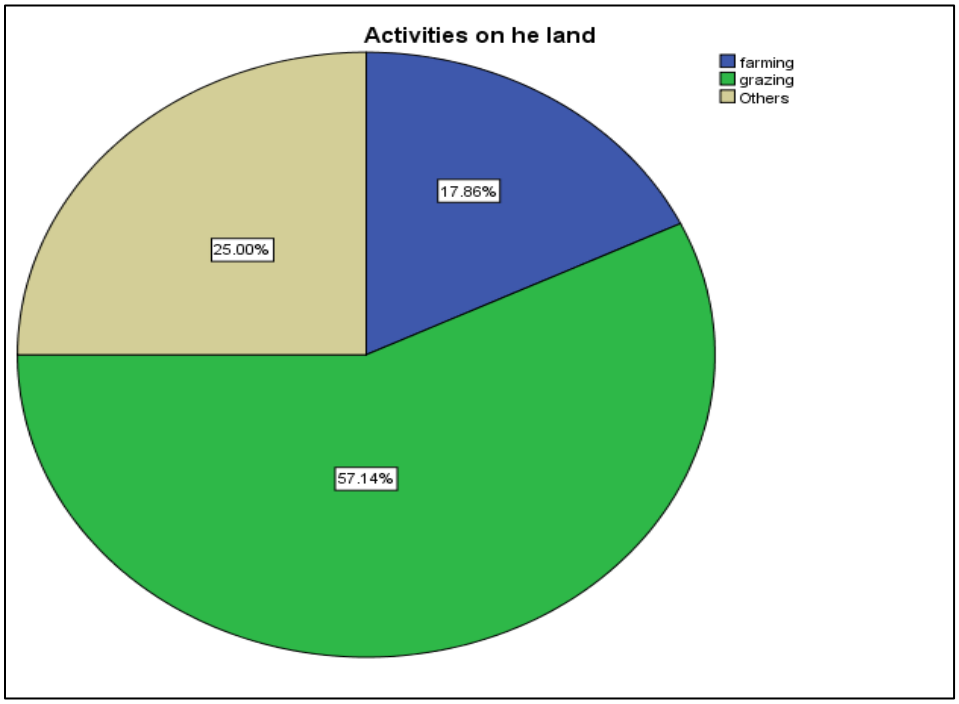
Source: Field data 2014

5.3.3 Community livelihood

The way of livelihood in the community always affects the water conservation. Most of them are concentrated with livestock keeping. Respondents who owned land used the used land more for grazing activities that were represented in the chart below (figure 6). 57.14% used land for grazing activities; they owned large livestock which included cattle, goats, donkeys and camel. The land grows grass and shrubs which they left for grazing activities. A few percentages of 17.86% practices farming on irrigation inform of drips and buckets. This was small scale farming for crops such as green grams and peas. Kitchen gardens also were made in urban areas which grew kales. The other 25% who owned land practiced activities such as agroforestry for charcoal

burning purposes. The community way of livelihood acted as a hindrance to effective water conservation as they do not pay attention to water demanding activities. Much of the water present is directed to livestock management and household needs which do not give the morale for water conservation. During drought seasons, the communities rely greatly on the government for survival and many deaths occur due to this reason as they have only one way of livelihood.

Figure 6: Community livelihood



Source: Field data 2014

CHAPTER 6

5.4 Summary of the Findings, Conclusion and Recommendations

5.5 Summary of the findings

The study helped to come up with the problems facing the realization of water conservation. These problems were mostly stated by the people and the ministries interviewed. Some of the problems included; high level of illiteracy from the community, high levels of poverty from the community, ignorance among members of the community, scarcity of water as a resource in the region, corruption among government officials.

The study showed that there is stakeholder involvement in water conservation though it is not recognized by the local people. A few of them knew of some NGO's that were involved in community water projects but most of them did not any of them by name. The stakeholder involvement showed efforts to provide water projects and also offer community awareness to the community.

The study also showed the existence of water initiatives that were present and most of them were introduced by the government ministries. The Ministry of Agriculture, Fisheries and Livestock production played a major role in the realization of these initiatives. They provided the community with facilities such as pumps, drills and taps that were used in the construction of shallow wells and boreholes. They also provided community education to the community and also helped them in forming water community groups that were kept in charge of the facilities of the boreholes and wells. This provided motivation and responsibility to the community to promote water conservation.

5.6 Conclusion

The conclusion of this study, which was aimed at recognizing the challenges facing effective water conservation in the region, shows that water as a resource is a major problem for the people of Mwingi County. It is not readily available because of the climatic conditions of the area. The area of study being an ASAL area, it needs a lot of effort and resources to implement some measures to control this issue.

Water being a major necessity for the livelihood and survival of the human population. There is; need to manage and control it, through this, there are several issues that hinder the realization of

water conservation. These challenges are almost similar all over the world especially in the ASAL areas. The challenges of water conservation are mostly faced by the communities in the rural areas than in the urban centers. This is because development in the rural areas has not been fully implemented and it has its own challenges, hence the rural people suffer more. These challenges lead to constrains to the governments and other interested stakeholders to provide good quantity and quality of water.

Water conservation should be a major concern in the world in order to promote sustainable development in all regions.There is no single and simple solution to water problems. Applying the lessons learned from successful methods elsewhere and allowing some modification to these methods can greatly improve the effectiveness of water projects.The challenges facing water conservation should be mitigated and controlled by the community as a whole. This brings communities to come together to help protect and manage the water and its resources.

5.7 Recommendations

The following recommendations will help to achieve the desired objectives in order to mitigate and control the challenges facing water conservation in Mwingi district.

5.7.1 Short-term recommendations

- Awareness campaigns by policy makers can also help in water conservation. These campaigns should aim for behavioral changes based on new attitudes and social norms towards water use.
- Increase voluntary water conservation through educational efforts, which may include a campaign to encourage installation of water conservation devices and more responsible use of water for livestock, washing, and other activities.
- Use of several policy tools can help influence water use and conservation. These tools such as regulation, pricing and awareness campaigns should be implemented to help manage water consumption.
- Other methods include replacing shower heads and faucet aerators with water efficient models to conserve water in the urban areas. The use of a water-filled jug or plastic bottle in toilet tanks to displace water which will allow the toilet to operate using less water.

- Capacity building for community-level governance through community water management committees, women empowerment, and the establishment of water user fee schemes.

5.7.2 Long-term recommendations

- Strong political lobbying by stake holders with the need to maintain independent domestic livestock production will lead policymakers to direct conservational efforts in the urban-rural residential sector.
- Enhance gender mainstreaming and advocacy efforts for the achievement of sustainable and effective water conservation for improved livelihoods.
- Climate change adaptation activities, like planting trees in high lands and introduction of water pans.
- The local communities should be involved in programmeinitiations that involve water conservation, planning, implementation, monitoring and evaluation.
- Use of participatory approaches should be included in capacity building through; trainings, workshops, seminars and exchange visits.
- Forage and fodder conservation-annual grasses and acacia pods
- Sustainable charcoal production
- Integrated soil and water conservation technologies
- Using drought escaping crops and using the available water resources for sustainable crop production for example sack technology.
- Introduction and maintenance of community-based water supply and sanitation services using low-cost systems manageable by communities.

5.8 Areas of further studies

During the research study, certain field got an interest for further studies. This included;

- Effects of gender mainstreaming and advocacy in climate change.
- Challenges facing livestock production in Arid and Semi-Arid Areas as a result of environmental degradation.

An Action Plan for effective water conservation in Mwingi North District.

Issue/ Challenge	Recommendations	Actors	How to Achieve	Timeframe	Benefits
Poverty	Introduction of self-help groups. Provision of relief help by relevant stakeholders.	Community based organizations NGO's Government	Introduce projects that will help the groups earn income. Create public awareness on how to manage and control water consumption.	Continuous process	Reduce the level of poverty in the area. Better water management techniques.
Illiteracy levels	Improve the level of education in school by employing qualified teachers Build the capacity of the community members on the importance of quality education. Improve the quality and infrastructure of the schools to	Government NGO's Community	Lobbying the government. Attracting sponsors and donors to school projects.	Continuous process	Better performance in schools by the pupils and students. Improved level of education Growth of better ideas and awareness on water conservation.

	motivate students				
Pollution	Educate community on water pollution control	Community, the Government	Offer environmental education to the community. Policies and regulations against water pollution.	Continuous process	Good quality water for domestic use. Control of water borne diseases.
Gender inequality	Form gender sensitization groups. Involve both men and women in leadership and other responsibilities in the community.	Community	Advocate and mainstream for gender equality.	2 – 3 years	Better management of water resources as a result of shared responsibilities.
Environmental degradation	Create awareness to the community on activities contributing to environmental	Government Community	Strict set policies and laws on environmental degrading activities e.g. sand harvesting.	Continuous process	Protected water resources making them sustainable. Better environment providing good living

	degradation		Planting of trees on the near water resources and avoiding cultivation in these areas. Introduction of sustainable ways of charcoal production reducing cutting down of trees.		conditions. Sustainable methods of energy production.
Climate change	Creating awareness on climate change. Adopting climate change adaptation strategies.	Government NGO's Community	Use of new technologies to manage water resources. Introduction of small scale irrigation farming.	Continuous process	Better community livelihoods. Decrease in food insecurity.
Depletion of water resources	Stop grazing livestock along the water resources. Training of the community on efficient use of water resources.	Community Government	Strict fining and punishment for law breakers. Provision of grazing land for the community.	Continuous process	Sustainable provision by the water resource to meet the community demand. Increase in quality and quantity of water.

	Enforcement of Laws on resource management.				

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APPENDICES

KENYATTA UNIVERSITY

INSTITUTIAL QUESTIOANNAIRE

My name is ShelmithWachira, a student at Kenyatta University. I am carrying out a research on partial fulfillment of my Bachelor's Degree in Environmental Planning and Management. This is a questionnaire for my project on the challenges and prospects affecting water conservation in Mwingi North District, Kitui County. The information you give is for academic purposes only and will be treated with confidentiality. I kindly request you to help participate in this research by answering the following questions.

Name of institution:

Respondents Name:

Respondents' position:

1. Does the local community know about water management and conservation?

   YES ☐ NO ☐

2. How often do you visit the community to create awareness?

a) Weekly ☐

b) Monthly ☐

c) Quarterly ☐

d) Yearly ☐

3. What measures/initiatives have been taken to help in water management and conservation?

4. Are there any other stakeholders involved in water conservation?

   Yes ☐ No ☐

   If yes, mention,

5. What part to you as the ministry and other stakeholders play in promoting water conservation and management awareness?

6. What techniques do you use in creating awareness on water management and conservation to mitigate water resource depletion?

7. What problems do you face during creating awareness on water conservation?

8. Are there any long term and short term goals/plans that have been set to cub the problem of water in Mwingi?

   Short term

   Long term

KENYATTA UNIVERSITY

Household Questionnaires

My name is ShelmithWachira, a student at Kenyatta University. I am carrying out a research on partial fulfillment of my Bachelor's Degree in Environmental Planning and Management. This is a questionnaire for my project on the challenges and prospects affecting water conservation in Mwingi North District, Kitui County. The information you give is for academic purposes onlyand will be treated with confidentiality. I kindly request you tohelp participate in this research by answering the following questions.

Name of the respondent: ……

Division: ……

Section A: Personal Information

1. How many occupants do you have in your house?
   a) 0 – 3 ☐
   b) 4 -7 ☐
   c) Above 7 ☐
2. What level of education have you attained?(Tick appropriately)
   a) Primary school ☐
   b) Secondary school ☐
   c) College ☐
   d) University ☐
   e) Others ☐
3. What is your average monthly income?
   a) 1000 – 10,000
   b) 10,001 – 20,000
   c) 20,001 – 30,000
   d) Above 30,000

4. What is your source of income? (Tick appropriately)
    a) Livestock production
    b) Farming
    c) Retail business
    d) Other economic activities (e.g selling in the market)
    e) Employment
5. Do you own piece of land?

    YES NO

    If yes, what activities do you practice in your land?

    a) Farming (which crops)
    b) Grazing
    c) Agro forestry
    d) Others (mention)

Section B Water management and conservation.

6. Where do you get your source of water?
    a) A well
    b) Borehole
    c) Rain water
    d) Dams
    e) River
    f) Other methods (mention)
7. How far is the nearest source of water?

a) 0-200M ☐

b) 201- 400M ☐

c) 401-600M ☐

d) 601-800M ☐

e) 801-1000M ☐

f) Over 1km ☐

8. Do you know water conservation methods?

Yes ☐ No ☐

i. What methods of water conservation measures do you practice?

a) Water harvesting ☐

b) Rock catchment method ☐

c) Run off diversion ☐

d) Sand dams ☐

e) Others ☐

9. Are there any water conservation initiatives that you are aware of in the county or region? How successful are they?

10. Do you know any stakeholders involved in water management? And what is their roles? (mention if any)

a) NGO's

b) Government ministries

c) Private owned water projects

d) Community owned water projects

11. What challenges do you face during water conservation in your homestead?