# INFLUENCE OF CAPACITY BUILDING ON ADOPTION OF SOIL CONSERVATION IN MIRIGA MIERU WEST DIVISION, IMENTI NORTH DISTRICT, KENYA.

BY



FRANCIS MUCHIRI NYAGAH

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## DECLARATION

My declaration is that, this research project report is my original work and has never been presented for examination for any award in any institution.

**Signature**---------- **Date:** 06/08/2012

NYAGAH FRANCIS MUCHIRI

L50/64861/2011

**Supervisor's Recommendation**

This research project report has been submitted for examination with our approval as University supervisors.

**Signature**---------- **Date:** 06/08/2012

PROFESSOR NATHAN GICHUKI

SENIOR LECTURER

SCHOOL OF BIOLOGICAL SCIENCES

UNIVERSITY OF NAIROBI

**Signature**---------- **Date:** 08/08/2012

MR JOHN CHANDI RUGENDO

LECTURER

SCHOOL OF ~~DISTANCE AND CONTINUING STUDIES~~ Continuing and Distance Education

DEPARTMENT OF EXTRA MURAL STUDIES

UNIVERSITY OF NAIROBI

## DEDICATION

This text is dedicated to my mother Janet, to my children Nkirote, Nkatha, and Bundi. Also to my wife Naomi. The innumerable hours spent working on this manuscript means less time could be devoted to family activities. The continuous unselfish support of this project by my family is deeply appreciated. Same way, I dedicate it to all people and programmes that are geared towards conservation of the environment including CETRAD organization which helped me in gathering of information and in materials that contributed to the success of this document.

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# ABBREVIATION & ACRONYMS

**CSA-** Community Supported Agriculture

**DSA-** Development Supported Agriculture

**FFW-**Food for Works

**GBM-** Green- Belt Movement

**GDP** – Gross Domestic Product

**IMF** – International Monetary Fund

**MOA-** Ministry of Agriculture

**NGO-** Non-Governmental Organization

**SC** -Soil Conservation

**SIDA-**Swedish International Agency

**SWC** - Soil & Water Conservation

**WB-** World Bank

## ABSTRACT

The rapidly increasing population in Kenya has led to a declining availability of cultivable land and a very high rate of soil erosion (Wegayehu, 2003). In the country, efforts towards soil conservation were started since the 1970s and 1980s. Since then a huge amount of money has been invested in an attempt to introduce soil and water conservation measures particularly in the areas where the problem of soil erosion is threatening and food deficit is widespread. The conservation measures were in most cases physical measures and undertaken through campaign using Food-for-Work or Cash-for-Work as an instrument to motivate farmers to putting up the conservation structures both on communal holdings as well as on their own plots.

However, the efforts put towards the promotion of the conservation technologies so far seem to have had limited success in achieving sustained use and widespread adoption and hence more or less failed to meet the anticipated objectives. The limited success of those efforts highlights the need to better understand the factors that encourage or discourage the adoption and sustainable use of introduced conservation measures.

This study therefore sought to assess the influence of capacity building on conservation structures in Miriga Mieru division, Imenti North District, Kenya. The study also explored the constraints faced by farmers in using conservation measures and elicited farmers' opinion for the betterment of future conservation initiatives. The study used questionnaire, interview and observation as a means of collecting data. The questions were both open and closed ended.

The data was both qualitative and quantitative in nature using descriptive statistics. The presentations and interpretation of the results were presented in form of tables, frequencies and percentages derived from SPSS software and interpretation done. The empirical results showed that, even though average number of the respondents was trained in soil conservation more effort is required to raise the number of trained farmers since the study revealed that, there was no significant relationship between knowledge and implementation of soil conservation measures. The study further established that there was a significant relationship between household resource capacity and implementation of soil conservation structures. These findings show that

addressing conditions that may inhibit financial incentives arising from reduced production costs and accessibility to source of support services would positively influence farmers to implement conservation farming and other sets of practices. An implication of the findings of this study is the need to increase farmers' awareness of soil erosion problem through the provision of knowledge and demonstration of gains and risk reduction characteristics of soil conservation practices.

Recommendation included that, government and NGO's in the area need to consider empowering the farmers of Miriga Mieru West Division by providing training geared toward making farmers conceptualize the benefit of SC, establishing a farmers training centre in the study area and increase the extension staff to farmers ratio. The same organizations involve in the mission of farmers level resources capacity building in terms of incentives, tools and loans for farm developments.

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background information

Critical issues of Soil erosion problems are numerous including the ongoing degradation of the earth's soils by human activity. This has been a persistent all the years that, there exist threats for human potential to feed a growing population. The soil or runoff that has been eroded ends up in groundwater, lakes, streams, and rivers. The annual global erosion amounts to about 36 billion tons, of which 10 billion are due to natural causes and 26 billion are the result of human activity (Crosson et al. 1995). Degradation is gauged for all soil in terms of compaction, erosion, nutrient loss and loss of organic matter. The other thing is that, if soil quality is stable or improving, we have a good indicator that the ecosystem is sustainable. But if it's deteriorating, the larger ecosystem will almost certainly decline with it (Wilken 1995, Mirzamoatafa et al.1998). Farmers are initially obligated to participate in the construction of conservation structures because this is undertaken through group labour. Such projects funded by the WFP (World Food Programme) have, however, been criticized for achieving limited success in addressing the problem.

Overview of soil conservation and need to engage the community is usually a fulfillment of millennium goal number seven which stipulate ensuring environmental sustainability. This also calls for capacity building towards conservation of the environment where soil conservation takes the lead due to its degradation and non renewability characteristics. The economic development of developing countries depends on the performance of the agricultural sector, and the contribution of this sector depends on how the natural resources are managed. Kenya is among the countries in the world that their economy is not strong (World Bank, 2003). Its economy is based mainly on agriculture providing employment for over 80% of the labour force which accounts for a little over 50% of the GDP (Gross domestic product). Adoption of conservation policies by government has naturally been variable but, as a generalization, it has increased over the past 10 years and still growing. Looking to the future, a recent review of factors affecting land resources and their use over the next 50 years lays much stress on the need to control soil degradation (Young, 1989). Soil erosion is the cause of substantial lowering of crops

yields and loss of production. Soil conservation by means of an enforced policy frequently does not work. Conservation is likely to be most effective where it is conducted with active co-operation of farmers, in their perceived interests and integrated with other measures for agricultural improvement (MOA) and SIDA, 2005).

In the world perspective Erosion of topsoil-already a serious problem in Australia, China and parts of the US - threatens modern civilization as surely as it menaced societies long since vanished, researchers warned(Tim R.,2004). In Kenya one ton is washed away in every acre of land every year. Nature washes away some 9.3billion tons of soil a year, but human intervention pushes that figure up to around 24 billion tons/year (MOA, 1981).An effective capacity building process must encourage participation by all those involved in soil conservation practices. The ecosystem approach is highlighted as an important concept for improving understanding and management of biodiversity and ecosystem services. The study on variables, Ways of training, Knowledge on soil conservation measures and capacity of the farmers to implement the soil conservation measures and their link with soil conservation practices reveals the problem's stem for interventions by various actors.

## 1.2 Statement of the Problem

Soil is functionally a non-renewable resource; while topsoil develops over centuries. The world's growing human population is actively depleting the resource over decades. As a non- renewable resource and the basis for 97% of all food production (Pimentel, 1993) strategies to prevent soil depletion are critical for sustainable development. Capacity building has been done very intensively mostly in the countries where greenbelt movement exist. These countries include United Kingdom, USA, Sweden, Canada, Kenya, New Zealand, Germany, Pakistan, Philippines, Thailand, South Korea, Lesotho, Tanzania, Malawi, Zimbabwe etc.

The Green Belt Movement (GBM) mandate is to protect natural or semi-natural environments, improve air quality within urban areas, educational to rural population, establishing of tree nurseries and activities of planting of trees. Other movements

include Development Supported Agriculture (DSA) and Community Supported Agriculture (CSA) which are for environmental conservation.

In Kenya GBM was initiated by Professor Wangari Mathai in 1988 and has done allot of capacity building both in rural and urban areas. Sensitization on environmental conservation, tree planting (Since 1977, 30million trees have been planted) and wining several protests which include the deviation of construction of a 60-story business complex in the heart of Uhuru Park in Nairobi in 1989, a deviation of Jeevanjee Gardens from the fate of being turned into a multi-story parking lot in 1991 and winning against the crusade about the illegal allocation of parts of the 2,000 acre (8 km²) in Karura Forest, a vital water catchment area in the outskirts of Nairobi in the year 2003.

Also the government has employed over 100,000 extension frontline workers in the ministry of agriculture and there are others in NGO's and in private sectors. This workforce combine to capacity build the farmers in soil conservation practices which cost the government over 2% of Kenya's.GDP (Elise, 2005).But still there is always an outcry that Soil loss costs 3 to 4 times Kenya's annual income from tourism, and a loss of 30-40 t/ha yearly is still experienced(Masinde el al, 2010).Due to this persistent continuation of soil erosion despite the already capacity building done to farmers, there was a need to explore further and discover the influence of capacity building on achieving knowledge and sustainable good soil conservation practices by farmers.

This research study therefore, sought to investigate the influence of capacity building on soil conservation in Miriga Mieru west considering variables:-ways of training in soil conservation measures, knowledge by farmers in soil conservation measures and farmers capacity in implementing soil conservation measures.Ensuring environmental sustainability is the seventh millennium goal that this study may help in fulfilling. This is because soil conservation when implemented effectively, will ensure environmental conservation. This is the reason why this was done in order to establish the link between capacity building and soil conservation practices. This revealed the real problem and actors will get the entry point for intervention.

## 1.3 Purpose of the Study

The purpose of this research was to determine the influence of capacity building on the adoption of soil conservation in Miriga Mieru division of Imenti North in Meru county.

## 1.4 Research objectives

The study was guided by the following study objectives-

i) To determine how famers get trained in soil conservation in Miriga Mieru West Division, Imenti North District in Meru County.

ii) To assess farmers knowledge about soil conservation in study areas.

iii) To assess the resource capacity of the farmers to implement the soil conservation measures in study areas.

## 1.5 Research questions

The study sought to answer the following research questions-

i) How do famers get trained in soil conservation measures in Miriga Mieru West Division, Imenti North District in Meru County?

ii) What is the level of knowledge of soil conservation measures by farmers in the study area?

iii) What is resource capacity of the farmers to implement soil Conservation measures in the study area?

## 1.6 Significance of the study

From the findings, there is an additional knowledge to community about the estimated soil loss in every year and why this is happening despite the efforts to avert the tread.

The other thing is that, in addition to the existing knowledge, there is a realization that, there is a relationship between capacity building with respect to knowledge, training ways and resource capacity in implementation of soil conservation measures. Thirdly the study opens other areas of further investigation. This is because the study when being undertaken has unearthed other areas that need further research.

## 1.7 Delimitations of the study

The study covered all the farms in Miriga Mieru division of North Imenti District in Meru County which as per the 2009 census, amount to 42,029. This was the target population from which the sample size was calculated. The soil conservation structures considered in the farms comprised of all the measures practiced in the area of study. The structures included terrace, cut-off drains, retention ditches, grass strips, trash strips, un-ploughed strip, check dams, artificial waterways, stone terraces, and gabions.

Figure 1 is the map of North Imenti District depicting the area of study (Miriga Mieru Division). As per the map, Miriga Mieru division is engulfed between Latitude 0 degrees North and 15250 degree North and Longitudes 0.425 Degree East and Longitude 0.375 East as shown on the map. As the map depicts, the division has five locations namely, Ntakira, Igoki, Municipality, Ntima and Nthimbiri (All these locations were considered in the study).

The area of the division was 122sq.Kms. (The census 2009, Kenya population and housing census, August, 2010).The division has a substantial area that is covered by Mount Kenya forest. This forest area was not included in the study.

## 1.8 Limitations of the study

Study contained limitations that information gathered was often not comparable, so it may not have given the same results when conducted in a different area of the same terrain and environment. This was resolved by constructing a checklist with SC measures that are common in most ecological zones. The respondents may have written what the researcher wants. This was conquered by using five different research assistants who's the researcher trained in order to avoid omissions. Time limit was a great challenge as well. This was solved by engaging five research assistances that were allocated in each of the five locations for data collection, and SPSS software was used in data analysis exercise.

## 1.9 Assumptions of the study

A sample was a subset where every item in a population had the sample probability of being in the sample. A research population was generally a large collection of individuals or objects that formed the main focus of a scientific study. The respondents were expected to answer questions responsibly that is with good personal conduct and obligations and clearly defined answers that confirm or adhere to the established standards. The data collection instruments had validity that was able to measure the relationship between the independent variables and dependent variables. The respondents would give the correct information that would provide the real situation as expected of the research.

## 1.10 Definitions of significant terms

**Access to credit**-this refers to the ease with which farmers can get money from lending institutions.

**Capacity Building-** It is conceptual approach to development that focuses on understanding the obstacles that inhibit farmers from realizing their developmental goals while enhancing the abilities that will allow them to achieve measurable and sustainable results in soil conservation

**Conservation tools**-tools for excavating sol to terraces

**Education level**-this refers to last school level from all primary, secondary up to University.

**Farmers training** - refers to attendance of any course by the farmer on soil conservation

**Farm soil**-refers to number of acres a farmer has

**Labor requirement**-this refers to the number of persons required to excavate or maintain soil conservation structures

**Labor cost** -the amount of money paid as daily wage

**Labor availability** - The easy of getting personnel to work on the farm to excavate structures when you want..

**Soil Erosion** Removal of topsoil faster than the soil forming processes can replace it.

**Soil conservation structures**-will refers mainly to the "Fanya Juu`` Terraces, Bench Terraces and other excavated structures.

**Soil Conservation-** Set of management strategies for prevention of soil being eroded from the Earth's surface.

**Training** - The term training refers to the acquisition of knowledge, skills, and competencies as a result of the teaching of vocational or practical skills and knowledge that relate to specific useful competencies.

## 1.11 Organization of the study

This chapter has highlighted on the background to the study whereby the researcher had looked into aspects of soil conservation linking it with capacity building. The author has also given the importance of the study. Statement of the problem showed why the study should have been done, purpose of the study research questions, significance of the study, delimitation of the study, limitation of the study, assumptions of the study and definition of significant terms.

There is a chapter four that deals with data analysis, presentation and presentations. The section change the data collected into facts that the objectives intended to make.

Last chapter deals with the summary of the study, discussion of the findings, conclusion, recommendations and areas for further studies.

# CHAPTER TWO

## LITERATURE REVIEW

### 2.1 Introduction

The literature review has been structured along the area identified as effective soil conservation measures. The review discusses way of training farmers, knowledge on soil conservation by farmers and resources capacity to implement soil conservation measures. In-depth review of researches and studies carried out on these variables is investigated to establish any gap necessitating further studies. Being a global problem literature reviewed covers global, country and regional perspectives.

### 2.1.1 Critical Issues of Soil Erosion Problems

Soil quality is one of the most basic and perhaps least understood indicators of land health. Soil supports plant growth and represents the living reservoir that buffers the flows of water, nutrients, and energy through an ecosystem. The ongoing degradation of the earth's soils by human activity, particularly agriculture, threatens human potential to feed a growing population. The annual global erosion amounts to about 36 billion tons, of which 10 billion are due to natural causes and 26 billion are the result of human activity (Crosson et al. 1995). The soil or runoff that has been eroded ends up in groundwater, lakes, streams, and rivers. The deposits of excess soil and the contamination in it, cause further ecological complications. Bodies of water need to be dredged and monitored for contamination. Water levels are lowered with the increasing soil eroded into them, making our world's water supply a concern directly related to the erosion of soil. The process of soil renewing itself is largely unknown. However, there is consensus on the need for conservation. Evaluating the scope of the problem or predicting the effects that various solutions might have on agriculture and the environment is very difficult. Degradation is gauged for all soil in terms of compaction, erosion, nutrient loss and loss of organic matter. Soil quality refers to the capacity of a soil to perform these beneficial functions. Its texture, structure, water-holding capacity, porosity, organic matter content, and depth, among other properties determine a soil's quality. Because soils naturally vary in their capacity to perform these functions, we must tie our understanding of soil quality to landscapes and land use. We must understand soil quality for two important reasons: First, we must match our use and management of land to soil capability. Second, we must establish

understanding about soil quality so we can recognize ongoing trends. If soil quality is stable or improving, we have a good indicator that the ecosystem is sustainable. If soil quality is deteriorating, the larger ecosystem will almost certainly decline with it (Wilken 1995, Mirzamoatafa et al.1998).

## 2.1.2 Overview of soil conservation

Soil erosion happens when particles of soil come loose and are carried away by water or the wind. When it rains so much that the water cannot seep into the soil fast enough, the extra water flows down the slope, carrying soil particles with it. Soil conservation means reducing the amount of soil erosion and maintaining soil fertility. It relies on increasing the amount of water seeping into the soil, reducing the run off. Many agricultural soils are easily eroded. The soil problem is likely to be more severe on certain types of soils, on steep slopes where there is intense rainfall and where the vegetation is removed (MOA, 1981).

Awareness of the need for soil conservation arose in the United States of America (USA) of irreversible soil by erosion before that time, perhaps as early as pre-classical times in the Mediterranean lands. Severe erosion occurred both in the indigenous communities as a result of increase in population and hence cultivation intensity and following settlement of tropical lands by western immigrants (Muya, 1997).

In the tropics description of erosion and its consequences dates from the 1930's and 1940's. Examples of erosion consequences can be viewed in Nigeria and a review, soil erosion in the British colonial empire. As a consequence soil erosion became part of the Agricultural policy of the colonial powers as such through the 1950's a notable example was Zimbabwe where conservation practices imported and adapted from USA were widely applied (Rochelean, 1988).

Whilst soil conservation specialist never wavered in their advocacy government awareness and policy emphasis declined in the 1960's. This coincided with post-independence period in ex-colonial territories, where conservation was for a time associated with "colonialists" policies thus could not immediately be given a prominent place on the development Agenda. Meanwhile, rising rates of population

increase were leading to the frequent extension of cultivation onto steeps and other vulnerable land (Rochelean, 1988).

From the mid-1970's onward soil conservation was given attention in development policy. If any single factor can be held responsible, it is the continuing increase in pressure upon the land, the disappearance in most countries of substantial areas of new land for settlement and thus a growing appreciation of the dependence of production on the land resources. A land mark was the formulation of the world soil charter by FAO (1982) coupled with increased emphasis on erosion control in FAO Policy. Adoption of conservation policies by government has naturally been variable but, as a generalization, it has increased over the past 10 years and still growing. Looking to the future, a recent review of factors affecting land resources and their use over the next 50 years lays much stress on the need to control soil degradation (Young, 1989).

The primary objective of soil conservation is maintenance of soil fertility. To achieve this, control of erosion is one necessary, but by no means sufficient, condition. Equally important are maintenance of the physical, chemical and biological soil conditions that are favorable for plant growth (MOA, 1981).

The earlier approach to soil conservation centered upon rates of soil loss. The requirements of arable cropping were taken as fixed and hence conservation measures were directed at reducing runoff though earth structures on the basis of assessed land capability, much sloping land was regarded as only suitable for non-arable use. In extension, soil conservation was often treated in isolation and sometimes on the basis of quasi-legal compulsory (Muya, 1997)

Arising from the problem of the earlier approach and from recent research, greater attention is now given to the effects of erosion on soil properties, fertility and crop yields. In conservation there is greater emphasis on maintaining a soil cover as compared with checking off where sloping land is already under arable use. Means must be found of marking this sustainable. In extension, it is recognized that conservation is only likely to succeed where it is implemented though willing co-operation of farmers. It must therefore be in their perceived interest as an integral [art of improvements leading to higher production (Rochelean, 1988).

Soil erosion is the cause of substantial lowering of crops yields and loss of production. The effect on yields is generally on tropical than on temperature soils and greatest on highly weathered tropical soils. The major causes of such yield reduction are loss soil nutrients through run off and lowering of available water capacity. Hence agro forestry practices which combine maintenance of soil fertility with control of soil loss are of particular importance. Where erosion is treated as simple loss of soil depth, it is frequently possible, however, on the basis of prevention of crop-yield losses. Agro forestry methods usually have lower initial costs than terracing or bunds and also have a potential for maintaining or increasing crop yields (Muya, 1997).

It is therefore likely than other being equal, that conservation by means of agro-forestry will show favorable results from economic analysis that conservation by means of earth structures (Morgan, 1995).Soil conservation by means of an enforced policy frequently does not work. Conservation is likely to be most effective where it is conducted with active co-operation of farmers, in their perceived interests and integrated with other measures for agricultural improvement (MOA) and SIDA, (2005).

## 2.2 World perspective on soil erosion

Erosion of topsoil - already a serious problem in Australia, China and parts of the US - threatens modern civilization as surely as it menaced societies long since vanished. Jared Diamond, a physiologist at University of California Los Angeles and author of Guns, Germs and Steel, said that Iraq, part of the Fertile Crescent in which agriculture started 10,000 years ago, was once the wealthiest, most innovative, most advanced country in the world. But today it was a "basket case", mainly because of "soil problems, salinity, and erosion, coupled with problems of deforestation".

Although more than 99% of the world's food comes from the soil, experts estimate that each year more than 10m hectares (25m acres) of crop land are degraded or lost as rain and wind sweep away topsoil. An area big enough to feed Europe - 300m hectares, about 10 times the size of the UK - has been so severely degraded it cannot produce food, according to UN figures(Tim R.,2004).

## 2.3 Capacity building

Capacity building also referred to as capacity development is a conceptual approach to development that focuses on understanding the obstacles that inhibit people, governments, international organizations and non-governmental organizations from realizing their developmental goals while enhancing the abilities that will allow them to achieve measurable and sustainable results(Ann Philbin, 1996).

An effective capacity building process must encourage participation by all those involved. If stakeholders are involved and share ownership in the process of development they will feel more responsible for the outcome and sustainability of the development. Engaging stakeholders who are directly affected by the situation allows for more effective decision-making. It also makes development work more transparent. UND (United Nations for Development) and its partners use advocacy and policy advisory to better engage stakeholders (Nancy B. and Abdelkarim A. 2003).

Capacity building has been done for several reasons including societal development in poorer nations is often contingent upon the efficiency of organizations working within that nation. Organizational capacity building focuses on developing the capacities of organizations, specifically NGOs, so they are better equipped to accomplish the missions they have set out to fulfill. Failures in development can often be traced back to an organization's inability to deliver on the service promises it has pledged to keep. Capacity building in NGOs often involves building up skills and abilities, such as decision making, policy-formulation, appraisal, and learning. It is not uncommon for donors in the global north to fund capacity building for NGOs themselves. For organizations, capacity building may relate to almost any aspect of its work: improved governance, leadership, mission and strategy, administration (including human resources, financial management, and legal matters), program development and implementation, fund-raising and income generation, diversity, partnerships and collaboration, evaluation, advocacy and policy change, marketing, positioning, and planning. Capacity building in NGO's is a way to strengthen an organization so that it can perform.

The first example depicts capacity building as tool to deliver individuals skills they need to work effectively in civil society. In the case of Mercy Ships, the capacity building is delivering the capacity for individuals to be stakeholders and participants in certain defined activities, such as health care. Capacity building on soil biodiversity and their ecological functions refer to different cropping systems, climate conditions and a range of economic situations from low- to high-input agriculture. The ecosystem approach is highlighted as an important concept for improving understanding and management of biodiversity and ecosystem services.

One of its objectives is to enhance and sustain soil fertility through the development and adoption of integrated nutrient management practices and appropriate BNF technologies. The research programme would develop holistic strategies that combine appropriate technologies and policy options aimed at narrowing the soil fertility gap with a better understanding of the main biophysical and socio-economic factors and constraints. Mention was made of the approach of a soil and water conservation research project in the Central Plateau, Burkina Faso, supported by the International Fund for Agricultural Development (IFAD) with several partners. It focuses on enhancing biomass through the use of local species, water harvesting with stone bunds, and raising awareness of the need to regenerate the primary production process (Mando, 2002).

The Green Belt Movement organizes women in rural Kenya to plant trees, combat deforestation, restore their main source of fuel for cooking, generate income, and stop soil erosion. Maathai has incorporated advocacy and empowerment for women, eco-tourism, and just economic development into the Green Belt Movement. Since Maathai started the movement in 1977, over 40 million trees have been planted. Over 30,000 women trained in forestry, food processing, bee-keeping, and other trades that help them earn income while preserving their lands and resources. Communities in Kenya (both men and women) have been motivated and organized to both prevent further environmental destruction and restore that which has been damage (Wangari Maathai, 2006).

## 2.4 Kenya's perspective on soil erosion

Nature washes away some 9.3billion tons of soil a year, but human intervention pushes that figure up to around 24 billion tons/year. In Kenya, a popular saying has it that "erosion removes soil corresponding to one lorry load from every acre every year." Kenya's problems are aggravated by a semi-arid climate over much of its interior, the cutting of forests for fuel wood and charcoal-making and poor land management and agricultural practices. In attempts to come to grips with mountain top soil losses, officials are introducing better crop management techniques, coupled with simple terracing in erosion-prone areas.

The Green Belt Movement (GBM) is an indigenous grassroots on-governmental organization based in Nairobi, Kenya that takes a holistic approach to development by focusing on environmental conservation, community development and capacity building. Professor Wangari Maathai established the organization in 1977, under the auspices of the National Council of Women of Kenya.

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## 2.5 Region perspective

Conservation and Management Specialist in Soil and Water Conservation Branch Ministry of Agriculture (Meru District Soil Conservation and Water Harvesting

report, 2003) gives the report that, Meru Central District, has a population of about 0.5 million and a total area of 3,000 $km^2$ (1,600 $km^2$ of arable land, 1,000 $km^2$ of gazette forest, and 400 $km^2$ that belong to Mount Kenya National Park) is 1 of 6 districts surrounding Mount Kenya. Agricultural production is very high in this mountainous area.

The National Soil and Water Conservation Program (NSWCP) lasted from 1974 to 2000. In the last 10 years of the program a catchment approach was emphasized. Efforts and resources were concentrated in a catchment for 1 year. Problems and opportunities were identified with land users in a participatory manner, and further development activities were planned. The agricultural extension service was the main local project partner; it took a leading role in disseminating technology and improving land husbandry practices. A baseline study found that both human activities and changing environmental conditions contributed to environmental degradation in Meru District. Project interventions were undertaken to protect and sustain the mountain environment (Meru District Soil Conservation and Water Harvesting report, 2003).

## 2.6 Knowledge as a Critical Element in Soil Conservation

The theory of the agricultural household views the farm households in developing countries as both a production and consumption unit, i.e. these decisions take place within the same economic unit (Colman and Young, 1988). The analytical foundation of the theory of farm household is based on the work of a number of economists. The theory contends that the majority of farm households in developing countries are resource-poor, subsistence-oriented (not fully integrated into markets), risk-prone and operates under the limited technological infrastructure (Ellis, 1988).

Capital scarcity is their characteristic feature. Hence the only factor they have is their labor resource. This household labour force can involve in various activities. And the general assumption is that the farm household allocates its labor to the production of goods and leisure in a manner that maximize the utility derived from the allocation (Ellis, 1988). Berhanu (1999) indicates that land improving activities like soil and water conservation practices are expected to shift the production function and influence the household income positively and take to a relatively higher level than without conservation practice. Even if the supply of labour in the household remains

the same, this result in the increase use of labour input in conservation activity and the available leisure time will be reduced. Stocking and Abel (1992) noted that adopting soil conservation requires additional labour. And this labour may have the opportunity cost depending on the situation. Therefore, in any investment like soil improvement thorough consideration of this aspect of resource is indispensable. If soil conservation takes leisure time and no other activity is reduced, opportunity cost is zero. But if another enterprise is withdrawn or off-farm income is given up in order to practice soil conservation; the cost is the income to labour that would have accrued from the enterprise or the amount of income forgone.

Many rural development projects assumed that in developing countries labour is widely available at low cost. And the evaluation criteria for the success of the projects were the number of kilometers of ditches dug or bunds built (Hudson, 1995). It is also a common and widespread practice in countries like Ethiopia Food-For-Work projects were based on bartering food for labour. However, Hudson (1995) points that they ended up with mixed results. "Some were successful in reducing famine but few made constructive improvement in soil conservation". Labour is a fundamental element of soil conservation practice. Stocking and Abel (1992) state that in the design of soil conservation schemes, work and manpower requirements are often a neglected aspect. In literature we can find different attitudes reflected towards labour use in soil conservation practices.

Stocking and Abel (1992) discusses the typical attitude expressed by Sheng (1986) with regard to labour use in soil conservation. Sheng (1986) expressed: "terracing by manual labour is the kind of labor-intensive program that will be good for most of the developing countries. This type of technology uses more labour and relatively less capital to alleviate the unemployment problem on one hand and protect the soil resources ... on the other." Stocking and Abel (1992) regard this statement as the view that attach minimum value to labor and its greater use considered as a benefit, not a cost. Another typical technical attitude presented by Stocking and Abel (1992) is that soil conservation is an activity for the dry season, when agricultural activities are less and slack demand for labor. Since many other off-farm activities undertaken in

the dry season, "promoting soil conservation as a beneficial activity that uses labor surpluses in the dry season can therefore be mistaken".

Stocking and Abel explained how inadequate consideration of labor could cause a failure in soil conservation schemes. And they conclude, "The availability of labor is a principal constraining factor in the acceptance or rejection of soil conservation. Labor-intensive techniques are only readily taken up and maintained on prosperous farms with a regular income from cash crops. Elsewhere, soil conservation structures are fewer and in poor repair, even though farmer response is positive as to their value" Stocking and Abel (1992).

## 2.7 Training in soil conservation measures

To promote soil conservation among the farming communities extension agents use various methods depending on target group, time of the tear and objectives. The most common ones include individual approach where farmers are trained individually, group approach where farmers are trained in a group and mass media (Muya 1997). In the 1970`s soil conservation was given to small scale farmers in high potential areas through subsidy to construct conservation structures. This was aimed at showing farmers the benefit of conservation. There was limited consultation on the most appropriate measures from a technical and social economic point of view. With introduction of training and visit extension by the MOA, the extension agent became overloaded with responsibilities so that it was not possible to give conservation education needed by the farmers. The catchment approach supported by SIDA in the 1980`s and 1990`s identified farmers within a given area where they were made aware of erosion problems and impact on land productivity. The farmers were then trained on the relevant conservation measures to address the problems (Muya, 1997).

From the year 2001 the approach of extension changed where farmers were expected to identify the problem and then look for extension agent to provide the technical knowhow. The farmers were also mobilized by extension agent to form groups where they were trained when they demanded for services. The services were provided free (MOA and SIDA 2001).

A green belt or greenbelt is a policy and land use designation used in land use planning to retain areas of largely undeveloped, wild, or agricultural land surrounding or neighboring urban areas. Similar concepts are greenways or green wedges which have a linear character and may run through an urban area instead of around it. In essence, a green belt is an invisible line encircling a certain area, preventing development of the area allowing wildlife to return and be established. This policy is engaged in training of farmers on conservation matters. In Kenya it was initiated by Wangari Mathai and was very successful. From the year 1987, training relationship with soil conservation structures management was discovered in USA. The structures could not be maintained, and therefore, the Missouri state had to enforce distribution of free soil stewardship materials to local churches in the county and an educational package given to each elementary school in Lafayette County. The district also has a video library available to the general public shied et al (1993).

## 2.8 Resources Capacity in implementation of soil conservation measures

Successful improvement of land husbandry in a catchment depends not just on the motivations, skills and knowledge of individual farmers, but also on actions taken by groups, communities or regions as a whole. Simple extension of the message, even coupled with demonstration, usually will not suffice. Community-based action through local institutions and users' groups will also be required.

The development of common-interest groups around the concepts and practices of conservation agriculture has already served to provide encouragement and mutual support to members as they make the changeover. These groups have become very effective in farmer-to-farmer spread of the beneficial ideas and practical technologies. They have also begun to develop into significant local pressure-groups for improvements in the policy and institutional environment so as for political and legal support to their initiatives.

For example, zero tillage in Brazil is a story of farmer-led technological evolution and integration. Farmers and technicians who adopted this technology have, so far, consistently resolved all the challenges to its sustainability in the humid sub-tropics

and humid wet-dry tropics of Brazil, and obtained results in the humid tropics. This successful experience was initiated and supported by the Brazilian Zero Tillage Association for the Tropics which helped to disseminate the technology in the tropical region of the country.

From the farmer's point of view, the main obstacles to adoption of zero tillage were the lack of knowledge, information and technical support. Considerations of erosion losses, lack of research, crop insurance and opinions of agronomists were not as important when deciding whether to adopt zero tillage or not.

In The state of Missouri State in USA, the government had noticed the soil conservation structures sustainability linkage with recourses where the cost-share program began in July 1982 as an incentive to landowners to put mechanical practices on their land to control erosion. It began as a 50 percent reimbursement program and has grown to the current 75 percent level for placing standard grade terraces, terraces with tile outlets, diversions, water impoundment reservoirs, erosion control structures Farm sciences among small holders also play a key role in implementations of soil conservation structures. Studies by shied et al (1993) indicate that low farm income hinders implementation of structure since the income is needed to purchase equipments and pay for the labor of excavation.

D.B Thomas (1997) noted that in Kenya there are situations where land use is contrary to the required standards. This usually refers to farming of subsistence crops on steep land where the proper use is either the planting of trees or permanent vegetations. In such situations, farm incomes are very low since farmers are not able to invest in conservation structures. Ayub (East Africa Standard October 4th, 2001) also notes that, low production level results in low net farm incomes.

## 2.9 Summary of literature review

The literature has covered how erosion is a problem globally and how it's a problem in Kenya. Also in a region perspective was done showing how it is a concern in the area of study. As indicated in the literature, allot of capacity building has been done both by government, NGO's and movements which concerns conservation of the environment soil conservation included. The gaps that can be detected from the

literature include: Lack of investigation on how capacity building influence soil conservation measures.

The study is needed on why there is persistent soil erosion despite all the capacity building done on environmental conservation. No study has ever been done to discover why this is happening. In this additional knowledge will be acquired after the results on what to be after recommendation. This will come out clearly due data collection and their analysis. In the policy side of view, government will be able to realize that there should be more emphasize on capacity building to farmers regarding soil conservation measures. In management government, NGO's and others partners will be able realize where to channel the resources.

## 2.10 Conceptual framework

### Strenuous Variables

**Government Policy**
-Not defining the extent of land along the river banks.
-Land on hilltops.
-Land owned on very sloppy areas.

### Independent variables

**Training**
-Approach
-Institutions
-Extension services
-Field days
-Contact farmers
-Backstopping

### Dependent variable

**Knowledge**
-Measures on the farm
-Number of structures on the farm
-Number of structures identified by a farmer.

Adoption of Soil conservation Measures.
-High harvests
-Structures on farms
-High farm net income

**Resources Capacity**
-Access to credit
-Farm income
-Collateral
-Employment
-Number of structures on the farm.
-Tools available

Climatic condition
-Rains
-Floods

**Figure 1: Conceptual framework**

Conceptual frameworks, according to educational researcher Smyth (2004), are structured from a set of broad ideas and theories that help a researcher to properly identify the problem they are looking at, frame their questions and find suitable literature. Most academic research uses a conceptual framework at the outset because it helps the researcher to clarify his research question and aims.

## 2.10.1 Summary of conceptual framework

Conceptual framework depicts the relationship between independent variables and dependent variable. Training, Farmers knowledge about SC measures, and capacity to implement SC measures are the independent variables that contribute to effective soil conservation practices (Dependent variable).

Strenuous variables, government policy and climatic conditions are depicted indicating that although they are not part of the study, it is possible that they can influence the research results in one way or another.

In the independent variables, there are notes in point form that help to realization of the aspects that are considered under that particular variable.

Process part is in between the independent variable's column and dependent variable's column. This shows what to consider in fulfilling the aspects of independent variable in fulfilling the requirements of dependent variable.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter describes the methodologies which were used in the research to determine the influence of capacity building on soil conservation measures in Imenti North District. The research methods are discussed under the following subsection; study design population, sampling procedures, Data collection methods and procedures for Data Analysis methods and justification, questionnaire validity and reliability.

## 3.2 Research Design

A research design is a programme used to guide the researcher in collecting, analyzing and interpreting observed facts. In this research data analysis was undertaken by use of correlation and chi-squares methods. Descriptive survey was used in collecting information by interviewing or administering a questionnaire to a sample of individuals. This type of research attempts to describe such things as possible behavior, attitudes to describe and characteristics descriptive survey which enable the researcher to have a systematic collection and presentation of data in order to determine the influence capacity building has on soil conservation measures. This design is the most appropriate in collecting data about the characteristics of a large population. Apart from being cost effective, it was within the constraints of time available resources and more so the questionnaire were employed as the main tool for data collection ( Harrison & Kelly, 2002

## 3.3 Target Population

A population is a complete set of individual's cases or objects with some common observable characteristics. A particular population has some characteristics that differentiate it from other populations. The target population for the study included all farm holds (42,029) within Miriga Mieru division. This was advantageous owing to the researcher's budget. The other reason was that, the target population was composed of all households in study area. As per 2009 census and Miriga Mieru division report of March 2012, the total households were 42,029. From this population, a sample size was drawn. The study area is composed of five locations.

All the five locations were considered. This made 100% selection this was because the number was small.

### 3.4 Sampling Procedure and Sample Size

A sample is a number of individuals selected from a target population for a study in such a way that they represent the large group from which they were selected. It would then be possible to generalize the characteristics of the sample to the population. Due to time and resource constraints, the researcher adopted random sampling which was carried out in the five locations that make Miriga Mieru West Division. The researcher first prepared a sampling frame(The listing of the accessible population from which to draw the sample) of all members of the population of interest from the list(Prepared by front-line extension service officers in Miriga Mieru West Division) a sample was drawn in a manner that each group member had an equal chance of being drawn during each selection.

Researchers use this sampling method if the sample for the study is very rare or is limited to a very small subgroup of the population. This type of sampling technique works like chain referral. After observing the initial subject, the researcher asks for assistance from the subject to help identify people with a similar trait of interest. There will be two groups that will be identified. Purposive random selection method was used in order to select members who had gone through capacity building course and list made. The other list was made consisting of farmers who had never attended any soil conservation capacity building. The two lists were used to get the effect of capacity building on soil conservation practices by comparing the activities observed and the results from the questionnaires.

A Simplified Formula for Proportions that was developed by Glenn D.Israel (1992) was used to determine the sample size. As per 2009 census, the division under study had a population of 42,029 households. These households are also the number of farms as per Miriga Mieru Division research report of March, 2012.

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

Where;

n is the sample size,

N is the population size and

e is the level of precision.

The sample size was determined as follows;

In this case, the confidence level was taken to be 95% allowing for an error tolerance merging of 0.05%.

Undertaking calculation:

N =42,029

e =0.05

Substituting the values in the formulae, the population sample is given as follows;

$$n = \frac{N}{1+N(e)^2} = \frac{42,029}{1+42.029*(0.05)^2} = \frac{42.029}{106.0725}$$

= 396.229

Rounding up to a whole number we got 397 households.

Due to time constrains and cost, the researcher chose to worked with half of the calculated sample size of 199. For ease of calculation and even distribution to all the 5 locations, the researcher worked with 200 as the sample size so that 40 farmers were drawn from each location. The correlation method was used to analyze the data to indicate the relationship and usually measures the strength of linear association between two quantitative variables x and y. Chi-square was used for computation because it is compatible to most of the data (David S et al., 2001).

In this case, the sample size for locations was five and since they were the only ones, the selection was100%. The next selection in the already selected locations was done using random sampling method. 200 households for better gathering of information were selected. The extension staff in the study area are seven of which six were selected for the study. This made about 85.7% selection which is higher as compared to 10% minimal as recommended by Gay (1992). The interviewing of extension staff was to confirm whatever will come from the farmers through questionnaires.

About 200 questionnaires and 6 interview schedules were prepared and issued to the farmers and extension officers respectively. This was accomplished by the help of the research assistants drawn from Miriga Mieru Divisional Agricultural and Livestock

ministries extension staff. Therefore, in the study, 200 (200 farmers) persons were involved as respondents.

### 3.5 Methods of data collection

3.5.1 Determination of This was aimed at transforming the actions into process in order to achieve the objectives of the study.

### ways of training of farmers in soil conservation in Miriga Mieru division in Meru County.

This process sought to verify or discover the different ways the farmers got trained in soil conservation in the study area. Ways of training methods considered in this study, included in farmers training institutions, on farm by being visited by filed extension staff and through contact farmers. Number of farmers that went through those various training was noted. The measurement was the number of farmers that had gone through those various training by the use of check list or mentioned by the farmer.

Data was collected administering 100 questionnaires to the randomly selected farmers listed as ones that have undergone any SC training. Differences in behavior was shown by number of methods used by various farmers and the number of measures implemented by farmers who attended any training among the various training ways offered to farmers. The expected data was number of farmers, various training method i.e. either formal (in an institution), field days or inter farmer training (contact farmers).The method of analysis was association (chi- square). Type of data expected was both qualitative and quantitative. The data was collected by means of questionnaires and observation of phenomena's.

### 5.5.2 Assessment of knowledge of soil conservation measures of farmers in the study area.

To access the knowledge of farmers on soil conservation in the area of study, the researcher used different tools namely; questionnaires, interview schedules and observation of the phenomenon. The 200 questionnaires were administered to farmers by the research assistants who directed the methods of answering questions so that there was no omission. By observation, implemented soil conservation can be identified. Also by questioning the farmer by use of questionnaire one was able to know number of different measures the farmer knew. Check list was used that

contained types of soil conservation measures and ticking of the number implemented was done. This check list also provided the number of farmers that knew various soil conservation measures and the ones that have implemented and how many have been implemented. In this, the type of data was both qualitative and quantitative and the method of analysis was association (chi-square).

### 3.5.3 Assessment of farmer's capacity to implement soil conservation in the study area.

In this respect, the questionnaires administering and observation was used to collect data. Checklist of various conservation measures was used in order to tick the various capacities of farmers and how each capacity build or have less capacity level have implemented the soil conservation measures. The capacity of a farmer was weighted by the enterprises the farmer has, employments of farmers, level of farmers income, tools used by the farmer, farm yields level and farm income. The measurements were the number of farmers who have capacity to implement soil conservation measures, how many measures the farmer have implemented and what category was the farmer in the level of capacity in implementation of SC measures in order to help in analysis. Since questionnaire and observation was used in collection of data, the data collected was both qualitative and quantitative in nature. Analysis of the data was by use of association (chi – square).

## 3.6 Instrument Validity and Reliability

### 3.6.1 Validity of the instruments

Validity is the accuracy and meaningfulness of inferences which was based on the research results. It is the degree to which results obtained from the analyses actually represent the phenomenon under study. Validation of the data was done using content validity. This measurers the degree to which data collected using a particular instrument represent a specific domain of indicators or content of a particular concepts. The researcher carried out pilot testing for the questionnaire and interview schedule to try out their validity. The pilot testing was carried out in Kibirichia area where the same environmental and farming conditions are the same to the study area. This enabled the researcher to conceptualize how big the questionnaire was and how much time was required to answer the questions. The questionnaire was pre – tested on a sampled farmer in Kibirichia area through convenience sampling techniques. Pre

– testing answer question whether items in the instruments are stated clearly and have the same meanings to all respondents. This was settled by examining the results and discussing with the supervisors.

### 3.6.2 Reliability of the instruments

Reliability of the instrument concerns the degree to which a particular measuring procedures gives similar results to the consistency of the scores obtained for each individual. To increase the reliability of the data collected the researcher employed test- retest techniques in which the instruments were administered twice to the same subjects. The pilot test of the instruments was done to one of the farming zones to ensure that the deserved data or results are obtained. Cronbach's alpha test was used in determining the reliability of instruments. This is a measure of internal consistency, which is, how closely related a set of items are as a group. A reliability coefficient of 0.70 or higher is considered "acceptable" in most social science research situations. The alpha coefficient was 0.79, suggesting that the items had relatively high internal consistency and the researcher therefore, considered the instruments reliable and accepted the research instruments. In this SPSS software was used to assist in computation from which interpretation was done using statistics methods.

### 3.7 Operational definitions of variables

**Table 1: Operationalization of variable**

| Research objectives | Variable | Indicator | Measurement | Level of scale | Data collected method | Type of analysis | Level of analysis |
|---|---|---|---|---|---|---|---|
| Adoption of soil conservation measures | dependent | Number of soil conservation in the farm | Number of farmers practicing SC measures | Nominal Ordinal | Interview Questionnaires Observation | Qualitative & Quantitative | Descriptive |
| To determine how farmers get trained on soil conservation measures | Independent | -Existence of extension services staff<br>- time spent with extension officers<br>-institutions<br>- field days<br>-Inter personal learning. | -Number Of Training institutions.<br>-Visits By The Agriculture Extension Officers.<br>-Number of extension staff.<br>-Number of farmers trained in FTC's<br>-Number of contact farmers | -Nominal<br>-Ordinal. | -Interviews Questionnaires | quantitative qualitative | Descriptive |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| To access farmers knowledge about soil conservation measures. | Independent | -Number of structures in the farm.<br>-Number of structures well maintained<br>- Number of farmers able to mention various structures. | -Number of farmers practicing the measures<br>-Number of structures in the farm.<br>- number of structures maintained | -Nominal<br>-Ordinal. | -Interviews<br>Questionnaires | Quantitative<br>Qualitative | Descriptive |
| To establish the influence of resource capacity on soil conservation measures | Independent | - Tools<br>- Employment<br>- Enterprises<br>-Number of SC measures in the farm | -Availability of labor<br>-Number of farmers employed<br>-Types of enterprises<br>-Types of tools | -Nominal<br>-Ordinal | -Interviews<br>-Questionnaires<br>- Observation | Qualitative | Descriptive |

An operational definition of variables is operational living or operationally defining a concept to render it measurable. It is done by looking at the behavior dimensions indicators factor or properties donated by the concept translated into observable and measurable moments to develop an index of the concepts. Measures can be objected or subjective. It is not possible to construct a meaningful data collecting instrument without first operating all your variables.

## 3.8 Methods of data analysis

Data analysis refers to examining what has been collected and making deductions and inferences. It involves uncovering underlying structures extracting important variables detecting any abnormalities and testing any underlying assumptions data obtained from the field in raw materials is difficult to interpret. The researcher had to analyze that data to make sense. The researcher did data editing, coding classification and tabulation. Use of statistical tools in data analysis such as use of measures of control tendency resulted in reducing large volume of raw data to that which can be read easily and can be used for further analysis. The researcher also used the four levels of measurements scale nominal ordinal, interval and ratio.

After data collection researcher scrutinized the instrument for completeness accuracy and uniformity. The study employed both quantitative and qualitative approaches to achieve its objectives. Collected data was analyzed using descriptive statistics. This helped to measure the various variables of the study coding was done to classify the answer to bring out their essential pattern. The researcher used SPSS to generate frequency distributions using descriptive statistics in order to examine the pattern of the responses. The findings were be presented inform of tables, pie charts, frequencies and percentages so as to bring out the relative differences of values and be easy to follow and be understood by the readers.

## 3.9 Summary

This chapter has dealt with the research design which was used. The target population was all the farm holdings in Miriga Mieru division in Imenti North district. The sampling procedure was stratified simple random sampling and the methods of data collection used self administered questionnaires and interview schedules. Records and documents were also analyzed. The researcher also gave a brief description of the data analyses techniques and methods applied; descriptive statistics. Snowball method of sampling was used where there existed difficult in selecting the research sample.

# CHAPTER FOUR

## DATA ANALYSIS, PRESENTATION AND INTERPRETATION

### 4.1 Introduction

This section entailed the analysis, interpretation, and the presentation of study findings. The chapter was divided into subsections where in the first section, general characteristics of the respondents such as age and gender were analyzed. The data was also analyzed around key variables as relates to the influence of capacity building on soil conservation efforts.

### 4.2.1 Respond Rate

200 questionnaires were distributed and 200 were recovered. This was a response rate of 100% which is statistically acceptable. This indicates that farmers depicted responsibility. Presented below are the findings of the study.

### 4.2.2 Respondents Characteristics

This section detailed the characteristics of the population. The study sought to identify characteristics such as the gender, age of the respondents, their position in society, level of education.

### 4.2.3 Gender distribution of the farmers

The study sought to establish the gender distribution of the respondents. The results are presented below.

**Table4.1 Gender**

| Categories | Frequency | Percentage |
|---|---|---|
| Male | 106 | 53 |
| Female | 94 | 47 |
| **Total** | **200** | **100** |

One can make conclusion that the majorities (53.0%) of the respondents were males, and 47.0% were female. This indicates that the farming activities were equally attractive to both men and women in the society. This represents gender equity in survey administration, and in line with Kenya's Vision 2030 which has gender mainstreaming as an aspect.

### 4.2.4 Age of respondents

Age of respondents is useful information needed in characters being studied. The study therefore sought to establish the age of the respondents. The results are presented in table 4.1 below.

**Table 4. 2: Age of the respondents**

| Age | Frequency | Percentage |
|---|---|---|
| Below 25yrs | 25 | 12.5 |
| 26-35yrs | 46 | 23.0 |
| 36-45yrs | 70 | 35.0 |
| Over 45yrs | 59 | 29.5 |
| **Total** | **200** | **100.0** |

From the table 4.2, we can establish that the majority (35.0%) of the respondents were aged between 36 years and 45 years old. This is followed by 29.5% of respondents who are above 45 years old. Respondents aged between 26 years and 35 years old make up 23.0% of the sample population, while respondents who are below 25 years old make up 12.5%. These findings show that there was lack of younger and innovative minds of the youth in soil conservation efforts. This indicates that below 25 years of age have not yet been given the responsibility of making major decisions in the farm. Even the few 12.5% captured might be representing their parents. Most of below 25years of are also in schools and colleges or rather in institutions of higher learning.

### 4.2.5 Marital status of respondents

The researcher sought to establish the marital status of the respondents. Marital status of respondents is useful information needed in characters being studied.

**Table 4. 3: Marital Status of respondents**

| Marital status | Frequency | Percentage |
|---|---|---|
| Married | 106 | 53.0 |
| Separated | 33 | 16.5 |
| Widowed | 40 | 20.0 |
| Single | 21 | 10.5 |
| **Total** | **200** | **100.0** |

We can conclude that the majority (53.0%) of the respondents was married, 20.0% were widowed, and 16.5 % were separated while 10.5% were single. This is the indicative of the marital status of the study area. Again this shows that the majority had basic family support that can in turn influence their contribution to soil conservation efforts.

### 4.2.6 Education level of respondents

The researcher also sought to establish the level of education of the respondents. The respondents were requested to point out the highest level of education attained.

**Table 4.4 Education level**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | none | 13 | 6.5 | 6.5 | 6.5 |
| | primary | 13 | 6.5 | 6.5 | 13.0 |
| | secondary | 39 | 19.5 | 19.5 | 32.5 |
| | tertiary | 135 | 67.5 | 67.5 | 100.0 |
| | Total | 200 | 100.0 | 100.0 | |

The majority (67.5%) of the respondents had attained tertiary level of education, 19.5% of the respondents have attained secondary level of education, and 6.5% were schooled up to primary level while yet another 6.5% never had an education. These figures show that the majority of the respondents had had some education. The figures further illustrate a 93.5% literacy rate in Miriga Mieru West Division of Meru County.

### 4.2.7 Education effects on SC measures

The study sought to determine the effects of education on the implementation of the soil conservation structures.

**Table 4.5 Education effects on SC measures**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | positive | 161 | 80.5 | 80.5 | 80.5 |
| | negative | 39 | 19.5 | 19.5 | 100.0 |
| | Total | 200 | 100.0 | 100.0 | |

Majority (80.5%) of the respondents felt that education had a positive effect on the implementation of soil conservation structure. However, a few farmers (19.5%) felt that education had a negative effect on soil conservation structures. They thought that, the higher a person is educated the more one term excavation of SC structures inferior.

### 4.2.8 Land sizes of respondents

The researcher sought to determine the respondents' farm sizes.

**Table 4. 6 Farm sizes of the respondents**

| Farm size | Frequency | Percentage |
|---|---|---|
| 2-3 acres | 110 | 55.0 |
| 4-5 acres | 60 | 30.0 |
| 6-7 acres | 18 | 9.0 |
| Above 8 acres | 12 | 6.0 |
| **Total** | **200** | **100.0** |

The majority (55.0%) of the respondents owned 2 to 3 acres of land, 30.0% of the respondents owned 4 to 5 acres, and 9.0% owned 6 to 7 acres while 6.0% of the respondents owned above 8 acres of land. The sample size was derived from the farmers who owned 2 acres and above. The reason was that, a farm of 2 acres and above can easily be conserved due to adequate area for structures construction. The result above also shows the tread of land sub-division into smaller portions which might lead to slums if no action is taken by national spatial planning (NSP).

### 4.2.9 Study area Land ownership

The study sought to establish the status of the respondents' lands tenure.

**Table 4.7: Study area Land ownership**

| Status of the land | Frequency | Percentage |
|---|---|---|
| With title deed | 122 | 61.0 |
| Without title | 49 | 24.5 |
| Hired | 29 | 14.5 |
| **Total** | **200** | **100.0** |

The majority (61.0%) of the respondents owned the land and had title deeds, 24.5% owned the land but without title deeds and 14.5% of the respondents hired the land in their possession.

### 4.2.10 Soil Conservation Techniques used by respondents

The researcher further sought to determine the soil conservation techniques applied by the respondents in their farms.

**Table 4.8: Soil Conservation Techniques used by respondents**

| SC conservation measures | Trained on SC | | Untrained on SC | |
|---|---|---|---|---|
| | F | % | F | % |
| Cut-off drains | 133 | 66.5 | 67 | 33.5 |
| Terraces | 149 | 74.9 | 51 | 25.1 |
| Check dams | 73 | 36.5 | 127 | 63.5 |
| Retention ditch | 24 | 12.0 | 176 | 88.0 |
| Uncultivated strip | 136 | 68.0 | 64 | 32.0 |
| Grass strips | 134 | 67.0 | 66 | 33.0 |
| Wood lot | 112 | 56.0 | 88 | 44.0 |
| Biological | 27 | 13.5 | 173 | 86.5 |
| Stone Terrace | 137 | 68.5 | 63 | 31.5 |
| Artificial waterway | 51 | 25.5 | 149 | 74.5 |

The majority (74.9%) of the respondents uses terraces in soil conservation while the minority (12.0%) uses retention ditches. Other popular soil conservation techniques in Miriga Mieru West Division of Meru County include stone terrace (68.5%), uncultivated strips (68.0%), grass strips (67.0%), and cut-off drains (66.5%). The possible reason for the above is that, retention ditches are mostly for water storage that it might be common in ASAL (Arid and Semi- Arid Lands).

The results

The results of the findings were analyzed by the use of descriptive statistics (chi-squares, ANOVA, correlation and regression). Representation was carried out by means of tables, graphs and pie charts.

## 4.3 Section B: Results

### 4.3.1 Determining how famers get trained in soil conservation in Miriga Mieru West Division in Meru County

It was necessary to understand the source of training and how the trainings were conducted since this would definitely influence the implementation of soil conservation structures. The survey therefore sought to establish where respondents obtained their soil conservation training. The findings will help to figure out the effective way of training farmers in soil conservation. Analysis was done by use of chi-square through SPSS. The results were represented by means of pie charts and tables. The aspects taken into consideration include; institutions, field visits by extension staff, contact farmer's field days. The aim was to determine whether there is any significant relationship between each of the named aspects and farmers implementation of soil conservation measures in the study area. Therefore, the study seeks to establish the link between the variable and implementation of SC measures in the study area.

### 4.3.1.1 Mode of soil conservation training

The study sought to find out the mode of training in soil conservation.

**Table 4.9: Mode of training on soil conservation for respondents**

| Mode | Frequency | Percentage |
|---|---|---|
| In an institution | 24 | 24.0 |
| Visit by extension staff | 18 | 18.0 |
| Field days | 54 | 54.0 |
| Contact farmer | 1 | 1.0 |
| More than one of the above | 3 | 3.0 |
| **Total** | **100** | **100.0** |

The majority (54.0%) received their training while participating in field days, 24.0% gained their training in an institution, and 18.0% of the respondents from visits by extension officers. 3.0% of the respondents obtained their training from more than one of these sources while 1.0% obtained their training from a contact farmer.

### 4.3.1.2 Distance from extension to respondents farm

The study sought to determine how far away extension officers lived from the respondents.

**Table 4.10: Range of distance of extension staff from the respondents**

| Response | Frequency | Percentage |
|---|---|---|
| No visit by ext.Staff | 33 | 16.5 |
| Less than five kilometers | 145 | 72.5 |
| More than five kilometers | 22 | 11.0 |
| **Total** | **200** | **100.0** |

Majority (72.5%) of the extension officers lived less than five kilometers away from the respondents, 16.5% of the respondents did not have extension officers visiting them, while 11.0% of the extension officers lived more than five kilometers away from the respondents. This implies that agricultural extension officers within the division resided in easily accessible areas which present unprecedented opportunity of knowledge dissemination to the farmers.

**Table 4.11: Frequency of visit of Extension Officer to respondents**

| Frequency of visits | Farmers | Percentage |
|---|---|---|
| Not visited by ext.Staff | 33 | 16.5 |
| Yearly | 41 | 20.5 |
| Yearly half | 58 | 29.0 |
| Monthly | 68 | 34.0 |
| **Total** | **200** | **100.0** |

At least 83.5% of the farmers responded to have been visited by the agricultural extension officers while 16.5.0% of the respondents was never visited by extension officers. In deed 29.0% were visited half yearly, 34.0% were visited monthly while 30.5% were visited yearly.

**Table 4.12: Number of SC measures by respondents trained in various ways**

| Ways of training | one | three | five | none | Total |
|---|---|---|---|---|---|
| in an institution | 0 | 15 | 6 | 3 | 24 |
| visit by extension staff | 4 | 11 | 3 | 0 | 18 |
| field days | 13 | 32 | 6 | 0 | 51 |
| contact farmer | 0 | 1 | 3 | 0 | 4 |
| more than one of the above | 3 | 0 | 0 | 0 | 3 |
| **Total** | **20** | **59** | **18** | **3** | **100** |

Being trained in an institution has a majority (75) of soil conservation measures. The method has garnered 26.13% of the total number of measures obtained in the study. This is an indication that formal training provides better understanding than when one is being trained outside the institution. This can be tagged to more time of assimilating and digesting ideas since questioning and explanations are done in an institution than in the field.

## Table 4.13:Chi-Square Tests(Training Ways)

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 28.675[a] | 12 | .004 |
| Likelihood Ratio | 30.803 | 12 | .002 |
| Linear-by-Linear Association | 18.033 | 1 | .000 |
| N of Valid Cases | 100 | | |

The chi-square test indicates that, various methods of training and adoption of soil conservation measures are strongly related. This is because the significant level is 0.004 when the significant level starts at 0.05.

## Table 4.14:Ways of training for respondents

| | | No. of soil conservation measures | | | | |
|---|---|---|---|---|---|---|
| **Ways of Training** | | **one** | **three** | **five** | **none** | **Total** |
| | in an institution | 0 | 15 | 6 | 3 | 24 |
| | visit by extension staff | 4 | 11 | 3 | 0 | 18 |
| | field days | 13 | 32 | 6 | 0 | 51 |
| | contact farmer | 0 | 1 | 3 | 0 | 4 |
| | more than one of the above | 3 | 0 | 0 | 0 | 3 |
| **Total** | | **20** | **59** | **18** | **3** | **100** |

The above tabulation shows that there are 40% of the respondents that do not get a chance of being visited by an extension staff. As per extension staff's interview results, one location in the study area is not represented by an extension staff.

**Table 4.15: Chi-Square Tests(extension staff visit)**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 48.878 | 9 | .000 |
| Likelihood Ratio | 59.231 | 9 | .000 |
| Linear-by-Linear Association | 3.617 | 1 | .057 |
| **N of Valid Cases** | **100** | | |

There is a significant relationship between extension staff visits and the number of soil conservation measures. This is an indication that extension staff is very vital in determining the soil conservation measures.

### 4.3.2 Assessing farmers knowledge about soil conservation in Miriga Mieru West Division in Meru County District

This section seeks to demonstrate how respondents' knowledge about soil conservation was measured. Many factors affect the administration of relevant soil conservation knowledge. The researcher sought to determine the relationship between knowledge of farmers on SC measures and implementation of the same which add up to adoption of SC measure. This help to know whether respondents had proper knowledge on SC measures, and how this knowledge helped them in their soil conservation efforts. Checklist was used in this case. Respondents were required to mention as many measures as they could remember. The named types of measures were ticked accordingly. The counting was done to obtain the number of measures one respondent has managed to remember. Observation was also used to captures any other types of measures a respondent forgot but has implemented. In analyzing ANOVA and chi-square was used in order to compared and confirm their results.

**Table.4.16 :Number of SC measures implemented Vs SC measure recited Cross tabulation**

| No. SC measures recited | | none | less than five | more than five | Total |
|---|---|---|---|---|---|
| | one | 13 | 25 | 0 | 38 |
| | three | 8 | 89 | 22 | 119 |
| | five | 0 | 31 | 5 | 36 |
| | none | 7 | 0 | 0 | 7 |
| **Total** | | **28** | **145** | **27** | **200** |

Table4.16 above depicts the method used to determine the relationship of what farmers know and what they implement on their farms. First column shows number of soil conservation types a respondent recited. The other columns depict the number of respondents. The upper row shows the number of measures implemented on the farms. For example farmers who recited three SC measures 8 did not implement any, 89 implemented at least one measure but they did not exceed 5 ,22 implemented 5 and above measures. Their total number was 119.

**Table 4.17:ANOVA(knowledge)**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1.150 | 3 | 1.150 | 1.710 | .193 |
| | Residual | 129.845 | 193 | .673 | | |
| | **Total** | **130.995** | **194** | | | |

In ANOVA computation, the results indicated that, there is no significant relationship between number of soil conservation mentioned by the respondents and number of SC measures the respondent constructed and maintained. For relationship to exist, the significant value should be less than 0.05 i.e. $p<0.05$ after computation .The one on the table is 0.193 which indicate lack of significant relationship.

**Table 4.18: Chi square test (knowledge)**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .356 | 3 | .949 |
| Likelihood Ratio | .356 | 3 | .949 |
| Linear-by-Linear Association | .215 | 1 | .643 |
| **N of Valid Cases** | **200** | | |

A Chi-square test was conducted on the frequencies to establish whether a statistically significant difference existed between individuals with knowledge and those without knowledge as regards to implementation of soil conservation structures. The computed Chi square value of 0.356 was not significant with p=0.949>0.05 at 5% level of significance and with 3 degrees of freedom. We therefore accept the null hypothesis that there is no significant difference in implementation of soil conservation structures, between individuals who have knowledge on soil conservation and those who had none.

### 4.3.3 Relationship between household resource capacities to Implement Soil conservation measures in the study area

It is believed that having more resources increases the farmer's prospect to implement the conservation farming practices. This section sought to assess the resource capacity of the farmers to implement the soil conservation measures and its relationship to implementation of the same. The aspects considered includes; farm income, proportions of income set for soil conservation measures, level of harvest, and access to credit and prices of tools for soil conservation. The results are represented by use of tables and pie charts.

### 4.3.3.1 Farm income for respondents

The study sought to establish the net yearly income of the respondents.

**Table 4.19: Net Monthly Farm Income of the respondents**

| Income | Frequency | Percentage |
|---|---|---|
| 1000-5000ksh/month | 50 | 25.0 |
| 6000-10,000ksh/month | 23 | 11.5 |
| 11,000-20,000ksh/month | 86 | 43.0 |
| Above 21,000ksh/month | 41 | 20.5 |
| **Total** | **200** | **100.0** |

Table 4.19 shows the farm incomes of the respondents.43% earn over Kshs. 11,000 from the farm monthly.

**Table 4.20 Number of SC measures Vs farm income Cross tabulation**

| Number of SC measures on the fames | | Income | | | | Total |
|---|---|---|---|---|---|---|
| | | 1000-5000ksh/month | 6000-10,000ksh/month | 11,000-20,000ksh/month | above 21,000ksh/month | |
| | one | 19 | 2 | 17 | 0 | 38 |
| | three | 13 | 2 | 63 | 41 | 119 |
| | five | 6 | 19 | 6 | 5 | 36 |
| | none | 7 | 0 | 0 | 0 | 7 |
| Total | | 45 | 23 | 86 | 46 | 200 |

Table 4.20 depicts of soil conservations implemented by the respondents with relation to their farm monthly income. Many respondents (119) had three measures on their farms while 7 had none in their farms.

**Table 4.21: Chi square test (farm income)**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 156.504(a) | 9 | .000 |
| Likelihood Ratio | 138.014 | 9 | .000 |
| Linear-by-Linear Association | 12.621 | 1 | .000 |
| **N of Valid Cases** | **200** | | |

A Chi-square test was conducted on the frequencies to establish whether a statistically significant difference existed between individuals who earned more and those who earned little as regards to implementation of soil conservation structures. The computed Chi square value of 156.504 was significant with $p=0.000<0.05$ at 5% level of significance and with 9 degrees of freedom. We therefore reject the null hypothesis that there is no significant difference in implementation of soil conservation structures, between individuals who earned more and those who earned little.

Majority (43.0%) of the respondents earned a net monthly farm income of between KES 11,000 and KES 20,000, 25.0% of the respondents earned a monthly income of KES 1000 to KES 5000, while 20.5% earned above KES 21000 per month. 11.5% of the respondents earned between KES 6,000 and KES 10000 per month. This indicates that most farmers slightly more than 75% were living above the poverty line affording to make an income of more than 1 US dollar in a day. This means that they could afford to spare some money to invest in implementation of soil conservation structures. Chi square indicates a very strong relationship between income of the farmer and soil conservations measures the farmer implement. A lot of sensitization on good methods of farming and storage is vital in order to maintain high production. This will sustain soil conservation practices. This will count for food security and vision 2030 for sustainable development.

### 4.3.3.2 Proportion of income used in conservation activities by respondents

The researcher further sought to establish the proportion of income used in conservation activities.

**Table 4.22: Proportion of income invested in SC by respondents**

| Response | Frequency | Percentage |
|---|---|---|
| None | 44 | 22.0 |
| 1/4 | 95 | 47.5 |
| 1/2 | 48 | 24.0 |
| 3/4 | 6 | 3.0 |
| 1/3 | 7 | 3.5 |
| **Total** | **200** | **100.0** |

one can establish that the majority (47.5%) used a quarter of their income in soil conservation activities, 22.0% did not use any proportion of their income in soil conservation, 24.0% used a half of their income in soil conservation, and 3.5% used a third of their income while 3.0% used three-quarters of their income to conserve soil. This is indicative of deliberate efforts by the farmers to conserve soils. 78% of the respondents have invested in conserving soil. This is a trial to sustainable development in vision 2030.

### 4.3.3.3 Level of harvest of respondents

The researcher further sought to establish the yield level of the respondents' land. This was to establish how level of harvest is related to adoption of SC measures.

**Table 4.23 Level of Harvest frequency**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Low | 43 | 21.5 | 21.5 | 21.5 |
| | Average | 138 | 69.0 | 69.0 | 90.5 |
| | High | 19 | 9.5 | 9.5 | 100.0 |

**Table 4.24: Chi-Square Tests(Harvest level)**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 126.591[a] | 8 | .000 |
| Likelihood Ratio | 117.155 | 8 | .000 |
| Linear-by-Linear Association | 29.014 | 1 | .000 |
| N of Valid Cases | 200 | | |

| | | | |
|---|---|---|---|
| Tota | 200 | 100.0 | 100.0 |

The relationship as per chi squire analysis is quiet strong. To increase harvest is also increasing soil conservation practices.

### 4.3.3.4 Access to credit of respondents

The respondents were further requested to provide information on whether they were able to access credit for farm improvement from financial institutions. The findings are as illustrated below.

## Table 4.25: Access to credit frequency table

| Response | Frequency | Percentage |
|---|---|---|
| Can Access | 147 | 73.5 |
| Cannot Access | 53 | 26.5 |
| **Total** | **200** | **100.0** |

The majority (73.5%) of the respondents accessed credit for farm improvement from financial institutions while the minority (26.5%) did not. Easy access to the credit facility enables farmers to acquire equipment which could be used in soil conservation efforts.

## Table 4.26: Access to credit Cross tabulation

| No. SC tractures | | | Accessible | Un-accessible | Total |
|---|---|---|---|---|---|
| | one | Count | 13 | 25 | 38 |
| | three | Count | 102 | 16 | 118 |
| | five | Count | 31 | 1 | 32 |
| | more than five | Count | 6 | 0 | 6 |
| | none | Count | 0 | 6 | 6 |
| **Total** | | **Count** | **153** | **48** | **200** |

From cross tabulation table, it is clear that, respondents who had an access to credit facilities had constructed more conservation measures compared to the respondents who were not able to access credits facilities. Access to Credit increase farmer's capacity to implement SC structures.

## Table 4.27: Chi-Square Tests (Access to Credit)

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 69.156[a] | 4 | .000 |
| Likelihood Ratio | 66.259 | 4 | .000 |
| Linear-by-Linear Association | 3.767 | 1 | .052 |
| **N of Valid Cases** | **200** | | |

There is a strong relationship between access to credit and soil conservation measures. As depicted in cross tabulation, the more credit facilities are accessible to the farmers the more farmers are enabled to conserve soils.

### 4.3.3.5 Whether excavation tools are expensive

The survey also sought to determine whether the excavation tools used by the respondents were expensive.

**Table 4.28: Cost of SC excavation tools as per respondents**

| Response | Frequency | Percentage |
|---|---|---|
| Very expensive | 120 | 60.0 |
| Cheap | 59 | 29.5 |
| Fair | 21 | 10.5 |
| **Total** | **200** | **100.0** |

The majority (60.0%) of the tools used by the respondents were very expensive, 29.5% of the tools were cheap while 10.5% were fairly priced. This explains why the farmers had opted for credit facilities at least to meet the cost of acquiring these tools.

### 4.3.3.6 Employment of respondents

This part dealt with the relationship between employment and behavior of farmers as to conserving the degrading soils. The data was analyzed by use of chi square.

**Table 4.29: Employment Vs No. SC measures**
**Cross tabulation**

| | No. of structures | | | | |
|---|---|---|---|---|---|
| | **one** | **three** | **five** | **none** | **Total** |
| Employed | 11 | 76 | 11 | 7 | 105 |
| Un-employed | 27 | 43 | 25 | 0 | 95 |
| **Total** | **38** | **119** | **36** | 7 | **200** |

There was in total 294 structures constructed by the farmers who were employed while there was 281 structures by respondents who were not employed. This is an indication that employment adds capacity to the farmers that provides power to implement more conservation measures.

**Table 4.30: Chi-Square Tests(Employment)**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 34.428[a] | 3 | .000 |
| Likelihood Ratio | 38.313 | 3 | .000 |
| Linear-by-Linear Association | 2.365 | 1 | .124 |
| **N of Valid Cases** | **200** | | |

Chi-square test show that there is a strong relationship between employment and implementation of soil conservation measures in the study area. Combining the two table's findings, one can say that, the more employment opportunities are created, the more the degrading soils will be conserved and rehabilitated.

**Table 4.31: Model of regression coefficient**

| Model | | Un-standardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Combined) | 3.967 | .521 | | 7.609 | .000 |
| | Ways of training | -.378 | .055 | -.503 | -6.852 | .000 |
| | Access to credit | -.460 | .156 | -.258 | -2.938 | .004 |
| | Income | -.342 | .070 | -.458 | -4.892 | .000 |
| | Harvest | .866 | .120 | .592 | 7.214 | .000 |
| | tool price | -.247 | .086 | -.222 | -2.876 | .005 |

The model was used as a check in order to confirm the findings of the research and also compare the results. It is clear that all the variables were significantly related to the adoption of soil conservation measures.

But the most variable with a higher weight in influencing the adoption of soil conservation measures is the capacity to implement soil conservation measures.

## 4.4 Summery

In the data analysis, the used tools included correlation, for relationship chi-square for associate and regression for comparing the strength variables i.e. independent in relation to the dependent variable. Capacity of a farmer to implement SC measures scored highest among ways of training and farmers knowledge. Presentation of the result was done by means of frequencies, percentages and tables.

# CHAPTER FIVE

# SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Introduction

This section gives a summary of the main findings, makes discussions and gives conclusions and recommendations. The main objective of the study was to investigate the influence of capacity building on soil conservation measures in Miriga Mieru Division of Imenti North District in Meru County in order for players to have an intervention. Specifically, the study sought to assess farmer's knowledge about soil conservation in Miriga Mieru West Division in Meru County, determine how famers get trained in soil conservation in the study area and assess the resource capacity of the farmers to implement the soil conservation measures in the study area.

## 5.2 Summary of the findings

| Objective | Main finding |
|---|---|
| To assess farmers knowledge about soil conservation in MirigaMieru West Division in Meru County. | • Majority of the farmers felt that education had a positive effect on the implementation of soil conservation structure.<br>• Majority of the respondents were trained in soil conservation. While this is encouraging, more effort is required to raise the number of trained farmers..<br>• The computed Chi square value of 0.356 was not significant with p=0.949>0.05 at 5% level of significance and with 3 degrees of freedom.<br>• Therefore there was no significant relationship between knowledge and implementation of soil conservation structures. |
| To determine how famers get trained in soil conservation in study areas. | • Majority (54.0%) received their training while participating in field days, 24.0% gained their training in an institution, and 18.0% of the respondents from visits by extension officers. 3.0% of the respondents obtained their training from more than one of these sources while 1.0% obtained their training from a contact farmer. |

| Objective | Main finding |
|---|---|
| | • At least 44.5% of the farmers realized positive effects upon applying their soil conservation knowledge, 28.5% realize no effects, while 5.5% realized negative effects. It appears that the training programs put in place achieved below average results.<br>• Majority of the extension officers lived less than five kilometers away from the respondents an implication that agricultural extension officers within the division resided in easily accessible areas which present unprecedented opportunity of knowledge dissemination to the farmers<br>• At least 59% of the farmers claimed to have been visited by the agricultural extension officers though much needs to be done to strengthen the extension services. |
| To assess the resource capacity of the farmers to implement the soil conservation measures. | • Most farmers slightly more than 75% were living above the poverty line affording to make an income of more than I US dollar in a day.<br>• This means that the farmers could afford to spare some money to invest in implementation of soil conservation structures.<br>• There were deliberate efforts by the farmers to conserve soils whereby 47.5% used a quarter of their income in soil conservation activities, 24.0% used a half of their income in soil conservation measures, and 3.5% used a third of their income while 3.0% used three-quarters of their income to conserve soil.<br>• Majority (73.5%) of the respondents accessed credit for farm improvement from financial institutions.<br>• Majority (60.0%) of the tools used by the respondents were very expensive and that is why farmers opted for credit facilities at least to meet the cost of acquiring these tools<br>• There was a significant relationship between household resource capacity and implementation of soil conservation structures. |

| Objective | Main finding |
|---|---|
| | • The computed Chi square value of 156.504 was significant with p=0.000<0.05 at 5% level of significance and with 9 degrees of freedom.<br>• Therefore, the likelihood of implementation of soil conservation structures increased with increased household resource capacity. |

## 5.3Discussion

Even though majority (80.5%) of the farmers felt that education had a positive effect on the implementation of soil conservation structure, only a handful (51%) of the farmers had received training in soil conservation. While this is encouraging, more effort is required to raise the number of trained farmers. The importance of building human capital, and increasing household resources related to labour for the continuation of soil conservation structures therefore emerged from the study. This may be plausible for indeed lower education level may be associated with less efficient use of new technologies and inadequate labour may result in small cultivated land areas. The capacity to only cultivate small areas may be a constraint on a farmer to plant crops other than those perceived by the farmer to be crucial to the household food security. The importance of improved manageability through program support services is well in line with observations by Gladwin et al. (2002) that practices such as improved fallow are knowledge intensive whereas the study of Manyong et al. (1999) reveal the importance of extension contact. The lack of significant relationship between knowledge and implementation of soil conservation structures from this study could be indicative of gaps in knowledge or potential misunderstanding about certain soil conservation practices may exist among farmers.

The study findings demonstrate that there were deliberate efforts by the farmers to conserve soils whereby 47.5% used a quarter of their income in soil conservation activities, 24.0% used a half of their income in soil conservation, and 3.5% used a third of their income while 3.0% used three-quarters of their income to conserve soil. This could be attributed to the observation that most farmers slightly more than 75% were living above the poverty line affording to make an income of more than I US dollar in a day. In addition, majority (73.5%) of the respondents accessed credit for farm improvement from financial institutions (SACCO Banks). The study

findings show that there was a significant relationship between household resource capacity and implementation of soil conservation structures. Therefore, the likelihood of implementation of soil conservation structures increased with increased household resource capacity.

## 5.4 Capacity of farmers in SC implementation

The conditioning variables that give a farmer the capacity to act are assets related to human, natural and cultural capitals (Bebbington 1999), which are simply referred to as household resources and management ability in this study. Management ability improves with experience, level of education and farmer training (Manyong et al. 1999; AO 2001 b; Clay et al. 2002; Place et al. 2002; Haggblade and Tembo 2003). Farmer experience is expected to have a positive relationship with implementation of soil conservation structures. Farmer training and increase in farmer education are expected to improve farmer adoption of conservation farming.

The household resources pertaining to land ownership, farm size, off-farm income and livestock or farm implements have varying capacity effect on farmers. This study reveals that the likelihood of implementation of soil conservation structures increased with increased household resource capacity. This is in line with another study that established that large farm size gives a farmer the capacity to use land intensive conservation practices (elements) such as improved fallow and crop rotation (Thangata et al. 2002) hence the farm size may be positively associated with conservation farming.

## 5.5 Conclusions

This study embarked on understanding the influence of capacity building on the implementation of soil conservation structures in Miriga Mieru Division of Meru County. Effort is required to raise the number of trained farmers since the study revealed that there was no significant relationship between knowledge and implementation of soil conservation structures. For those who received training, (54.0%) received their training while participating in field days, 24.0% gained their training in an institution, and 18.0% of the respondents from visits by extension officers. The study further established that there was a significant relationship between household resource capacity and implementation of soil conservation structures. These findings show that addressing conditions that may inhibit financial incentives arising from reduced

production costs and accessibility to source of support services would positively influence farmers to implement conservation farming and other sets of practices. In addition, building management capability (human capital) through farmer training while at the same time ensuring there is no drain on human capital due to mortalities would also improve the adoption of conservation practices. An implication of the findings of this study is the need to increase farmers' awareness of soil erosion problem through the provision of knowledge and demonstration of gains and risk reduction characteristics of soil conservation practices. This is important because the extent to which farmers understand and feel the need for controlling soil erosion affects implementation of soil conservation measures positively.

## 5.6 Recommendations

The specific recommendations this study envisages would enhance the practice of soil conservation practices are:

1) The government with other key stakeholders and partners in the area of Agriculture should embrace the idea of giving incentives to farmers to encourage the implementation of soil conservation measures. Incentives such as farm inputs can contribute a great deal towards the implementation of the soil conservation structures. However the study recommends a combination of incentives with participatory approaches; such that incentives are given in exchange for work done. This course of action will reduce the costs incurred on training farmers who in the process do not adopt the practices.
2) The dissemination of appropriate practices should be cognizant of farmers' role in conveying information to their fellow farmers. The indication by a moderate proportion that they learned the practices through fellow farmers should be exploited. The double pronged approach in trying to reach out to farmers will result in rationalization of resources.
3) The farmers' know-how on practices related to soil conservation appears to be based on what farmers learned from their predecessors. It is therefore, important to establish if farmers are appropriating the intended benefits of the recommended practices. This will facilitate well tailored intervention in promoting soil conservation practices where appropriate.

4) Training in the area of soil erosion was lacking and therefore this study recommends initiation of trainings in this vital area and dedicated extension officers to be employed to adequately handle farmers on the same or training of paraprofessionals to assist extension officers.
5) Introduction of farmers training institution by the government in Miriga Mieru division.

## 5.7 Areas of further research

Further studies on farmers SC perceptions which will review why farmers are not really putting maximum effort on SC practices. The other area concerns farmers attitudes on SC. This will give the better methods of approach in order to change the tread. Knowledge on SC measures need to be enhanced in order for farmers to embrace the practice.

The other area of further research is in the area of land ownership. This is just mentioned in the study but not dealt with in the study. The land is being sub- divided as the population is growing. The land size is diminishing into small portions. This tread affects SC adoption in a way. So, further research is needed to establish this fact.

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# APPENDICES

## Appendix 1: Letter of Transmittal

Francis Muchiri

P.O.Box 1019,

Meru

DATE----------

Dear Respondent,

I am a student at University of Nairobi conducting a research on the investigation. This is part of my Masters in project planning and Management project. Your kind response to the questionnaire is crucial to the successful completion of this research project. Your response will be anonymous, as data will be combined and analyzed as a whole.

Please attempt to answer all the questions and tick one appropriate box (answer) that best suit your perspective for each statement and also answer in written form the unstructured questions.

Your participation in the study will greatly be appreciated.

Yours sincerely,

Francis Muchiri

## Appendix II: Farmers Questionnaire

**15. How many soil conservation measures do you have in your farm?** Please respondent answer the below questions by ticking in the appropriate box and filling in the necessary information in the space provided

**SECTION A: RESPONDENTS' BASIC INFORMATION**

**1. Gender?**

a) Male 1 b) Female 2

**2. What is your age bracket?**

a) Below 25 years 1 b) 26-35 years

c) 36-45 years 3 d) Over 45 years 4

**3. Marital status**

a) Married 1 b) Separated/discovered 2

c) Widowed 3 d) Single 4

**4 .What is the number of people who depended on you**

a) 2 and less 1 b) 3-4 2 c) 5-6 3 d) More than 7 4

**5. Level of education**

a) None 1 b) Primary 2 c) secondary 3 d) tertiary 4

**6. What is the size of your farm?**

a) 2-3 acres 1 b) 4-5 acres 2 C) 6-7 acres 3 d) above 8 acres 4

**7. What is the state of your land?**

a) With title deed 1 b)Without title 2

c) Other specifications----------

**SECTION B: TRAINING.**

**8. What are the effects of your education on the implementation of soil conservation structure?**

a) Positive 1 b) Negative 2

c) Other specifications.....

**9. Have you ever been trained in soil conservation?**

a) Yes 1 No 2

If yes, how? Institution 1 Extension staff 2

Field day 3 Contact farmers 4

**10. If the conserver to question (9) is yes what are the effects on the conservation of your farm?**

a) Negative 1 b) Positive 2

c) Other (specify) ----------

**11. What are the effects of training on the SC measures in your farm?**

a) Negative 1 b) Positive 2

c) Other (specify) ----------

**12. How regularly do the extension officers visit you in your farms?**

a) Weekly 1 b) Monthly 2 c) Half Yearly 2 d) Yearly 3

e) Other (specify) ----------

**13. How far do extension agents live away from your farms?**

a) Less than a kilometer 1 b) 1-2 Kilometers 2

c) 3-4 kilometers 3 d) More than 5 kilometers 4

## SECTION C: KNOWLEDGE ON SOIL CONSERVATION MEASURES

**14. Name different methods of soil conservation measures? Check list.**

| | | | |
|---|---|---|---|
| a) Cut- off drain | 1 | b) Terraces | 2 |
| d) Check dams | 3 | e) Retention ditch | 4 |
| g) Uncultivated strip | 5 | h) Grass strips | 6 |
| j) Wood lot | 7 | c) biological | 8 |
| f) Stone terrace | 9 | i) artificial waterway | 10 |

**None 1 Less than 5 2 More than 5 3**

a)None 1 b) less than five 2 c) more than five 3

**16. How many SC measures have you implemented and maintained?**

a) One 1 b) three 2 c) five 3 d) more than five 4

d) Other (specify).....

## SECTION D: RESOURCE CAPACITY

**17. What is your yearly net farm income (ksh)?**

a) 1000-5000ksh b) 6000-10,000ksh

c) 11,000ksh-20,000 d) above 21,000ksh

e) Others (specify).....

**18. What proportions of this income that is used in conservation activities?**

a) none ¼ b) ½ c) ¾

d) Other (specify).....

**19. What is the level of harvest from your land?**

a) Low 1 b) Average 2 c) High 3

d) Other (specify).....4

**20. Are you able to access credit for farm improvement from financial institutions?**

a) No 1 b) Yes 2

**21. If the answer to above is (no), then where do you get funds to excavate structures?**

State----------

---

**22. How expensive are tools you use for excavation of structures in the nearby shops?**

a) Very Expensive b) Cheap

c) Others specify----------

**23 Are you employed?**

No 1 Yes 2

**24 Type of tools in the farm**

| | | | |
|---|---|---|---|
| a) Pangas | 1 | b) Jembes | 2 |
| c) Spring jembe | 3 | d) Mattock | 4 |

**25What types of soil conservation do you have in your farm?**

| | | | |
|---|---|---|---|
| a) Cut- off drain | 1 | b) Terraces | 2 |
| d) Check dams | 3 | e) Retention ditch | 4 |
| g) Uncultivated strips | 5 | h) Grass strips | 6 |
| j) Wood lots | 7 | c) biological | 8 |
| f) Stone terraces | 9 | i) artificial waterway | 10 |

## Appendix III: Divisional Statistics/Sample size

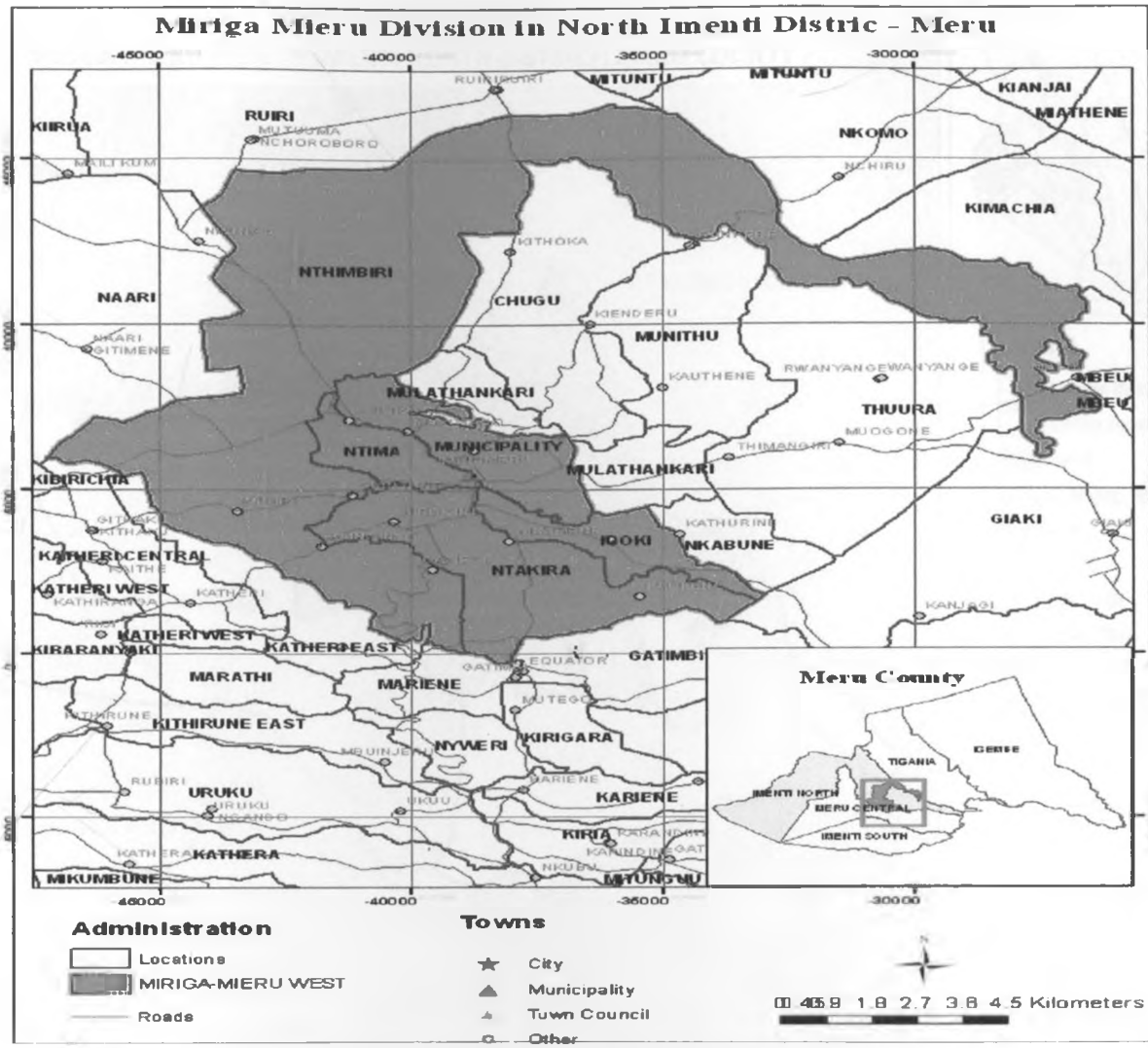
| S/N | Location | Area $Km^2$ | No of Sub-Loc. | Farm families | Sample Size as per location |
|---|---|---|---|---|---|
| 1 | Ntima | 4.5 | 2 | 7774 | 40 |
| 2 | Municipality | 8.7 | 3 | 15510 | 40 |
| 3 | Igoki | 5.9 | 3 | 4848 | 40 |
| 4 | Ntakira | 17.1 | 5 | 9185 | 40 |
| 5 | Nthimbiri | 85.9 | 3 | 4762 | 40 |
| **Total** | | **122.0** | **16** | **42029** | **200** |

**Source: 2009 Kenya population and housing census (Aug.2010, pg.21)**

## Appendix IV: World Economic Outlook (2010)

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GDP Growth | -0.2 | 1.1 | 0.3 | 1.4 | 4.6 | 6 | 6.3 | 6.9 | 1.3 | 2.6 | 5 |

**Source: International Monetary Fund (IMF)**

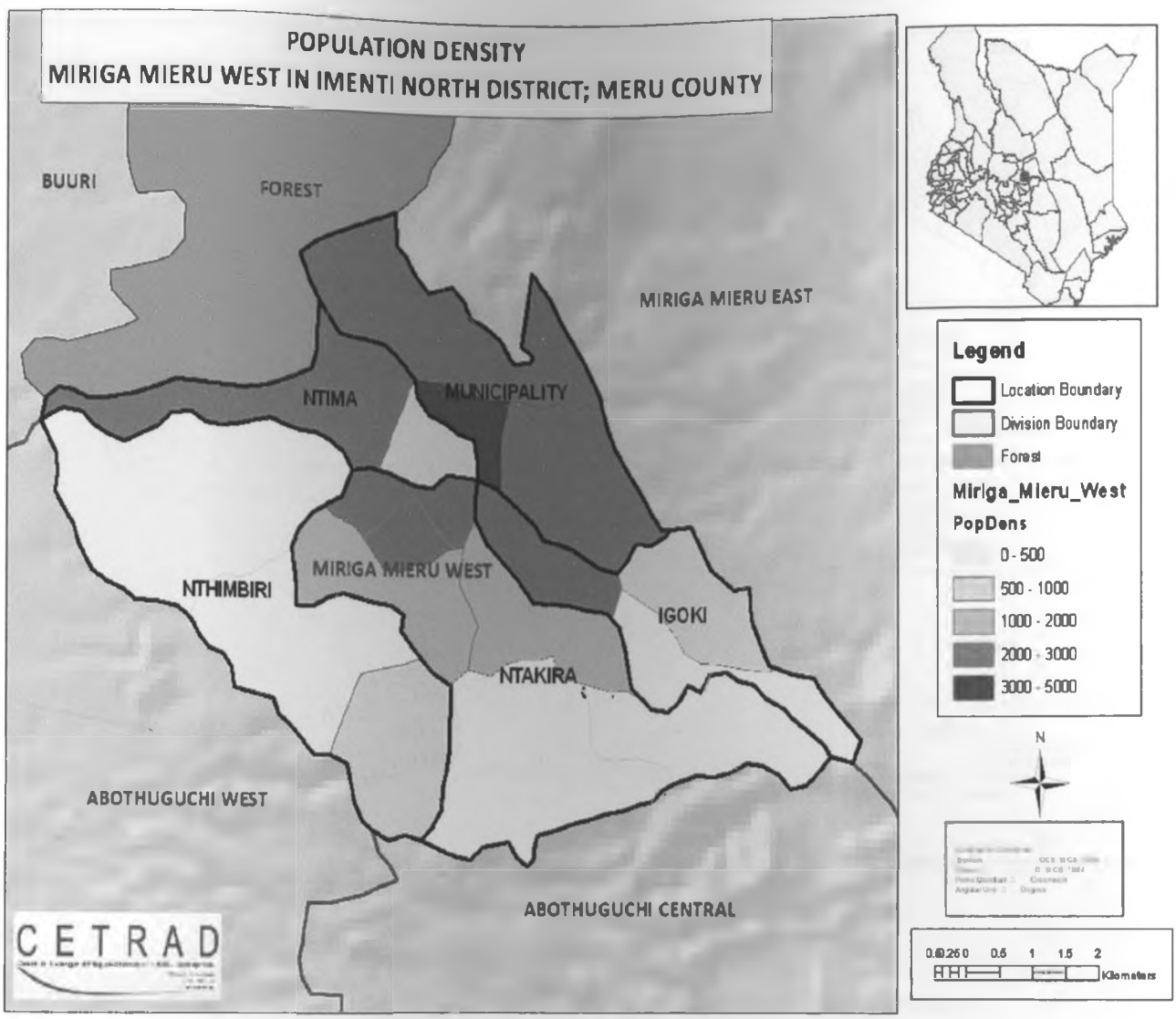



## Appendix V: Study Area Map

A Map of Imenti North District showing Miriga Mieru West Division

Shaded in green.

Source: Author's Generation using CETRAD GIS Data (Kenya Bill of statistics, 2009)

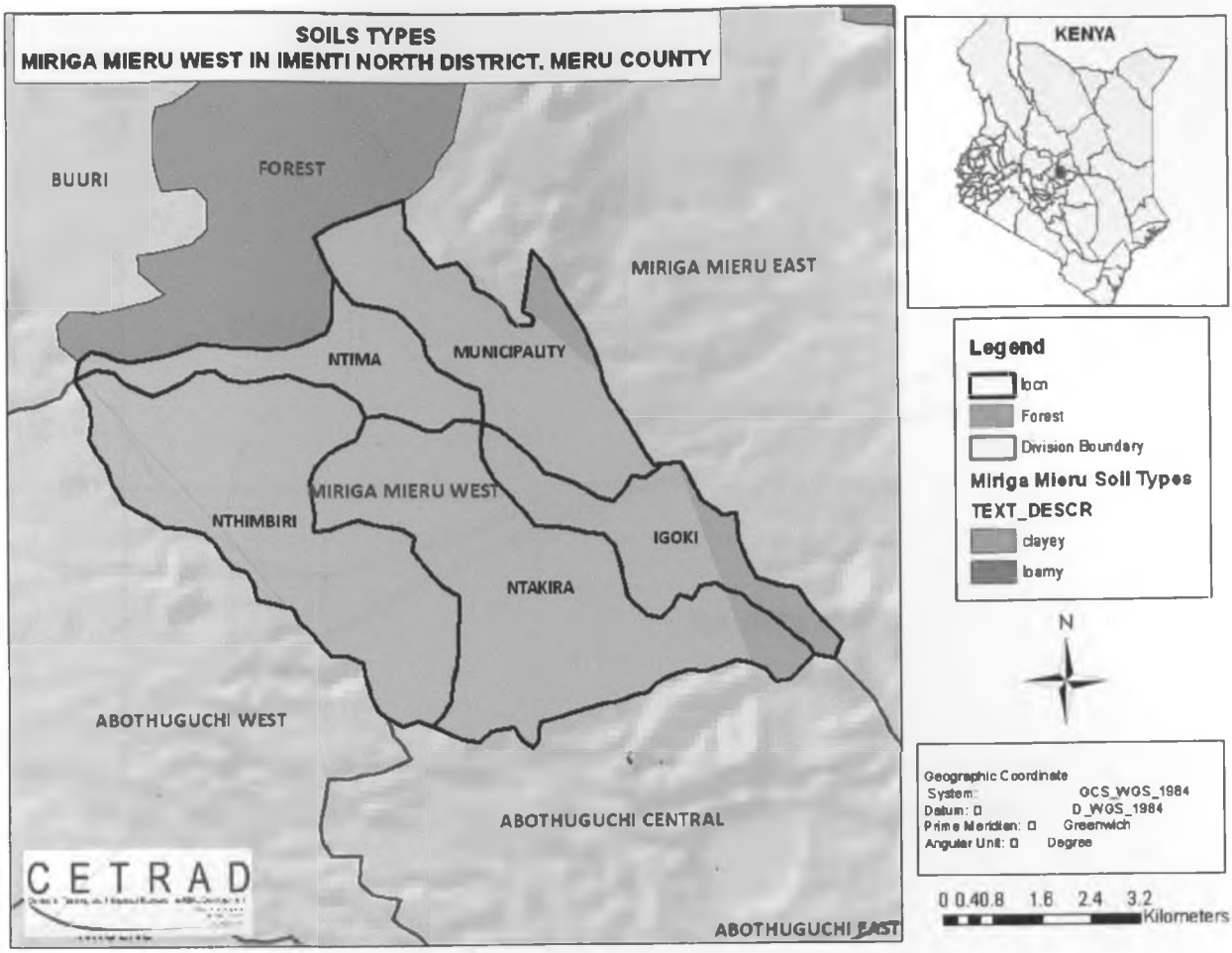



## Appendix VI: Population map

A Map of Imenti North District showing Miriga Mieru West Division

Population density and spread.

Source: Author's Generation using CETRAD GIS Data (Kenya Bill of statistics, 2009)

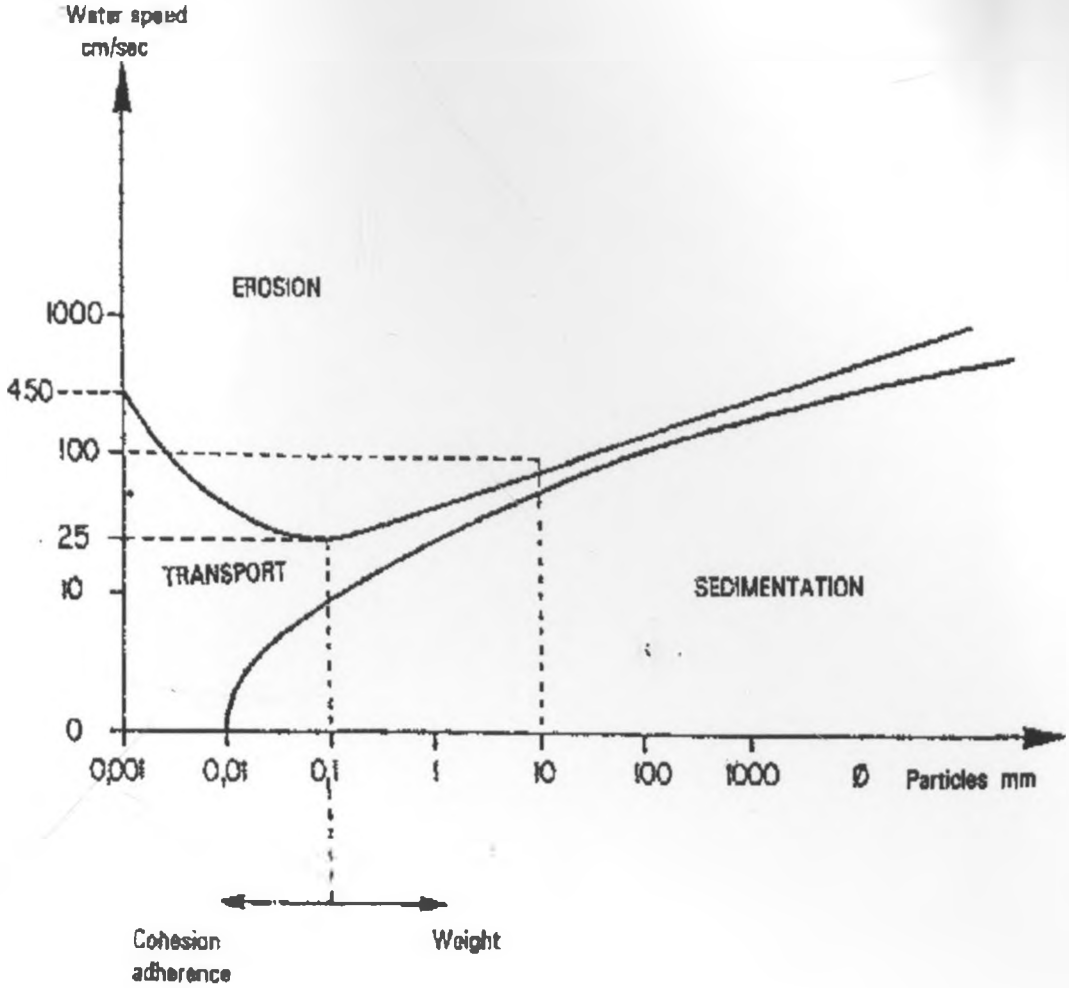



## Appendix VII: Soils types Map

A Map of Imenti North District showing Miriga Mieru West Division

Soils types.

Source: Author's Generation using CETRAD GIS Data (Kenya Bill of statistics, 2009)




**Appendix VIII**: Hjulström's diagram of soil Erodibility
(Roose, 1996)