

# **KAMPALA INTERNATIONAL UNIVERSITY**

**THE ROLE OF RURAL COMMUNITIES IN SOIL CONSERVATION:  
A CASE STUDY OF NYAMIRA DISTRICT, KENYA**

**PREPARED BY:**

**OTEKI N. LINDA  
BEM/5244/41/DF**

**SUPERVISOR: DR.ATEENYI TWAHA ALI BASAMBA**

**A RESEARCH REPORT SUBMITTED TO THE FACULTY OF SOCIAL SCIENCES IN  
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR AWARD OF THE DEGREE  
OF BACHELOR OF SCIENCE IN ENVIRONMENTAL MANAGEMENT OF KAMPALA  
INTERNATIONAL UNIVERSITY**

**JUNE 2007**

## ABSTRACT

Accelerated soil erosion is one of the major constraints to agriculture. The objectives of this study were to find out the; the human activities causing soil degradation in the study area, to find out the conservation measures used by the communities and the level of awareness on soil conservation. Methods used included interviews, observation and photography as well as questionnaires.

These associated activities have resulted in over grazing, erosion and even loss of soil fertility.

The activities were found out to be cattle keeping, cultivation on slopes and stone quarrying which have led to overgrazing and soil erosion.

Conservation measures by the community were found out to be strip farming, fallowing, mixed cropping, terracing, addition of manure and planting trees.

Conclusions made were soil conservation is used but can't apply because crop residues are regarded as feed for livestock while mulching is laborious. On the other hand low yields in the area are because of the limited amount of moisture available. There is need to have new techniques same as traditional practices which are easy to understand, apply and have low inputs.

Recommendations were that farmers should be encouraged to divert water from external catchments into their farms, cultivate on places with inflow from external catchments especially in flat lands. Considerable use of structures as exposed to vegetation should be applied as well as, bare fallows.

## DECLARATION

I **Oteki N.Linda** solemnly declare that this research work is original in its form and presented by me and has never been presented to any institution of learning for any award.

Signed.....*akeboke*.....

**Oteki N.Linda**

Date of submission.....*16<sup>th</sup>, 07, 07*.....

## APPROVAL

This is to certify that this Research Report of **Oteki N. Linda** has been carried out on the Role of Rural Communities in Soil Conservation. A case study of Nyamira District, Kenya.

She has been under my supervision and the Report is now ready for submission to the Board of Kampala International University with due approval.

Signature:.....

**Dr.Twaha Ali Basamba**

Supervisor

Date of Consent.....17.2.2007

## DEDICATION

This Research Report is dedicated to my mother **Mrs. Jane Mwangi** whose endless efforts, encouragement, support and guidance have been very important in the production of this Report and the completion of the course in general.

I also dedicate it to my grandfather, the late **Joseph Orina** whose dream was to see all the members of his family study and prosper.

## ACKNOWLEDGEMENT

My sincere thanks go to my parents **Mr. and Mrs. Oteki** for the financial support they have given me during the Research and the entire time of study and for the guidance and accepting to miss me while I was away for study.

Much gratitude to **Dr. Twaha**, my Supervisor whose tireless guidance and positive criticism have enabled me to produce this Report.

I also thank my lecturers **Ms. Anne Tumushabe, Mr. Orishaba Ammon** and **Mrs. Betty Abong'o** for their efforts in availing me the precious knowledge.

My sincere gratitude goes to my family members who accepted to miss my company while I was away for a long time to pursue my career. Much thanks to brother **Eliud Onyancha**, sisters **Evelyn Kemunto, Nelly Gesare, Jacinta Kwamboka** and dear one **Elphira Kerubo**.

I acknowledge the wonderful support from **Mr. Atuhurire Samuel (Sammy)** for being both a friend and a helping hand in the production of this Report. My appreciation goes to **Mr. Muhanguzi Ronald** for accepting to be my Research Assistant while I was in the field.

I thank all those who have helped me in one way or another during my time of study and especially in the production of this Research Report. I may not be able to mention all your names but receive my sincere gratitude.

**May God bless you abundantly.**

## TABLE OF CONTENTS

Abstract.....	ii
Declaration.....	iii
Approval.....	iv
Dedication.....	v
Acknowledgement.....	vi
Table of contents.....	vii
List of tables.....	ix
 <b>CHAPTER ONE: INTRODUCTION</b>	
1.1 Background of the study.....	1
1.2 Problem statement.....	1
1.3 Research objectives.....	2
1.4 Research questions.....	3
1.5 Hypothesis.....	3
1.6 Justification of the study.....	3
1.7 Scope of the study.....	3
1.8 Encountered problems.....	3
 <b>CHAPTER TWO: LITERATURE REVIEW</b>	
2.1 Soil degradation in developing countries.....	5
2.2 Human activities causing soil degradation.....	6
2.3 Conservation strategies.....	8
2.4 Community participation.....	10
 <b>CHAPTER THREE: METHODOLOGY</b>	
3.1 Study area.....	12
3.2 Research design.....	12
3.3 Area and population of study.....	12
3.4 Sample selection and size.....	12
3.5 Interviews.....	13

3.6	Observation and photography.....	13
3.7	Questionnaire.....	13
3.8	Data analysis .....	13

**CHAPTER FOUR: RESULTS & DISCUSSION**

4.1	<b>Activities carried by residents.....</b>	14
4.2	Soil degradation in Nyamira district.....	15
4.2.1	Water erosion.....	16
4.2.2	Wind erosion.....	16
4.2.3	Cattle keeping.....	18
4.2.4	Stone quarrying.....	19
4.2.5	Cultivation on slopes.....	19
4.3	<b>Soil conservation strategies.....</b>	20
4.3.1	Strip farming.....	20
4.3.2	Fallowing .....	21
4.3.3	Mixed cropping.....	21
4.3.4	Terracing.....	22
4.3.5	Addition of manure.....	22
4.3.6	Planting trees.....	23
4.4	<b>Community awareness on their role in soil conservation.....</b>	24
4.4.1	Integration.....	24
4.4.2	Conservation farming.....	25

**CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS**

5.1	Conclusion.....	26
5.2	Recommendation.....	27
	<b>References.....</b>	28

**APPENDIX**

i.	Research questionnaire.....	30
ii.	Time schedule.....	33
iii.	Budget.....	34



## LIST OF TABLES

Table 1: Activities carried out by Nyamira district	
Residents.....	14
Table 2: Respondents .....	15
Table 3: Responses on erosion type affecting villages of	
Nyamira district.....	17
Table 4: Conservation activities in Nyamira district.....	24

## **CHAPTER ONE**

### **1.1 Background to the study**

Soil conservation strategies have been in use in the East African region for many decades. Soil conservation technologies have been extensively researched and tested in a wide variety of environments and farming systems (Republic of Kenya, 1998). Soil conservation was however enforced during colonial times more for general environmental protection than as a necessary measure for ensuring sustainable productivity of the natural resource base. Soil conservation embraces erosion control, fertility maintenance, runoff control and moisture conservation (Kilewe, et al., 1993). The subject of soil conservation has also featured so prominently in education training, research and extension services in the east African region including; integration of soil conservation in the broader concept of land or natural resource management and the need for sustainable technologies and strategies for monitoring and assessing the efficiency of the various conservation measures and practices under normal land use conditions. Dry soils have been reclaimed by farmers to conserve them, (Swamonathan, 1973). Although several soil conservation technologies have been developed and promoted, the adoption of many recommended measures is dismissal and soil erosion continues to be a problem hence there is need to determine the social and economic factors that influence the adoption of soil conservation measures (Republic of Kenya, 1998).

### **1.2 Problem statement**

Modern soil and water conservation technologies have been widely documented in various farming systems in Kenya. In spite of this, many Nyamira district rural communities have not adopted these technologies due to the prevailing traditional methods which still cover up the problem though some farmers of recent begun to adopt some of the new

technologies. Soil conservation programmes indicate that the problem of low adoption is often not because of the technology perse, but rather the incompatibility of the technology promoted with the prevailing social economic environment in the farming systems. (Kaswamila ,1995; Samantha, 1996; Semgalawe,1998;Lucila et al.,1999;Jones and (Tengberg,2000) In Nyamira district there is rampant soil degradation due to increased pressure on land resource for agricultural production as a result of high human population growth rates leading to soil erosion. Accelerated soil erosion is one of the major constraints to agricultural production in this area. The cost of this erosion is paid in terms of reduced crop yields, food insufficiency, siltation of water ways, damage of various structures and loss of the land value (Meliyo et al., 2002). This therefore means that there is need to promote soil conservation among the rural communities so as to ensure increased agricultural productivity, food security, farm incomes and eventually reduce poverty.

### **1.3 Research objectives**

#### **General objective**

The general objective of this study was to assess the role of rural communities in soil conservation in Nyamira district in Kenya.

#### **Specific objectives**

The specific objectives of this study were:

- To find out the different human activities causing soil degradation in the area
- To find out the different conservation activities carried out by different community groups in controlling soil degradation.
- To find out the level of awareness of the communities on soil conservation strategies.

#### **1.4 Research questions**

1. What are the human activities that are carried out that cause soil degradation?
2. What are the conservation activities that control soil degradation in the community?
3. What is the level of awareness of the communities on soil conservation?

#### **1.5 Hypothesis**

1. Different human activities carried out by the people of the communities' cause soil degradation.
2. Farmers use various methods in trying to control soil degradation.

#### **1.6 Justification of the study**

Soil degradation is a common problem in different rural areas where people depend on agriculture as the sole way of earning a living. There are various causes of soil degradation most of which are initiated by farmers and others occur naturally. Most of these degraded soils do not easily recover fertility and end up causing poor yields to farmers. What is needed is the awareness on the need and means of conserving these soils to raise the crop yield of the farmers. The government needs to formulate policies which can help farmers in conserving the soil.

#### **1.7 Scope of the study**

The research was carried out in Nyamira district among the many districts that practice farming as the main activity. The selected areas were those mainly involved in farming which are basically rural communities.

#### **1.8 Problems encountered**

- Financial limitation due to the fact that the local people are not exposed to research and hence expected money before giving information.
- Impassible roads to the area of study
- Respondents did not return some of the questionnaires.

In solving the above problems the researcher did the following;

- Finances were limited and this made the researcher to get financial assistance from the parents
- The researcher had to go to the areas of study early in the morning to avoid being caught up with rain which could make the roads impassible.
- Since the researcher was using various methods in collecting data, she decided to use the few questionnaires returned together with the other methods to increase on the reliability of data.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Soil degradation in developing countries

If we accept the argument that soil conservation must be cost-effective to be acceptable to the farmer, then the low value of production from semi-arid soils means that only cheap and simple solutions are appropriate. On a fertile soil with good rainfall it may be sensible to invest a lot of labour or money in sophisticated schemes for controlling the run-off, but not in semi-arid areas with low and unreliable yields. It follows that attempts to eliminate soil erosion completely may be unrealistic, and that some level of erosion may have to be accepted, and also some risk of soil conservation measures failing. An example of a realistic approach to the risk of failure is the flood diversion dams built in the People's Democratic Republic of Yemen for spate irrigation schemes. Each end of the diversion is built of stone, or nowadays concrete, with a simple earth centre section. It is accepted that the earth section will be destroyed by big floods but it is cheap to repair or replace (Thomas, 1982). To upgrade the design and construction so that they could withstand the 25-year flood would increase the construction effort beyond what the farmers can provide. This same approach should be applied to all mechanical conservation programmes in semi-arid areas of Kenya and Nyamira district in particular.

Most of the developing countries are faced with the twin problem of increasing population and dwindling soil resources. This calls for appropriate soil conservation measures. Likewise, El-swaify et al (1982) have shown that drainage basins of India and South America have extremely high erosion values. Hence it is necessary to minimize or control runoff and soil loss from various lands. Extensive soil erosion is most

chronic in soil degradation such as sheet, rills and gullies. Out of 150m ha, 69ha are reported to be in the critical stage of deterioration (NCA, 1976).It is estimated that total annual production loss is associated with soil degradation (Anonymous, 1972).It has also been reported that soils are degraded annually which carry 8.4m tones of major plant nutrients (Swamonathan, 1973).Dry soils have been reclaimed by farmers to conserve them.

Soil exhaustion and depletion are usual phenomena in many developing countries of the world, where population growth and the increasing pressure on land, that modern farm technology is bringing about, cause a breakdown of the traditional farming system. Salinity-alkalinity is a limiting factor in respect of the fertility in many countries particularly where food is grown under irrigated conditions in the arid and semi arid regions of the developing countries (Yadav, 1977).The flat to nearly-level surfaces and saucer like depressions make the movement of surface water sluggish leading to accumulation of raw water resulting in water logging. These soils are soaked or saturated with water. This is according to the study on Kenyan arable lands (Framji, 1974). Conserving the soil that all the rain infiltrates can be expected to raise crop yields. It has been observed that in semi-arid Kenya, if run-off of 10% annual precipitation is reduced to zero, maize yield can be expected to rise by about 25% and grass by about 16%(Gicheru, 2000).According to Framji (1974) rural areas of Kenya, experience soil erosion due to their cultivation on slopes. This is more evident in the highlands for example, Kericho, Nandi, Nyamira and others.

## **2.2 Human activities causing soil degradation**

While working in the North Eastern part of Kenya, (Onyancha, 1992) found out that soil erosion was one of the major causes of soil degradation. Further in his work he learnt that this was caused by

uncontrolled cutting down of trees, overgrazing and bush burning. Elsewhere, (Carlton, 1980) learnt that different methods of farming could be possible causes of soil degradation. According to him these included, shifting cultivation, mono-cropping and overgrazing. In communal lands, severe loss of soil is prevalent on such lands due to overgrazing, destruction of vegetation, soil disturbance on stock routes and lack of incentives for investment in conservation practices. Overgrazing has been shown to be very difficult to implement in communities where livestock numbers determine social and food security of the family (Gicheru, 1997). If a farmer tries to grow the same crop year after year, he quickly exhausts it (Critchley, 1980). This exhaustion brings on the loss of crumb structures. The exhaustion leads to two things. First of all the crops grown get smaller because the plant food available lessens. Secondly, once soil erosion has taken away the better top soil, the plants find it more difficult to grow.

According to Wickaman (1992), a piece of land made to support too many cattle is prone to erosion. The animals eat away so hard at the grass that it has a struggle to keep alive. Sheep and goat are the worst as they eat the grass back to the ground. Some of the grass dies off and particularly at the end of a dry season, bare patches are attacked by erosion and the better top soil is once again removed. Once the top soil has gone, the grass finds it hard to re-establish (Kondoa, 1999).

Gicheru (2000) states that the major cause of soil degradation is soil erosion, which is a natural process made worse by man. In many cases erosion is due to the keeping of too many cattle, because cattle are regarded as a sign of wealth and importance. In some areas of East Africa, overcropping is another cause of soil degradation because the land has to be used over and over again without being given a rest. Soil erosion is also enhanced by the steepness of some slopes (Kinama, 2001).



Soils are mostly poor in humid climates on account of excessive leaching, in semi arid and arid climates due to salt incrustation and in subsistence intensive grain farming on account of lack of restorative crops in crop-sequence (Cappock, 1971). Soil exhaustion results rapidly from excessive population pressure unenlightened farming practices and the excessively liberal and therefore dangerous doctrine of production at the lowest investment of soil capital.

According to an estimate, half of the earth's forest has disappeared since the beginning of agriculture. Trees which regulate the downstream flow of water, help in control of erosion (Gachene, 1990). He further explains that with such a deforestation there is erosion of soil and hence loss of soil fertility. Irrigation is certainly required for agriculture. However unskilled irrigation can cause serious problems like salinization and water logging (Kondoa, 1999). Water logging turns a healthy land into a wet desert.

### **2.3 Conservation strategies**

Swamonathan (1973) found out that dry soils have been reclaimed by farmers to conserve them. Experience in Machakos shows that farmers have diverted water from external catchments into their farms in order to increase water availability for soils. (Kinama, 1991). Critchley (1984) while working in Baringo district found out that farmers cultivate where there is inflow from external catchments. There has been considerable emphasis on the use of structures as opposed to vegetative and water conservation in East Africa (Gachere, 1989). Although bare fallow can be used in certain circumstances to conserve soil moisture, soil conservation is also enhanced where the surface is covered by vegetation and is free from compaction. Maintenance of vegetation cover and good agronomic practices should therefore be the first priority of attack in creating sustainable soil conservation (Pereira, 1967). Hedgerows of perennial crops such as pigeon peas and contour strips of fodder grasses could however

provide economically sustainable solution to soil erosion control in both humid and arid regions (Francisco, 1998). In Thailand soil conservation using agronomic practices reduced losses. Tillage technologies have been shown to reduce soil erosion and to conserve soil moisture Pereira et al., (1967).

The fact that a soil becomes poorer if constantly cultivated has long been recognized by farmers in east Africa. Methods of cultivation have made allowances for it (Dickens, 1990). In south east Tanzania the Makonde have maintained the fertility of their soil by thicket rotation. This changing of crops helps maintain the soil fertility. Conditioning of soil to make it resistant to detachment and transportation and more absorptive can help in conserving it. (Gicheru, 2000). He further notes that covering the soil with trees and grass to protect them from rain and wind can help reduce soil erosion by slowing down run-off and wind. One way to reduce salinization of soil is to flush salts by applying much more irrigation but cautiously to avoid water logging.

In areas of heavy rainfall, loss of nutrients through leaching can be efficiently offset only by heavy inputs of lime and fertilizers which however places a considerable strain on farmers' resources (Cappock, 1971). By focusing attention on crop agronomy it is possible to arrive at some sound soil-plant relationships, on the basis of which one can get to know the physical suitability of an area for a particular crop. Moreover, such knowledge may be useful for careful soil management, agricultural development and future orientation (Buckaman and Brady, 1969).

Farming on a slope is well established in Bokiambori flat land (Swaminathan, 1982). Cultivations and planting are done on a gentle gradient, sometimes together with graded channel terraces. This encourages infiltration but permits surplus run-off at low velocities. Sometimes this may be combined with simple practices to encourage infiltration such as returning crop residues. This seldom provides a

complete solution because of the problem of disposal of the surface run-off when it does occur.

Successful use of mulching in the semi-arid areas of Nyamira was reported by Stuart et al. (1998). Trials of different materials and amounts are reported from Naivasha (Hilton), and from the dry savanna of northern Kenya.

Timeliness of farming operations is always important, particularly where the rainfall is erratic, and yields can be dramatically affected by planting or cultivating at the right time. Common problems are having to wait for rain to soften the ground because it is too hard to plough when dry, and perhaps then not being able to plant because the ground is too wet. The essence of Farming Systems Research is to look at the whole farming operation to identify the constraints or bottle-necks before starting component research on parts of the system.

#### **2.4 Community participation in soil conservation**

Otul (1990) found out that farmers lack knowledge on proper soil conservation. Raymond (1986) found out that farmers have a lot of indigenous knowledge which they were not able to apply well in their conservation of soil and hence needed guidance. Incentives by the government can play a big role in ensuring that the farmers put into practice proper soil conservation methods. Kagemi (1991) explained that farmers feel there is need for community participation in ensuring fertility of soils is kept. Soil conservation practices in many farming areas especially where badly eroded lands and even gullies have been reclaimed for production by the farmers have led to visible benefits, Kilewe et al., (1993).

According to Meliyo et al., (2002), involvement in off farm activities, land tenure, location of the fields and type of crops grown by the community are the major factors that influence soil conservation practices. Also flexible soil and water conservation measures to cater for different farm patterns and participatory soil and water catchments or watershed level than at individual farmer's field.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Study area**

Nyamira district lies between latitudes 4 degrees 22' and 5 degrees 09's in Nyanza province, western part of Kenya. Different agro-ecological zones can be distinguished in Nyamira district, the highlands and lowlands. The district is neighbored by Kisii central and Kisii south which are known to be commercial areas. It has steep slopes of up to 60% and medium mountains with an annual average amount ranging from 900 to 1700 which is usually bimodal. The long rain season is from March to May and the short rain season from September to November. The average temperature ranges between 20 to 25 degrees with the minimum occurring in July and the maximum in February. Cash crops in this area include coffee and tea. Farming is Marjory for home consumption. There are few commercial and administrative units located at the headquarters.

#### **3.2 Research design**

During field work, both quantitative and qualitative methods were used to collect data.

#### **3.3 Area and population of study**

The research was carried out in Nyamira district. A district being a large area that could not be covered by the researcher, 6 villages that practice agriculture widely were used to represent the bigger district.

#### **3.4 Sample selection and size**

The researcher selected 60 people whom she gave questionnaires to. The number involved leaders, men, women, youth and children to increase on the reliability of the data.

Methods used included:

### **3.5 Interviews**

Repetitive sampling for interviewing various individuals was done. The interview was random. The advantage was that immediate answers were acquired which were relatively accurate and consistent. The interview was conducted in an informal manner.

### **3.6 Observation and photography**

Observation of various areas was done e.g. lands that have been affected by soil erosion. The method was important in evaluating the efforts by farmers to conserve soil.

### **3.7 Questionnaire**

There was use of questionnaire formats to gather data from farmers of the rural communities in Nyamira district.

### **3.8 Data analysis**

Data collected was edited, coded and entered into an Excel worksheet. Statistical analysis was done using the SPSS (Statistical Package for Social Statistics) software to generate information and percentages which was then summarized into appropriate tables.

## CHAPTER FOUR

### 4.0 Results and Discussion

#### 4.1 Activities carried out by residents of Nyamira parishes

Cultivation and cattle keeping and the main activities in the study area (Table 1), brick making and charcoal burning are the other activities from which people earn an income.

It is important to note that most of the incomes earning activities are carried out in gender groups; women practice home pottery, while men carry out brick making, quarrying and charcoal burning.

Table 1: **Activities carried out by Nyamira district residents**

Activities	Number of people	Percentage (%)
Cattle keeping	12	20
Cultivating	20	<del>33.33</del> 33
Brick making	10	<del>16.67</del> 17
Charcoal burning	8	<del>13.33</del> 13
Stone quarrying	10	<del>16.67</del> 17
Total	60	100

## RESPONDENTS

Table 2:

### No of respondents

Villages	Group respondents per village	Group number per village	Total number
1.Bokimori,	Village		
2.Bogesinsi,	leaders-	2	12
3.Bokiambari,	Men-	3	18
4.Bombo,	Women-	2	12
5.Nyamaiya and	Youth-	2	12
6.Rangenyoy	Children-	1	6
<b>Total</b>		<b>10</b>	<b>60</b>

## 4.2 SOIL DEGRADATION IN NYAMIRA DISTRICT

The Researcher found out that major challenges of soil erosion remain in the East African communal lands, Nyamira inclusive.

Severe loss of both water and soil is present on such lands due to overgrazing, destruction of vegetation, soil disturbance on stock routes and lack of incentives for investment in conservation practices.

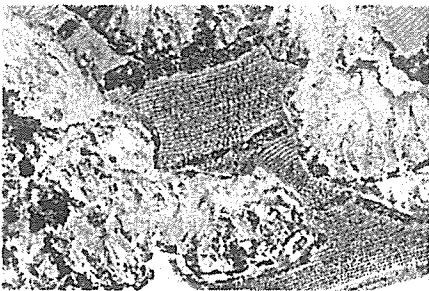
Controlled grazing has been shown to be effective but very difficult to implement especially in communities where livestock numbers determine social and food security of the family according to the community leaders interviewed. However, this was not evident to be a major problem in the area because the farmers practice mixed farming (both cattle keeping and cultivation).



#### 4.2.1 Water erosion

Water erosion is rampant in the semi arid lands of Nyamira district where they suffer severe rainfall erosion often more than their neighbor villages in the humid tropics. These areas like some parts of Bombo receive higher erosive capacity rainfall.

The most parts to be affected by water erosion is in hilly areas like Nkora, Mageri, Etono, Kioge, and Nyamaiya high sloping lands.



*(Plate 1)*

An erodible soil devastated by water erosion in Motobo

#### 4.2.2 Wind erosion

Wind erosion is a more serious problem though not a big part of Nyamira district but in some semi and parts where there is overgrazing. This is according to respondents because of two factors:

- a) The dry lands have scarily vegetation and yet animals graze on them. This exposes the soil to the drag (shear) forces of wind, whose strength increase with increase in wind fetch, with minimal or no interruption by obstacles on the surface (wind breaks) normally provided by vegetation cover.
- b) The soil surface in dry lands is normally dry thereby promoting the chances of the soil particles being eroded and entrained by the wind erosive forces.



*Plate 2; effects of wind erosion due to deforestation on kioge lands*

**Table 2: Responses on erosion type affecting villages of Nyamira district**

<b>Village</b>	<b>Water erosion percentage</b>	<b>Wind erosion percentage</b>	<b>Respondents to water erosion</b>	<b>Respondents to wind erosion</b>
Bokimori	40	60	4	6
Bogensisi	20	80	2	8
Bokiambari	50	50	5	5
Bombo	70	30	7	3
Nyamaiya	80	20	8	2
Rangeyo	40	60	4	6

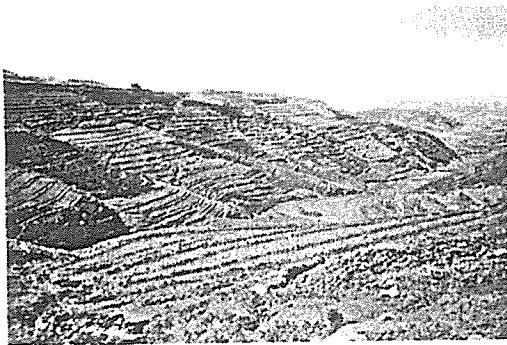
The lower rainfall in drier areas compared with that in humid climates does not mean a corresponding low level of soil erosion by water. Indeed rainfall erosion is high in Nyamira district areas. According to respondents, this is partly because the rainfall in the area has a high proportion of convective thunderstorm rain of high intensity and high erosive power. It is also because there is poor protective vegetative cover, especially at the beginning of the rainy season due to over grazing.

Some of the soils in Nyamira are particularly vulnerable, either because they have poor resistance to erosion (high erodibility), or because of their chemical and physical properties. Nyamaiya suffers a particularly high loss of productivity per unit loss of soil. This is in accordance to the response from cultivators in Nyamaiya village who are facing a leaching problem.

### 4.2.3 Cattle keeping

It was learnt by the researcher that farming is the main activity in the area. It is mainly mixed and for home consumption. Nyamira gives a very small percentage of their land as permanent lands for grazing. Some of the land set aside for grazing in the area includes; Ntana, Monyara and Mageri fields which cover a small area. According to the youths of the district sometimes they have to walk long distances along the roads in search of pasture. Few farmers have managed to plant fodder for their animals. This is sufficiently less in comparison to the demand. The result is overgrazing on fallow, uncultivated and forest lands. The reduction on ground vegetation causes soil erosion, gradual depletion of soil organisms and ultimately the land is transformed into wasteland. Cattle keeping were observed as the major activity in Nyamusi where the soils are not very fertile to meet the needs of the community. This means that they have to depend on cattle keeping more than cultivation for their survival. According to elder Mong'are, each homestead needs a good number of herds to sustain itself in the area

This is evidenced on the plate showing the effect of overgrazing on the land of Nyamusi where cattle keeping is the main activity. The land is almost bare exposing it to more soil erosion.

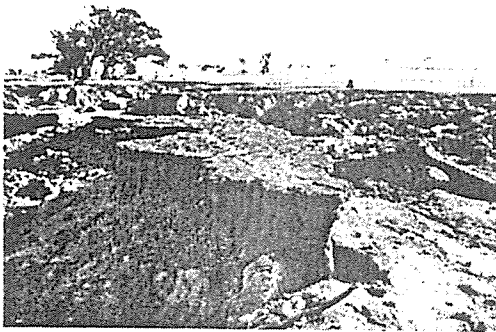


*Plate 3*

Rill erosion in Nyamusi

#### 4.2.4 Stone quarrying

This is another economic activity that was evident in Rangenyo area of Nyamira district. According to Chief Monari of Rangenyo village, men mine the stones leaving the chopping of the stones to women, youth and in rare cases children. The activity is so intensive because most of the residents look at it as a huge income earner. This has an effect on the soil in the case that when the area is abandoned, it leads to subsidence of land thus making the whole area big depression and it becomes a waste land.



*Plate 4 showing effects of stone quarrying on Rangenyo lands*

#### 4.2.5 Cultivation on slopes

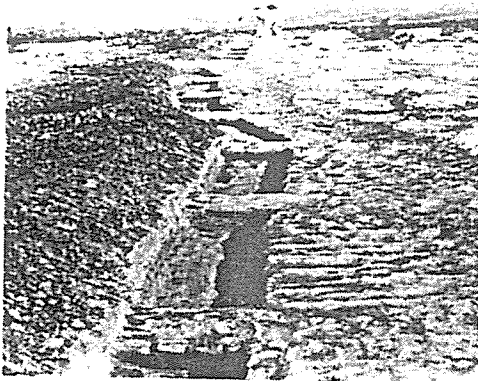
According to respondents in hilly areas like Nyamaiya, there is serious soil erosion in Nyamira district because of its topography. “The ever increasing population needs more land for agriculture yet the available land can not meet the needs of the population” said Mzee Nyarang’o, Nyamaiya village leader. This results into the cultivation on steep slopes. It therefore requires skilled farming to hold the soil on the land, something that is not possible because maize the main food crop is noted for giving little protection to the soil.



*Plate 5: effects of cultivation on slopes as observed on Etono area.*

### 4.3 Soil Conservation

There are always strong links between measures for soil conservation and measures for water conservation, and this applies equally in semi-arid areas of Nyamira district. Many measures are directed primarily to one or the other, but most contain an element of both. Reduction of surface runoff by structures or by changes in land management will also help to reduce erosion. Similarly, reducing erosion will usually involve preventing splash erosion, or formation of crusts, or breakdown of structure, all of which will increase infiltration, and so help the water conservation.



*Plate (C) A water conservation trench constructed on the gentle slope as a water catchment method to a reservoir.*

#### 4.3.1 STRIP CROPPING

Strip cropping is most useful on gentle slopes of Nyamiraiya, where it has reduced erosion to acceptable levels without any banks or drains. This is an act of growing crops in a strip on sloping areas to hold soil particles from being washed away by running water from high and steep slopes. The residents of Bombo were found to be growing millet and sorghum as shields in their strip farming method.

The Rotation method has been normally used in order to maintain the soils nutrients and crop holding capacity in Nyamira district hilly areas which include; Nkora, Kioge and Mageri. The objective is to improve fertility by the use of legumes or to help control pest or disease. In the dry parts of Bogesinsi a successful practice is to alternate a cereal crop with a free seeding self-regenerating annual forage legume such as subterranean clover.

#### 4.3.4 Terracing

Of the types of terraces, few have widespread application in dry areas in the district. Level terraces have been appropriate where irrigation is available, or intermittent level terraces used for run-off farming as described in Fanya juu terraces which offers a way of achieving level terraces by limited input of labour over a period of time. Contour bunds have been useful because of the dual purpose of conserving both soil and water in highland areas of Nyamaiya village.

There have also been circumstances where a combination of shallow soils with limited storage capacity, and heavy rain, results in frequent surface run-off which calls for a system of graded channel terraces, either without storage or with some storage and a designed overflow especially in the Nyamira flat lands. The problem they are experiencing is that any such system is expensive in relation to the productivity of the land, and it has become difficult to maintain grassed waterways as disposal channels when rainfall is limited and unreliable.



*Plate 7: terraces constructed to avoid erosion on Bombo*

#### 4.3.5 Addition of Manure

Nyamira district is a land of cultivation and animal keeping.

All the bi-products of farming act as manure which maintain the soil fertility and soil texture. Farmers on slope lands and flat areas bury plants remains in the soil and even apply cow dung and urine as manure which are highly nutritious. In semi arid areas the plant and animal

remains help the soil to maintain water catchment levels and ability to hold the plant growth.

As the populations grow in Nyamira district and the average arable land holding per family diminishes, farmers have become increasingly aware of the need to maintain their farms in optimal productive condition.

Farmers in the district's more densely populated areas have devoted considerable effort and resources to soil conservation, especially on lands devoted to commercial crops. Such conservation measures have been maintained through continuous investment of labour.

#### **4.3.6 Planting trees**

Tree planting has not only emphasized in the area for rain formation, also trees have helped in holding the soil together not be eroded by flowing water from highlands.

Trees have been planned on slopes of Nkora, Mageri, Etono and Kioge hills where erosion has been of great danger.

Also trees have been planted in the flat lands in semi and grazing areas where overgrazing has hit a maximum, leaving bare soils to be exposed to both water and wind erosion. In some parts of Bombo village, tree planting has worked because it has helped in maintenance of a considerate green grass level since water catchment has been maintained by trees planted in 2000 when the area put in action the government call of tree planting.

There are no universal conservation practices that work everywhere. Planning soil conservation is like having a large array of techniques and practices set out each in a separate pigeonhole. The object of planning soil conservation is to make up a good farming base.

**Table 3: Conservation activities in villages of Nyamira district**

<b>Conservation activity</b>	<b>Respondents</b>
Strip cropping	6
Fallowing	5
Mixed cropping	14
Terracing	13
Addition of manure	9
Planting trees	13
<b>Total</b>	<b>60</b>

#### **4.4 COMMUNITY AWARENESS ON THEIR ROLE IN SOIL CONSERVATION**

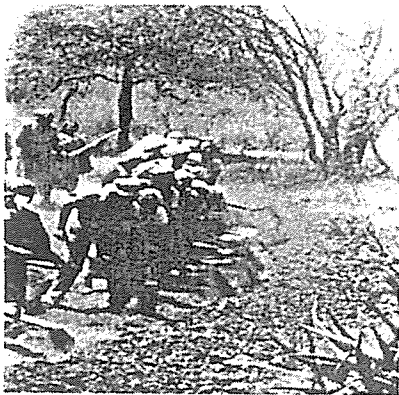
##### **4.4.1 Integration**

The approach by farmers in Nyamira district especially in Nyamaiya and Bombo rural areas is that they have not adopted use of mechanical works and structures in soil conservation programmes due to the steep sloping surfaces in the area. Also, the researcher learnt that they have moved towards the view that the only effective programmes are those which have the full support of the people (communal based). The subsistence farmer cannot afford to respond to emotional appeals to care for the soil, and this means that conservation measures have had visible short-term benefits to farmers. For the subsistence farmers in the area, the benefit they have most appreciated are increased yields per unit of land, or perhaps better production per unit of labour, or perhaps improved reliability of yield.

The idea of working together in groups on tasks which require a big labour force is well-established in many parts of the district, particularly for planting or harvesting. The practice has been successfully extended to conservation works. The advantages according to village leaders are:



- A village group can tackle jobs too big for an individual or family;
- It generates a sense of community care for the land
- Work groups are a good forum for extension workers and have encouraged improved farming methods.



PS:  
Community members working together

#### **4.4.2 Conservation farming**

Like conservation tillage, conservation farming has covered many different farming techniques used by farmers in the district. It includes any farming practice which has improved yield, or reliability, or decreases the inputs of labor or anything else leading towards improved land husbandry, which is the foundation of good soil conservation in commercial farming areas in the district.

There is a long history of traditional farming and soil conservation practices in Nyamira district which have been tested and developed locally over periods of time which are long enough to include all the likely variations of climate. These traditional practices have given the best long-term results, bearing in mind that the farmer's interpretation of 'best' has been based on reliability rather than maximum yield. But some dry areas in the district are changing rapidly, and the traditional patterns have yielded a lot. There is also the point that the agriculturalists in the area still lack the recipe for certain success; and you cannot require farmers to adopt new practices that are only 50 percent successful."

## **5.2 Recommendations**

1. Farmers should divert water from external catchment into their farms in order to increase water availability for soils especially in drier areas to maintain crops in dry seasons.
2. Farmers should cultivate in areas where there is inflow from external catchments especially in plains or flat lands of the district.
3. There should be considerable emphasis on the use of structures as opposed to vegetative and water conservation in the area.
4. Bare fallows should be used in certain circumstances to consume soil moisture. Soil conservation is further enhanced where the surface is covered by vegetation and free from competition.
5. The vegetation cover and good agronomic practice are supposed to be given the first priority in creating sustainable soil conservation. This should be through further emphasis on tree planting and elephant grass for soil cover and animal fodder, respectively.
6. There should be more government support and other organizations to help in educating the farmers as well as facilitating them.
7. Ripping or sub-soiling can be beneficial, either to increase the porosity of the soil, or to break a pan which is reducing permeability. Deep placement of fertilizers can also be used to encourage more rooting depth.

## REFERENCES

- African Highland Initiative (AHI). (2000).Annual Report Lushoto, Tanzania.
- Francisco, H.A., (1998): The economics of soil conservation in selected ASIALAND Management of sloping Lands network sites. IBSRAM Issues in sustainable land management no.5.
- Gachene, C.K.K. (1998): Nutrient losses in eroded material from some Kenyan soils. In soil and water conservation in Kenya.proc.of the Third National workshop,Kabete,Nairobi.(Eds)Thomas,D.B.et al.
- Gicheru, P.T. (1997) Water-erosion indicators. In “National Land Degradation Assessment and mapping in Kenya”.UNEP 1997 pp 54-60.
- Hazel, P.B.R. and Norton, R.D. (1986).Mathematical programming for economic analysis in agriculture.
- Kilewe, A.M. (1987). Prediction of erosion rates and the effects of topsoil thickness on soil productivity. PhD Thesis University of Nairobi.
- Pereira, H.C, P.H.Hosegood, and M Dagg (1967).Effects of tied ridges, terraces and grass leys on lateritic soil in Kenya.Expl Agric.3:89-98.
- Republic of Kenya; Soil and Water conservation manual for Kenya.Ed D.B. Thomas 1998; Min of Agriculture, Livestock Development and Marketing.
- Samantha. (1996).Discourse on Land degradation in Uluguru Mountains, Tanzania. Evolution and influences. Journal of Rural studies 12(20:187-199).

Semgalawe, Z.M. (1998). Household Adoption Behavior and Agricultural sustainability in the Northern Mountains of Tanzania. The case of soil conservation in the North Pare and West Usambara Mountains. PhD. Thesis. Wageningen Agricultural University. The Netherlands.

TIP. (2001). Traditional Irrigation and Environmental project. Moshi, Tanzania.

Wickama, J.M and Mowo, J.G. (2001). Indigenous nutrient resources in Tanzania. Managing African soils no.21.

APPENDIX A

**RESEARCH QUESTIONNAIRE**

**SECTION A:**

1. Name of village
2. Age
3. Sex
4. Occupation
5. Educational level:
  - [a] None
  - [b] P1-P3
  - [c] P4-P8
  - [d] Secondary
  - [e] Tertiary
  - [f] Others (specify)

**SECTION B: DIFFERENT ACTIVITIES CARRIED OUT IN RURAL AREAS  
IN NYAMIRA DISTRICT**

6. Do you carry out agriculture in your area?  
Yes   
No

If yes, what type of agriculture do you practice?

- [a] Cultivation
- [b] Cattle keeping
- [c] Mixed

- 7 a) If its cultivation on, which part of the land do you carry it out?
  - i. Hill tops
  - ii. Hill sides
  - iii. Flat lands

[b] Briefly explain how you carry out cultivation

.....

[c] Is there anything you use to improve your yield production?

.....

[d] Do you think such application has any potential damage to the soil?

.....

[e] If yes, explain how?

.....

[f] Which type of cultivation do you carry out?

.....

8. a) for cattle keeping, how many heads of animals do you have?

i. 1-10

ii. 10-50

iii. 50 and above

[b] How do you access water for your animals?

i. Driving them to water sources

ii. From streams in the valleys

iii. Digging out individual wells

[c] What is the main source of pasture for your livestock?

.....

9. Which other activities are carried out in this area?

.....

10. Do you think they can cause soil degradation in the area?

.....

11. If yes, explain how?

.....

**SECTION C: ROLES PLAYED BY DIFFERENT GROUPS IN THE AREA**

12. Are the different activities in your area gender based?

Yes

No

13. If yes, what is your role in cultivation?

.....

14. Which other activities are gender based in the area?

.....

15. What role do different groups play in these activities?

.....

**SECTION D: WHAT THE COMMUNITIES HAVE DONE TO MINIMIZE SOIL DEGRADATION**

16. Have you tried to minimize the causes of soil degradation?

[a]Yes

[b]No

17. If yes, explain how you have done it.

.....

18. If no, why?

.....

19. How have other people done it?

.....

20. Apart from your own initiative, have the following helped in minimizing soil degradation in the area?

[a] Extension agents?

[b] NGO'S

[c] CBO's

[d] Government

THANK YOU

**APPENDIX B**  
**SCHEDULE OF ACTIVITIES 4<sup>TH</sup>-30<sup>TH</sup> JUNE**

ACTIVITY	DATE				
	4 <sup>th</sup> -7 <sup>th</sup>	8 <sup>th</sup> -12 <sup>th</sup>	13 <sup>th</sup> -17 <sup>th</sup>	18 <sup>th</sup> -20 <sup>th</sup>	21 <sup>st</sup> -30 <sup>th</sup>
Familiarizing with the area and local people (Reconnaissance)					
Visiting some of the most affected places and giving out questionnaires					
Interviewing the farmers					
Compiling of results					
Writing of results					
Submission of dissertation					



**APPENDIX C**

**BUDGET**

<b>EXPENSE</b>	<b>AMOUNT (Kshs)</b>
Transport	1000
Accommodation	2000
Food	1500
Stationery	500
Miscellaneous	1500
Total	6500
Source of funding	Self