

**MIXED FARMING AND SOIL DEGRADATION; A CASE STUDY OF NYARUBUYE  
SUB COUNTY KISORO DISTRICT SOUTH WESTERN UGANDA**

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## DECLARATION

I Turinayo Gerald, BEM/10003/81/DU, do declare that the work presented in this dissertation is original and has never been submitted for any academic award or any other purpose.

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## APPROVAL

I certify that this dissertation on the Impact of Mixed Farming on soil in Nyarubuye sub county, kisoro district; south western Uganda was conducted and compiled under my supervision for the partial fulfillment of requirement of the award of degree of bachelors of science in Environmental Management of Kampala International University.

SUPERVISOR

Signed  .....

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Date 26<sup>th</sup> AUG 2011 .....

## DEDICATION

I dedicate this work to my beloved mum UWAYEZU ANGELLA, my brother NSENGA MOSES RUDAHIGWA and friends. Thanks so much for your struggle, sacrifice, love, support and guidance towards completion of the course. May you be rewarded abundantly?  
GOD BLESS YOU

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## LIST OF ABBREVIATION

NGOs	Non Governmental Organizations
NARO	National Agriculture Research Organization
NAADS	National Agriculture Advisory Services
WRI	World Resource Institute
UNEP	United Nations Environmental Programme
UNDP	United Nations Development Programme
FAO	Food Agriculture Organization

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## **ABSTRACT**

The study was undertaken to analyze the relationship between mixed farming and soil degradation in Nyarubuye Sub County. The study objectives included; finding out different mixed farming practices in Nyarubuye Sub County, identify impacts of mixed farming on soil degradation in Nyarubuye Sub County and to analyze the solutions of on how to over come soil degradation. Data was collected basing on the above objectives and each objective was handled after the other. Different mixed faming practices in Nyarubuye Sub County were identified and these included mixed cropping, live stock farming agro forestry though most farmers practiced more than one. On the other hand the impacts these farming practices on soil were identified and were found to be serious. These included soil erosion as a result of over grazing and poor farming methods, soil compaction and soil pollution among others. Different forms of soil degradation in Nyarubuye Sub County due these farming practices were identified and these included soil exhaustion, soil compaction among many. Research results from strategies employed by farmers to overcome the problem of soil degradation were revealed and these included, Afforestation, terracing, mulching. Sensitization was analyzed as an important strategy that can avail farmers with knowledge on soil degradation as a problem and how it can be dealt with. According to findings from the study, the researcher concludes that soil degradation is a serious problem in Nyarubuye Sub County, Uganda, and world at large and from findings and emphasizes use of various strategies effectively to overcome the problem. However the researcher recommends further research on the problem.

# CHAPTER ONE

## INTRODUCTION

### 1.0 Introduction and Background of the Study

Soil degradation is the deterioration of soil through depletion of soil nutrients. It can also be defined as the continuous reduction of soil nutrients. Throughout the history, a fertile soil resource base has been the foundation of agricultural production in Uganda playing an important role in sustaining the population and economy of Uganda. However increase in food production as a result of increase in population has led to soil degradation that is soil can no longer support crop production, pastures for animals? This has been a major problem more especially in steeply sloping areas of Nyarubuye Sub County. Soil degradation is a common problem everywhere and this has decreased food production. On other hand mixed farming refers to growing of crops and rearing of animals.

According to Tivy J. 1993 mixed farming refers to a science business and art of management of biodiversity in situ and cultivated species of plants and rearing of animals in order to fulfill human needs of food fibers, shelter, fuel, drugs and other useful products. He further explains that mixed farming is a synonymous with farming which depend on production of food fodder and industrial organic materials.

According to Brackley M. (1988) soil degradation refers to loss of value, quality of soil. The impacts of soil degradation are reduced quality and quantity of crop production. Soil degradation is also as a result of natural degrading processes which includes drought, climate change, floods. The human factors responsible for soil degradations include poor agricultural practices and policies, poverty population changes, land ownership and political instabilities. Therefore soil degradation is a global phenomenon with great effects.

Longer fallows on hillsides measured rill and interrill (sheet) forms of soil erosion on experimental plots cultivated with sorghum (using smallholder practices) on three adjacent hill slopes near Kabale town (Tukahirwa1995). In 1994 soil losses were 1.4, 38.3, and 19.4 tons/ha/year on the 10%, 25% and 45% slopes. Respectively, and run off was 6.3, 18.4 and 13.8 mm/ha/year. These are very low values in a tropical African context. Low erosion and run off were related to low rainfall erosivity (1049MJ ha/hr/year) (gentle rainfall), very high infiltration

rates (2021 mm/hr and 1637 mm/hr on the 10% and 25% slope respectively), and low soil credibility due to a favorable soil mineralogy, a stable soil structure, and a high organic matter content (5-10%). Aside rainfall and slope, she also found that surface cover (density of sorghum plants) greatly influenced erosion rates. Field observations made by Farley (1996) in Kabale and Kisoro districts largely confirm these findings. While reducing rill and interrill forms of soil erosion at the landscape level, the system of drag-down hoeing on forward sloping terraces appears to severely reduce the physical quality of soils on especially the upper parts of terraces, which constitute a sizeable part of the total cultivated area in Kigezi. Bagoora (1988) measured the incidence of landslides in four areas in one sub-county in Kabale District and concluded that erosion was a serious problem in the area.

Clearly, only some of the changes in land use over the last fifty years can be said to promote or constitute instances of land degradation (here confined to soil erosion and soil nutrient depletion). However, there is little if any hard Evidence to support the assertion that population growth over the last 50 years in Uganda has caused farmers to degrade soils through the effects of diminishing fallow (that depletes nutrients) and inadequate investments in soil conservation.

The increasing population has led to an increase in demand of available land for agriculture activities due to high demand of food for the increasing population. Soil degradation in Uganda and world wide at large Sub has been because of various farming practices which are not sustainable such as use of fertilizers deforestation, wetland and swamp reclamation, over grazing and other related farming activities are the common farming practices in Nyarubuye Sub County.

### **1.1 Conceptual perspective**

Mixed farming is a system of farming in which a farmer conducts different types of farming practices together, on a single farm in a view of increasing his income through different sources. Young A (1997) Mixed farming is the combining of two independent agricultural enterprises on the same farm. Mixed farming practices with the main agricultural practices include poultry farming, dairy farming, intercropping, and sheep rearing agro forestry, among others. On other hand soil degradation is defined as the process by which soil loses nutrients through soil erosion, bush burning, landslides, over grazing and others. All these reduce soil nutrients and leads to decline in soil productivity. Barrow C J (2000).

## **1.2 Statement of the Problem**

Despite various attempts made by the government, Non Governmental Organizations (NGOs) such as National Environment Management Authority (NEMA), National Agricultural Advisory Services (NAADS), National Agricultural Research Organizations (NARO) and other related organizations to stop soil degradation in Nyarubuye sub county, soil degradation has remained a big problem.

Soil degradation has remained one of the threats officially cautioned by the high level of threat panel of the United Nations, the World Resource Institute (WRI), United Nations Environment Program (UNEP), the United Nations Development Programme (UNDP) and World Bank.

However the above problem has been largely due to un sustainable farming methods such as intercropping over cultivation, deforestation over grazing and use of artificial fertilizers in crop farming. Drainage of wetlands on the hand has left most wetlands dry, degraded and exhausted. Therefore it's a combination of the above factors that causes soil degradation. Soil degradation has got the following consequences in Nyarubuye Sub County;

There are several impacts of soil degradation and among them include the following; Reduction in crop production and even the little produced are of poor quality, loss of biodiversity among others.

After identification of factors responsible for soil degradation and consequences of soil degradation it's therefore possible to find out solutions to overcome soil degradation as a problem.

## **1.3 Purpose of the Study**

The purpose of the study is to establish the relationship between mixed farming and soil degradation that is the role of mixed farming in promoting soil degradation in Nyarubuye Sub County.

## **1.4 Objectives of the Study**

- i) To find out different mixed farming practices in Nyarubuye Sub County.
- ii) To identify impacts of mixed farming on soil in Nyarubuye Sub County.
- iii) To suggest the solutions to be put into place to over come soil degradation.



### **1.5 Research Questions**

- i) What are different farming practices found in Nyarubuye Sub County?
- ii) What are the impacts of mixed farming on soil in Nyarubuye Sub County?
- iii) What are the solutions that can be put into place to overcome soil degradation in Nyarubuye Sub County?

### **1.6 Scope of the Study**

The research was carried out in Nyarubuye sub county Kisoro district south western Uganda. It mainly focused on the role of mixed farming in soil degradation. It further pointed out strategies that can be put into place to overcome soil degradation. The research took place from 9<sup>th</sup> May 2011 to 27<sup>th</sup> may 2011 in Nyarubuye sub county, kisoro district south western Uganda.

### **1.7 Significance of the Study**

The study will provide a basis of finding solutions to the existing agricultural and soil degradation problems in Nyarubuye sub county.

It will also formulate strategies that can be used to overcome soil degradation and improve on agriculture production in Nyarubuye Sub County. This will be of great importance to Nyarubuye Sub County community.

The study will be important to the government and Non Governmental Organizations such as National Environment Management Authority (NEMA) to find out management strategies to overcome soil degradation in addition to those ones of a researcher. Therefore it will act as a management tool.

To other researchers, the research will act as a tool to fill the left gaps in their research of similar or related problems.

Finally the study will provide, update literature for academicians more especially in the department of environmental management Kampala international university and other environmental protection organizations which advocates for protection of environment and its component and it will also be used as a bans for further research. This will help a researcher to

fulfill requirements for the degree of bachelors of Science in environment management Kampala International University.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

Literature review attempts a substantial assessment of the relevant literature on the impacts of mixed farming on soil. One reason for a substantial literature review is that it is a form of acknowledgement of work done by others in the selected field. It is also the way of identifying and justifying ones research topic in the context of knowledge available, on mixed farming and soil degradation.

#### **2.1 Mixed farming**

Mixed farming is the combining of two agricultural enterprises on the same farm. It involves growing of crops and rearing of animals. Mixed farming exists in many forms depending on external and internal factors. External factors include weather patterns, market prices, political stability, and technological advancement among others. On other hand internal factors include soil characteristics, composition of the family and farmers capacity to afford different agricultural enterprises.

#### **2.2 Different mixed farming practices**

##### **2.2.1 Food-Fodder Farming**

In this method of mixed farming, the fodder crops are grown along with other crops. Farmers can grow sorghum, pusa, Giant Napier among others as fodder for their cattle along with food crops. It is through this system that availability of high variety of fodder is ensured for dairy cattle while growing crops for production of grains, pulses vegetables, oil and fruits among others.

##### **2.2.2 Intercropping**

This is practice of growing two or more crops in close proximity. The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources that would otherwise not be utilized by a single crop. Examples of intercropping strategies are planting deep-rooted crops with shallow rooted crops, or planting a tall crop with a shorter crop that requires partial shade. The degree of spatial and temporal overlap in the two crops can vary

somewhat, but both requirements must be met for a cropping system to be an intercrop. Numerous types of intercropping, all of which vary the temporal and spatial mixture to some degree, have been identified (FAO and RAPA 1994).

### **2.2.3 Agro forestry**

According to the World Forestry Centre (ICRAF) 1993, “Agroforestry system is a collective name for the land use systems and practices in which woody perennial plants are deliberately integrated with crops (and some times animals) on the same land management unit. The integration can be either in a spatial mixture or in a temporal sequence. There are normally both ecological and economic interactions between woody and non-woody components in Agro forestry. Again in the year 2003, the ICRAF further defined the agro forestry system as - a dynamic, ecology based, natural resources management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels (World Agro forestry Centre, 2003). According to another opinion -

Agro-forestry is sustainable land-management system, which increases the overall yield of the land, combines the production of crops (including tree crops) and forest plants or animals simultaneously or sequentially on the same unit of land and applies management practices that are compatible with the cultural patterns of local population (King and Chandler, 1978)

### **2.3 Soil Degradation**

Soil degradation is on increase world especially in the countries within the tropics. Mismanagement of arable areas by farmers and grazing areas by livestock owners is one of the major causes of soil degradation. More sustainable management of lands would reduce environmental pressures. Conservation tillage that is reduced or no tillage is the key to suitable arable land management as it protects the soil resources, increases the efficiency of water use and of special importance in semi and areas reduces the effects of drought (FAO 1999).

Soil degradation can either be as a result of natural hazard or due to unsuitable land use and inappropriate land management practices. Natural hazards include land topography and climatic factors such as steep slopes frequent floods and tornadoes, blowing of high velocity wind, rains of high intensity, strong leaching in humid regions and drought conditions in dry regions.

Deforestation of fragile land, over cutting of vegetation shifting cultivation, over grazing, unbalanced fertilizer use and non adoption of soil conservation management practices, over pumping of ground water are some of the factors which comes under human intervention resulting in soil erosion. The United Nations Environmental Programme (UNEP).

Farming both causes and suffers environmental degradation. The International Soil Reference and Information Center in the Netherlands estimates that every year 3million ha (7.4million acres) of cropland are affected by erosion, 4 million ha are turned into deserts and 8 million are converted into non agriculture uses Such as homes, high ways shopping centers, factories, reservoirs etc. over the past 50 years. Some 1.9 billion hectares of agricultural land (an area that is now greater than that now in production) have been strongly degraded or deep gullies, severe nutrient depletion, crops grow poorly, restoration is difficult and expensive, while 910 million hectares, about the size of china are moderately degraded, nearly 9 million ha of former crop lands are so degraded that they no longer support any crop growth at all (Cunningham-Saigo 2001). The causes of this extreme degradation vary but farming takes the highest percentage. According to the ISRIC World Soil Information data, 46.4% of soil is experiencing an important decrease in productivity and partially destroyed biological functions. A third of it is in Asia and a fifth is in Africa. 15.1% of soil can no longer be used for farming as its biological functions have been seriously destroyed and it would take large investments to restore them. About 9.3 million ha (0.5%) of soil is irreparably damaged and no longer has any biological function.

Over 50% of soils that have been degraded by deforestation are situated in Asia and 15% are in South America. Deforestation is the main cause of soil degradation in South America (41%), in Asia (40%) and also in Europe (38%), particularly in Central and Oriental European countries.

Overgrazing is the main cause of soil degradation in Africa, 36% of soils in Africa is degraded by overgrazing (50%), in the South Pacific and in Australia (80%), 37% of soils degraded by inappropriate agricultural practices are in Asia. Agriculture is the most common cause of soil degradation in North and Central America (58%) and the second cause of soil degradation in Africa (25%). 50% of the 133 million ha degraded by the overexploitation of vegetation cover for domestic purposes is in Africa. Almost all the soil degraded by industrial pollution is in Europe.

## **2.4 Impacts of mixed farming on soil**

Mixed farming is an agricultural enterprise that involves growing of crops and rearing of animals simultaneously. Mixed farming affects soil negatively depending on farming practices, crops grown and kind animals kept on the farm. According to Lester Brown, a third of all cultivated land is losing its arable layers faster than it is gaining them and this lessens its productivity. Brown noted that one of the factors that can explain the collapse of certain civilizations, like the Mayas, is the erosion of land which leads to less food being produced.

### **2.4.1 Over grazing**

This is a farming practice stocking animals in small plots. Over grazing in patches implying differential selection of plants and live stock results in significant modifications in the ecosystems of arid and semi arid areas. This jeopardizes the stability and conservation of those habitats in the medium and long term in as much as the damage caused to plants and soil seems to be irreversible (Milton et al, 1994).

The semi arid and arid regions of Uganda covering an area of approximately 40,000km<sup>2</sup> whose main activity is extensive cattle breeding on natural grasslands, is at the moment in advanced state of ecological degradation and desertification (Busso, 1997). Originally comprising extensive grasslands with isolated bushes and trees, the landscape currently consist of alternating patches of intensively grazed and lightly or ungrazed patches with bare soil a constant feature (Distel and Barrow C.J 1995) depicted the vegetation dynamics for the area in terms of a state and transition model with grazing history and fire frequency as the main agent responsible for the transition between states.

A mutual, interdependent relationship exists between vegetation and soil changes in vegetation in marginal environments such as the study area give rise to enduring alterations in the soils that are not reversible with short term decreases in the animal land. Beyond a fire disturbance threshold, the probability that deteriorated patches will be able to recuperate their previous and from a production point of view more valuable qualities diminishes strongly. The threshold is determined to some extent by herbivorous activity but to an even greater extent by soil plant interaction (Enger and Smith 2000).

Over grazing is the major disturbance affecting top soil properties in these regions (Green wood et al 1994) causing both the direct effects of trampling and the indirect effect of defoliation? Among the degradation effects induced by over grazing increased bulk density and penetration resistance, higher soil loss from water and wind erosion, changes in pore space distribution and a decrease in soil aggregate, stability and in infiltration rate , Green wood et al (1997). The indirect effect of defoliation not only causes of a reduction in plant cover but also lead, in the long term, to the substitution of vegetation in the grassland. A part from contributing to defoliation, the deterioration of soil properties and changes in botanical composition, grazing can also have a negative effect on root growth (Verkaar, 1988, Vepraskas 1994).

#### **2.4.2 Soil erosion**

Soil erosion is one of the major indicators of soil degradation. Manner et al 1974 explain that land use practices provide variable opportunities for accelerated soil erosion. He stated that some practices are particularly exploitative and disruptive of ecosystems. In this regard factors like social altitudes subsistence economies and technology are very important in accessing the interaction between land and the environment.

Lied (1992) states that intensive cultivation often in unprotected slopes is a common practice in most highland areas of Uganda. As a result soil erosion and water body sedimentation from high rates of hill side soil removal occur. Okello Olenk and Okwel (1990). Therefore highland areas of south western Uganda are the victims of soil erosion. Tukahirwa 1992 reports that accelerated soil erosion hazards have not been assessed comprehensively in Uganda which they attribute to continuous cultivation; reduction in soil fertility reduction in available land per house had soil erosion and drought. UNEP and FAO (1994) states that although the erosion hazard had not been assessed quantitatively in East Africa. It was noted to be a major problem on the steep cultivated slope of hilly areas. Tukahirwa (1992) reports that the soil resources in highlands of Uganda have high potential for agricultural productivity. Over stocking of animals which trample and make soils weaker thus susceptible to erosion agents. Also continuous cultivation of food and cash crops is the major factor responsible for soil erosion in Africa and research shows that agricultural productivity is declining in many parts of Uganda due to soil erosion

### **2.4.3 Soil leaching**

This is defined as the movement of nutrients from upper soil layers to lower soil layer where crop roots can't reach. It is a form of soil degradation that involves loss of soluble substances and colloids from the top layers of soil by percolating precipitation. The rate of leaching increases with rainfall, high temperatures and the removal of protective vegetation. This is attributed to different mixed farming practices such as over grazing and crop farming which leaves soil open to leaching agencies mainly rainfall.(FADNAP 1993)

### **2.4.4 Soil compaction**

This is due to over grazing of heavy animals such as cattle on a piece of land or use of heavy machines in farming. Continuous pressure from heavy machines such as tractors and continuous grazing of animals such as cattle leave soil totally compacted. This causes loss of soil living organisms which assist in breaking of organic matter and its mixing in soil. Compacted soil has small soil pores, less pore continuity and greater strength which don't allow free circulation of air. The soil has fewer spaces that contain air and water needed for plant growth, is less permeable, can store less soil water and is harder for roots to penetrate.

### **2.4.5 Soil pollution**

Use of fertilizers in farming improves and causes soil degradation. Constant use of fertilizers interferes with soil pH which interferes with soil fertility. Continuous use of acidic fertilizers in crop farming changes soil pH to acidity which interferes with production. On the other hand use pesticides in controlling pests, herbicides in weed control among others all contribute to soil pollution.

## **2.5 control measures to soil degradation**

### **2.5.1 Contour ploughing**

This is a farming practice of plowing across a slope following its elevation contour lines. This is a well established agronomic measure that contributes to soil and water conservation. The rows formed control water runoff during rainstorms to prevent soil erosion and allows the water time to settle into the soil. In contour plowing the ruts made by the plow run perpendicular rather than parallel to slopes, reducing on the velocity of water flow.



### **2.5.2 Organic farming**

This is a form of Agriculture that relies on techniques such as crop rotation green manure compost manure and biological pest control to maintain soil productivity. Organic farming excludes or strictly limits the use manufactured fertilizers, pesticides, plant growth regulators such as hormones, livestock antibiotics, food additives and genetically modified organisms.

Organic agricultural methods are internationally regulated and legally enforced by many nations, based in large part of the standards set by the International Federation of Organic Agriculture Movements (IFOAM) as umbrella organization for organic farming organizations established in 1972. Organic agriculture is a production system that sustains the health of soils, ecosystems and general environment (FADNAP 1993)

### **2.5.3 A forestations and reforestation**

A forestation refers to planting of trees or seed in order to transform open land into forest or woodland and reforestation refers involves using native trees restock already existing depleted forests. A forestation and reforestation is the best way of controlling soil erosion on steep slopes (Hamilton. A. C 1984)

In some places, forests need help to re-establish themselves because of environmental factors. For example, once forest cover is destroyed in arid zones, the land may dry and become inhospitable to new tree growth. Other factors include overgrazing by livestock, especially animals such as goats, and over-harvesting of forest resources. Together these may lead to desertification and the loss of topsoil; without soil, forests cannot grow until the long process of soil creation has been completed. In many areas, reforestation is impossible because people are using the land.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.0 Introduction**

This is a procedure that was followed while doing the research. This chapter includes procedure; research design, data collection techniques, sampling methods, sample size, data processing and analysis and data presentation.

#### **3.1 Area of study**

The study was carried out in Nyarubuye sub-county Kisoro district south western Uganda. Kisoro district is boarded by Democratic Republic of Congo in west, Rwanda in the south and the districts of Kabale and Kanungu in the East and North respectively. The area is predominately occupied by Bafumbira and mainly agriculture is their source of food and income.

#### **3.2 Location**

Kisoro district is located in south western region of Uganda and it lies between longitude  $29^{\circ} 35'$  East and  $29^{\circ} 50'$  East Latitude  $1^{\circ} 44'$  and  $1^{\circ} 23'$  south. Nyarubuye Sub County is located in the west of the district. According to 1991 population and housing census the district has an area of  $729.7\text{km}^2$  with 14 sub counties and a town council.

#### **3.3 Geology and Soil**

The rock system underlying Kisoro district is well influenced by western volcanic formations of Pleistocene age which resulted from formation of muhavura ranges. The soils are mainly volcanic which cover the area around Bafumbira mountain ranges in the sub counties of Nyarusiza, part of Chahi, Nyakabande and a small part of Nyarubuye. Almost  $\frac{3}{4}$  of Nyarubuye Sub County is hilly leaving  $\frac{1}{4}$  flat.

The soils in the hills and valleys consist of peat soils which are formed as a result of accumulation of thick layer of organic matter below swamp vegetation as a result of snow decomposition. These swamps produce the rich soils for agriculture that dominate the valleys of Nyarubuye Sub County in district.

Kisoro district has two soil units derived from the volcanic soils these are;

***Sabyinyo complex***; lies in the alpine and semi alpine areas of the altitude ranging between 2250m-2400m above sea level. The soils change from the brown color characteristics of the highlands to plains color of back in the bamboo zone, the maximum is reached especially at levels where drainage is likely to be slow.

***Bafumbira complex***; this dominates most of central Kisoro district where weathering has leveled most areas, the soil are derived from rift valley formation which are characteristic of the northern section of the district. (District State of Environment Report, august 1998).

### **3.4 Climate**

#### **3.4.1 Rainfall**

The district of Kisoro with Nyarubuye Sub County inclusive receives bi modal rainfall that is received twice in a year. The first rains are heavy in intensity and stretch from April to June in which over 2000mm of rainfall received. The second season begins in august to October and amounts to 1,200mm. The mean annual total rainfall received in Kisoro district is 1600mm.

#### **3.4.2 Temperature**

The temperature of Nyarubuye Sub County is modified by altitude. Due to high altitude Nyarubuye Sub County has relatively low temperature mean annual maximum record of 24.4<sup>0</sup>c and 10.9<sup>0</sup>c as mean annual minimum. However temperature variations exist in Nyarubuye Sub County in different months

#### **3.4.3 Vegetation**

The vegetation of the sub county is dominated natural forests but most of which is being cleared due population growth. The high demand for food in Nyarubuye Sub County, Kisoro district and Uganda has left most vegetation cleared (District state of Environment Report august 1998).

Kisoro district has three characteristic zones

High altitude forest; this vegetation cover includes the tropical and temperature forest which are now remaining on the shapes of the mountain ranges and in Bwindi impenetrable national park.

Tree that are found in this zone are broad leaved, while others are pines which are characteristic of temperate regions.

Forest or savanna mosaic at high and low to medium altitude. This vegetation cover shows clear characteristic forest remnants which are quite noticeable between 2.200m and 3200m with gradual links of savanna and wood shrub patches at lower level towards the central plains. Due to increased population in the district the vegetation zone has suffered a lot in the past from heavy encroachment by the local population.

Swamp forest; the swamp forest which exist in the district are of two types, permanent forest swamp where water doesn't dry up even in the dry season and seasonal swamps which dry up certain areas. Forest swamp coverage dominates in the western and northern part of the district covering Nyarubuye, Kirundo, and Nyabwishenya among others.

**Table 3.2 Vegetation Coverage (km<sup>2</sup>) in Kisoro district**

	Broad leaved plantation	Geniferous plantation	Tropical high forest (heavy stuck)	Tropical high forest (degraded)	Grass land and bush land	Papyrus reeds swamps
Kisoro district	2.0	0.0	102.9	11.4	29.2	9.8
Uganda % of the total area	0.08	0.06	2.5	1.16	27.04	2.0

**Source:** *National Biomass Study (Forest Department 1995)*

#### 3.4.4 Land use

Farming or agriculture is a noticeable activity of the population that is cultivation of crops and rearing of animals are practiced in Nyarubuye sub county. Agriculture is predominantly subsistence in Nyarubuye with use of rudimentary farm implements (Odeke E A 1960) he also suggests that land holdings are fragmented.

Traditional fallow systems are rarely practiced in densely populated areas Wadada 1996. The major crops grown in Nyarubuye sub county include sweet potatoes, Irish potatoes, sorghum, maize sugarcane, banana , (food crops) and coffee (cash crops). All these crops are grown according to altitude.

#### **3.4.5 Land tenure**

The land tenure system in Nyarubuye Sub County is that of individual land rights subject to the class or family control on permanent title (Kasemba Mugerwa 1989) farmers constrained by land can approach those with unutilized land for growing additional crops to meet their substance needs. This is usually restricted to annual crops like beans, sweet potatoes, maize among others. This practice was observed to aggravate land fragmentation (Mugerwa 1989).

The type of land tenure is as a result of population increase, land access procedure in Nyarubuye Sub County is very difficult because of land fragmentation in Nyarubuye and Kigezi as a region. This is because land is obtained through buying in heritance, exchange and lending.

#### **3.5 Research design**

A descriptive survey research design was adapted for the study. This was mainly because the study was on relatively large scale and for relatively short duration. This was done by gathering information from selected population samples by interviewing them. It served many functions including exploration, description, explanation and experimentation have preventive samples and to avoid biases. The quantitative and qualitative methods were also be used for triangulation purposes mostly in getting data from respondent.

#### **3.6 Study Population**

The study consisted of both men and women who have been in the field of farming for two or more years. Different age brackets in farming sector were selected. The study also included key informants such as local council chairpersons, farmer representatives, from different selected villages and NAADS coordinator total. A total of 78 respondents were selected.

#### **3.7 Sample Selection and procedure**

The primary methods that were employed in selecting respondents were disproportionate stratified sampling. This was adopted because unlike other methods it minimizes chances of

being biased when selecting the study population. Nyarubuye Sub County has a population of about 85600 people.

The size used was 78 respondents because it provided enough information to the researcher. Nyarubuye Sub County consists of two parishes of Kalambi and Busengo and out of these two parishes Kalambi was selected using simple random technique. Again using simple random technique two villages were selected in each parish and a list of all farmers from two villages will then obtained from the local council chairperson of the two villages, and systematic sample random sampling procedure 18 farmers were be selected from each village 4 representatives from local councils and a NAADS Coordinator making a total of 78 respondents. The sampling procedure was made possible for the researcher by the assistance of local chairpersons to locate the respondent. Respondent were also selected basing on where they carry out agriculture for example farming on wetlands, steep slopes and other areas.

### **3.8 Data Collection Techniques.**

The methods that were used to collect the data includes; personal interviewing, using interview schedules, informal interviews, using interview guide, observation (use of observation checklist)

#### **3.8.1 Interviews**

##### **3.8.2 Face to face interview.**

This was a major method that was employed in collecting data. The method considered appropriate because it allowed the researcher to freely interact wilt the respondents (farmers).Personal interviewing was considered most ideal because it necessitated the physical presence of a researchers and the personal approach do not only ensure the despondence of confidentiality but also help the interviewer (researcher) to ensure that all questions have been wide stood and aroused, closed ended questions were used to collect data from the key informants because they gave them a liberty and freedom to answer questions.

##### **3.8.3 The interview schedule**

The interview schedule was used to gather information from farmers and it contributed on the basis of variables and objectives of the study. The respondents were informed of the purpose of the study. It was also made clear to them that, they had a right to refuse to answer some

questions if they participated in the study. Numbers were used in study instead of their names for confidential purposes.

The interview schedules were administered in a clear language and questions which were put in neutral way such that respondents were not biased. The schedules also consisted of both close ended questions which were used to elicit the quantitative aspects of the study while open ended questions were used for qualitative aspects to key informants.

#### **3.8.4 Informal interviews**

The personal interviews were supplemented by informal interviews between the researcher and key informants, the researcher used the interview guide to gather the data from key informants and questions were open ended. The interview guide were constructed on the basis of variables under the study and consisted of mainly statements or topics related to the study objectives. The interview guide was used for its advantage in greater flexibility and a researcher made sure that he established a good report to communicate and be understood easily so as generate genuine information from the respondents.

### **3.9 Observation**

Observation was another method that was used in collecting data on more sensitive issues or other observable features in the area. Observation was a classic method scientific inquiry because much was learnt by observing for example soil erosion, farming practices among others. Observation checklist was used to collect data.

### **3.10 Data Processing**

Data processing consisted of editing coding and tabulating the information where necessary. Editing entitled examining the completed instruments which ensured completeness, accuracy and consistency, this was done in the field and after. Coding on the other hand will be entailed classifying answers to questions into meaningful categories. Most of the questions were coded and for those which were not coded, a sample of responses was examined and the most frequent occurring responses were coded and similar types grouped into categories to limit their number.

The researcher reduced the data into tallies, groupings, tables' pie-charts and percentages for easy analysis.

### **3.11 Data analysis**

This was the statistical description of data that was undergone coding and tabulation process. It includes tables finding frequencies and percentages. The researcher also analyzed the data basing on the variables of the study. The data was analyzed according to the occurrence of the frequency of themes in data and this eased the process of interpretation and presentation of findings of the study was analyzed by the researcher himself.

### **3.12 Ethical considerations**

The researcher first sought permission from respondents in order to provide him with the information.

The researcher also went ahead to form a report with the respondents such that could feel free with the researcher and this was done through introduction of a researcher and respondents to each other.

The researcher ensured maximum confidentiality of the respondents' information and this helped in easing the tension of the respondents which could have hindered the collection of information

The researcher also considered the principle of individuality of the respondents most important

At the end of the study the researcher thanked his respondents for their cooperation.



## CHAPTER FOUR

### FINDINGS, DATA ANALYSIS AND DATA INTERPRETATIONS.

#### 4.1 Introduction

This chapter presents the findings of the study on the impacts of mixed farming on soil in Nyarubuye Sub County, Kisoro District, data analysis and interpretations. They are presented according to the objectives thus mixed farming practices, impact of mixed farming on soil, different forms of soil degradation as a result of mixed farming and solutions to soil degradation. The data collected will be presented in tabular form after which is interpreted for clarity and easy understanding. Meaningful conclusions are thus drawn that reflects the factors underlying the existence of the problem.

#### 4.2 Background and characteristics of respondents

This was divided into six categories namely age, family size education level, source of income number of years in farming and crops grown.

##### 4.2.1 Age category of respondents

**Table 4.1: The age category of respondents**

Age group	Frequency	Percentage
16-30	15	19
31-45	30	38
46-60	28	35
61 and above	5	6
<b>Total</b>	<b>78</b>	<b>100</b>

**Source: primary data**

The ages of all respondents within the sample population were sought. From Table 1 above the variable was categorized into four groups. Age group 31-45 contributed the highest proportion of respondents (38%). This was followed by age group 46-60 with (29%), 19-30 with (27%) and finally the age group 61 and above contributed the lowest number respondents (6%). Ages 31-45 and 46-60 were the majority in farming and this is the most energetic age groups who take care of their families (family heads). This being the people the most age group with less education in

the area, they take less charge to care for soil. This in one way or the other promotes soil degradation in the in Nyarubuye Sub County.

#### 4.2.2 Family size of respondents

**Table 4.2 Number of people in a family of respondents**

Number of persons	Frequency	Percentage (%)
1-3	10	13
4—6	13	16
7 and above	55	71
<b>Total</b>	<b>78</b>	<b>100</b>

**Source: primary data**

The respondents were asked about their family size. This was categorized into three that is 1-3, 4-6, 7 and above. It was found out that most respondents had 7and above members in their families (71%), followed by families with 4-6members 16% and families with 1-3members had least number of members (13%). Because of high population in the area, un sustainable farming practices are common in the area. These include over cultivation, over grazing among others. These play important role in promoting soil degradation.

#### 4.2.3 Education level of respondents

**Table 4.3 Education level of respondents**

Education level	Frequency	Percentage (%)
Informal education	25	32
Primary level	40	51
Secondary level	10	13
Secondary and above	3	4
<b>Total</b>	<b>78</b>	<b>100</b>

**Source: primary data**

It was found out that most respondents attended primary (51%), this was followed by respondents who never attained any form of formal education 32% and these were followed by those who attained secondary education (10%) and the least respondents had attained above

secondary education (4%) as shown in table 3 above. Because of high level of illiteracy in the area as revealed by research, most people possess less knowledge on soil degradation as a problem and how the problem can be controlled.

#### 4.2.4 Source of income for respondents (economic activity)

**Table 4.4 Source of income for respondents**

Income source	Frequency	Percentage (%)
Agriculture only	69	88
Government only	0	0
Agriculture and government	9	12
<b>Total</b>	<b>78</b>	<b>100</b>

**Source: primary data**

These were divided into three categories that is those who get their source from Agriculture, government, both agriculture and government. Agriculture had highest dependency as their source of income (88). It was found out none of farmers (respondents) gets money from government only (0%) and few of respondents (12%) get money from both agriculture and government and these included NAADS coordinator and representatives from local councils and few primary teachers. Because of most respondents (farmers) being involved in agriculture production, this revealed that agriculture is the major economic in the area. Due to land shortage in the area, this therefore shows that the little land available is over used for production; hence soil degradation is the final impact.

#### 4.2.5 Type of crops grown by respondents

**Table 4.5 Crops grown by respondents (farmers)**

Crops grown	Frequency	Percentage
Food crops only	72	92
Cash crops only	0	0
Both food and cash crops	6	8
<b>Total</b>	<b>78</b>	<b>100</b>

**Source: primary data**

From table 5, majority of respondents (farmers) were found out to grow food crops, no farmers were found out to grow food crops only (0%), and 8% respondents (farmers) were found out to grow both food and cash crops cash crops included coffee, tobacco among others. Food crops included beans, sweat potatoes, maize sorghum millet bananas, Irish potatoes, sugarcane and yams. Since most of the farmers concentrated on food crop growing, monocropping a farming technique most used in cash crop growing was most common.

#### 4.2.6 Number years in farming

**Table 4.6 Number of years of respondents in farming**

Number of years in farming	Frequency	Percentage (%)
1-9	27	35
10-19	21	27
20-29	22	28
30 and above	8	10
<b>Total</b>	<b>78</b>	<b>100</b>

**Source: primary data**

The number of respondents have spent in farming were categorized into four, with most respondents being in farming for 1-9 years (35%), followed by 20-29 years farming (28%), and 20-29years followed with 27%. It was found out that the least number of respondents were in farming for 30 and above years (10%). Information from respondents who have been in farming

revealed that when the land is cultivated when fresh gives high yields compared to continuously cultivated land. This was revealed by farmers who gave statistics of their for some years.

#### 4.3 Mixed farming practices

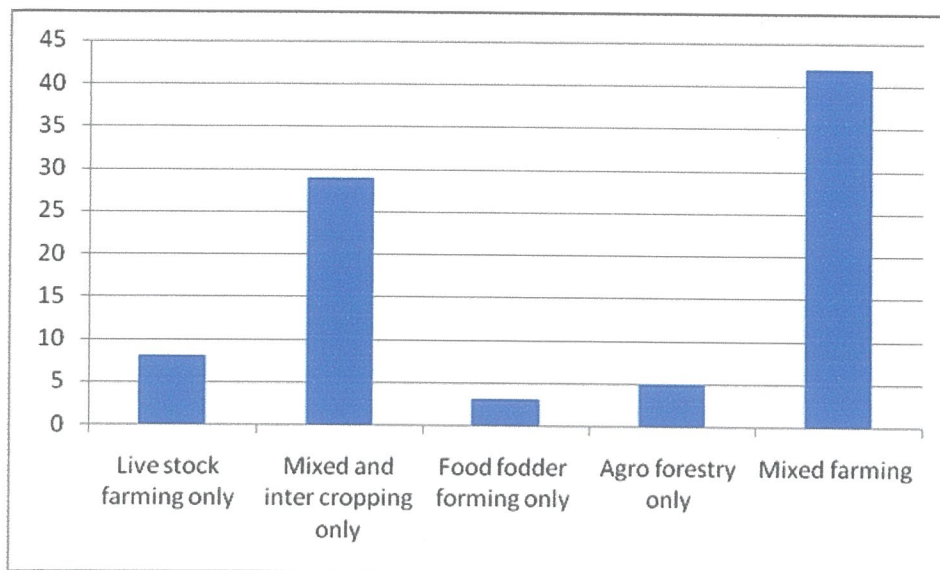
The study revealed that different mixed farming practices are practiced in the area. These included mixed and intercropping, food fodder farming, agro forestry, and livestock farming among others.

**Table 4.7 Mixed farming practices in Nyarubuye Sub County**

Mixed farming practices	Frequency	Percentages (%)
Livestock farming only	8	10.2
Mixed and inter cropping only	20	25
Food fodder farming only	3	3.8
agro forestry only	5	6.3
Mixed farming	42	53.8
<b>Total</b>	<b>78</b>	<b>100</b>

**Source: Primary Data**

**Figure 1. A bar graph showing mixed farming practices in Nyarubuye Sub County**



#### **4.3.1 Mixed cropping and intercropping.**

Mixed cropping is a farming practice that involves growing more than one crop on the same piece of land at the same time. The study revealed out that most of respondent practice mixed/multiple cropping in the area. Shortage of land in the area is behind different farming practices in Nyarubuye sub County. More than 20 out of 78 respondents representing more than 26% practice mixed cropping. The crops identified to be grown mixed cropping practice include sorghum alongside maize, maize alongside Irish potatoes, and sorghum maize alongside beans among others.

On other hand, inter cropping a form of mixed cropping involves cultivation of an additional crop in the spaces available between the crops. Some of respondents pointed out that this is practiced in order catch up with planting seasons due to problems of land shortages.

#### **4.3.2 Agro forestry**

This is a farming practice that was revealed by respondents to be practiced in Nyarubuye Sub County though revealed by few respondents. Respondents revealed that, this type of farming requires relatively large pieces of the reason why it is not largely practiced in the area.

#### **4.3.3 Live stock farming**

Information gathered from respondents indicated that most of respondents practice livestock farming in Nyarubuye Sub County. Different livestock animals that were identified in the area include poultry, goats, cattle, sheep and pigs among others. From the information gathered, livestock farming is practiced on small scale in Nyarubuye Sub County as most of animals are for home consumption and remains are for sale.

On other hand dairy farming out of 78 respondents, only one respondent was identified to practice dairy farming in the area.

#### **4.3.4 Food fodder farming.**

This farming practice was found out to be practiced by few farmers along side other farming practices. Out of 78 respondents, only five were revealed to practice food fodder farming along other farming practices.

#### **4.3.5 Mixed farming.**

This is a farming practice that was revealed by most respondents. It involves growing of crops and rearing of animals. Most of respondents revealed this farming practice though practiced on small scale in the area. Out of 78, respondents who were contacted in the area, 42 were found out to practice mixed farming representing 53.8%.

#### **4.4 Impacts of mixed farming on soil**

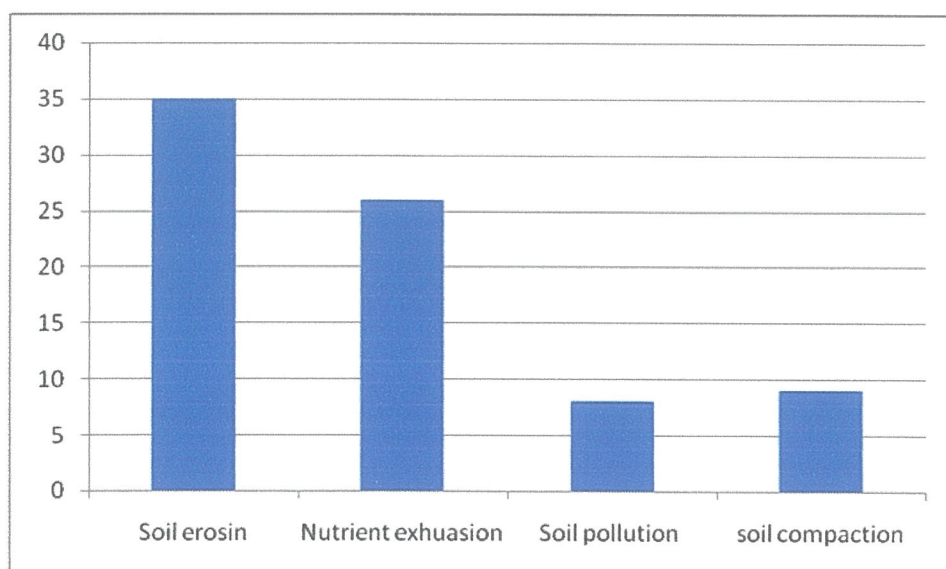
These were divided into two, namely that is impacts of livestock farming on soil and impacts of crop farming on soil. The different identified impacts of mixed farming on soil in Nyarubuye Sub County include, soil erosion, nutrient exhaustion, soil pollution, soil compaction among others.

**A table 4.8 showing different impacts of mixed farming on soil**

<b>Impacts of mixed farming on soil</b>	<b>Frequency</b>	<b>Percentages (%)</b>
Soil erosion	35	44.9
Nutrient exhaustion	26	33.3
soil pollution	8	10.3
Soil compaction	9	11.5
<b>Total</b>	<b>78</b>	<b>100</b>

**Source: Primary Data**

**Figure 2. A bar graph showing impacts of mixed farming on soil**



#### **4.4.1 Soil erosion.**

According to the study, soil erosion was the most serious impact of mixed farming on soil. From 78 respondents, 35 representing 44.9% were the majority who revealed soil erosion. This indicated the seriousness of the problem in the area. The factors behind the existence of the problem were identified as scarcity of available land for agriculture, animals overgraze small



pieces of land leaving soil bare. (a condition a researcher termed as over grazing). This leaves soil bare thus allowing soil erosion agencies to easily wash it away. Such animals include cattle and goats. Poor farming practices in the area were also another identified factor to be behind soil erosion.

Over grazing of animals such as cattle, goats and pigs among others also cause soil erosion. Pig production was found to be notorious for its destructive effects on vegetation. One of pig behaviors was identified that pigs dig into the soil with the snout; this was found to affect the soil by weakening its structure thus facilitating soil erosion.

#### **4.4.2 Nutrient exhaustion**

This was identified from records of crop harvests for different years as it was revealed by different respondents. 26 out of 78 respondents were identified to be affected by soil exhaustion. The information gathered from different respondents revealed that there was continuous reduction in crop production year after year whose cause was identified as nutrient exhaustion.

According to the study, this was identified to have been caused by perennial crops which over stay on a piece of land for long time and other farming practices more especially continuous cultivation of land without allowing time to settle.

#### **4.4.3 Soil pollution.**

Information gathered from the study indicated a negative relationship between fertilizer use in crop farming and soil production. From the information gathered from different respondents who use fertilizers in crop farming, indicated that use of fertilizers increases crop production, but with continuous use fertilizers reduces crop production. Also use of pesticides, herbicides among other chemicals in farming is also other factors behind soil pollution in area.

#### **4.4.4 Soil compaction.**

This was too identified to be among the impacts of mixed farming in Nyarubuye Sub County. Out of 78 respondents, 9 represented by 11.5% was identified to be affected by the problem. The factors behind the problem were identified to be over grazing cattle in the area.

#### 4.4.4 Impacts of mixed farming on (soil) steep slopes

The impacts of farming on steep slopes were also identified in the study. These were visually observed by the researcher and the severe impact of farming on soil was observed to be soil erosion. According to research, soil erosion was as a result of both crop and livestock farming. Cultivation on steep slopes makes soil loose and weak hence easily washed away by water.

According to research findings, 88% depend on agriculture as their source of food and income, and 90% of the area is hilly. This shows that most of farming is carried out on hill slopes and this there shows that soil erosion a problem in the area.

Different forms soil degradation as a result of mixed farming were identified from the the study, The most serious observed and identified forms of soil as a result of mixed included;

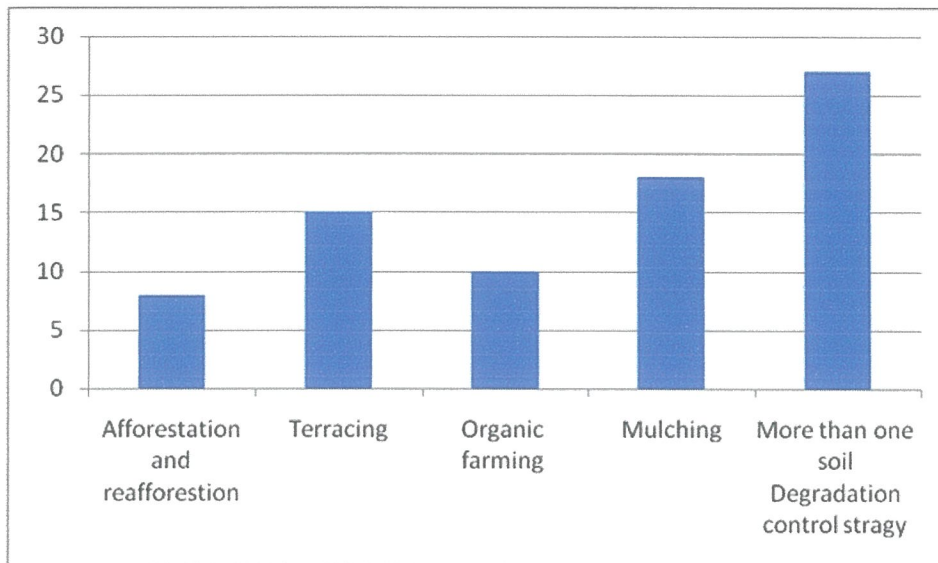
#### 4.5 Solutions/strategies to soil degradation

Several suggestions by respondents as a ways through which soil degradation can be reduced and among suggestions included afforestation and reforestation, organic farming terracing and sensitization on sustainable farming practices among others.

**Table 4.9 Summary of peoples' strategies towards controlling soil degradation in Nyarubuye Sub County**

Strategy/solution	Frequency	Percentages (%)
Afforestation and reafforestation	8	10
Terracing	15	19
Organic farming	10	13
Mulching	18	23
More than one soil degradation control strategy	27	35
<b>Total</b>	<b>78</b>	<b>100</b>

**Figure 3. A bar graph showing different strategies towards controlling soil degradation in Nyarubuye Sub County.**



Source: Primary Source

#### **4.5.1 Afforestation and reforestation in areas of degraded soil**

A forestation refers to the establishment of forest or stand of trees in an area where land use was not a forest. Reforestation is the establishments of forest cover either naturally (by natural seeding, coppice or root suckers) or artificially (by direct seeding or planting). Out of 78 respondents, only 8 respondents representing 10% were identified to be plant trees on steep slopes prone to soil erosion and other degraded areas. It was revealed that most farmers don't use this method to control soil erosion because it requires it occupies large pieces of land and that trees don't do well with food crops.

#### **4.5.2 Terracing hill sides**

Because of Nyarubuye being a hilly area, most of respondents more especially those in the hilly part of the area prefer terracing in controlling soil erosion. The research revealed that 15 out 78 respondents representing 19% use terracing in reducing soil degradation. Some respondents who were not willing to use afforesation and reforestation revealed terracing as method of controlling

soil erosion on steep slopes. It involves construction of terraces on steep slopes which helps to reduce on the speed of runoffs. FAO 1993

#### **4.5.3 Organic farming.**

This is a form of agriculture –that relies on techniques such as crop rotation, green manure, compost manure and biological pest control to maintain soil productivity. Organic farming strictly limits the use of manufactured fertilizers and pesticides, herbicides and fungicides. 10 respondents out of 78 representing 13% were revealed to use organic farming in controlling soil degradation. Farmers argued that use of organic has no impact on soil health that however its difficult to raise enough manure to use in different plots under agriculture production.

#### **4.5.4 Mulching.**

Mulching is one of the simplest and most beneficial practices you can use in the garden to improve on soil quality. Mulch is simply a protective layer of a material that is spread on top of the soil. Mulches can either be organic such as grass clippings, straw, bark chips, and similar materials or inorganic such as stones, brick chips, and plastic. Both organic and inorganic mulches have numerous benefits. Out of 78 respondents 18 representing 23% were identified to use mulching in controlling soil degradation. Mulches reduces rate of water movement in hilly areas and reduces leaching in both flat and hilly areas.

#### **4.5.5 Sensitization on sustainable farming practices**

This was analyzed and developed by the researcher after identifying that most people are not aware of what best methods that can be employed in different in different areas in Nyarubuye Sub County. Respondents pointed out that sensitization on sustainable farming practices would contribute much in controlling soil degradation. Respondents further pointed out that this can be achieved through close intervention via their Sub County leaders.

Farmer representatives added on saying that, public needed sensitization on other different causes of soil degradation and its problems and their control measures.

#### **4.6 Problems encountered in the study**

There were a number of problems encountered but which did not adversely affect the study as the researcher devised ways of minimizing them. The following problems were encountered during the study

Weather changes; Un predictable rainfall which interfered researchers programmes consuming too much of time.

Reluctance of some respondents to answer questions as some respondents were expecting money from the researcher.

## CHAPTER FIVE

### SUMMARY, CONCLUSION AND RECOMMENDATIONS

#### 5.0 Introduction

The study was about the impacts of mixed farming on soil and it involved 78 respondents including key informants like the LC chairpersons NAADS coordinators and farmer representatives.

The respondents were all farmers who have been in field of farming at least more than two years and were selected purposively. Data was mainly collected through personal interview and observation. The study employed mainly quantitative method on a bigger extent and qualitative method on the small extent.

#### 5.1 Summary of findings of the study.

The rationale of the study was triggered by the persistence high levels of soil degradation existing world over, in Uganda and Nyarubuye Sub County in particular. The overall outcome of this study indicated that soil degradation is a severe and serious problem that needs immediate action.

The study revealed that the majority of respondents were between 31-35 years (38%) followed by ages 46-60 with (29%) and 16-30 with 27%. Least number of respondents were 60 years and above (table 1).

Considering family size, most respondents came from families with 6 and above members contributing 71% of respondents. This was followed by families with 4-6 members contributing 16% of respondents and least respondents came from families with 1-3 members 13%.

With regard to education levels most respondents had attained primary education 51%, however 32% had no formal education at all. 13% had secondary education and 4% had secondary education and above (table 3).

Respondent's source of income was also considered and 88% of respondents get their income from agriculture and 0% can get their income from government only while 12% get their income from both agriculture and government.

Respondent's number of years in farming revealed that most (35%) were in farming for 1-9 years and the least respondents were in farming for 30 and above years.

The findings also revealed out that crop production was reducing with a number of years. This was revealed by one of farmers who gave statistics of his crop production for five years. This indicated soil exhaustion in the area which was as a result continuous cultivation and poor farming methods.

The findings of the study revealed that soil erosion in the area is as a result cultivation and over grazing on steep slopes.

On part of suggesting solutions to soil degradation, the majority of respondents suggested that sensitization of the public about the impacts of soil degradation, how it can be dealt with.

## **5.2 Conclusions.**

According to the findings from the study, it can be concluded that soil degradation is a serious problem that exists in most areas around the world. The study revealed that soil as a result of farming exists in different forms including soil exhaustion, soil leaching soil erosion among others.

However soil exhaustion was noted to be most common as respondents complained of shortage land that results into continuous cultivation of available small plots of land.

The study revealed that soil was the major impact of farming on steep slopes and its impacts were ranging from distraction of crops and animals to soil exhaustion.

## **5.3 Recommendations.**

Soil degradation is a common problem which exists almost on every cultivable land everywhere. Effective measures against soil degradation should be aimed at dealing with farming casual factors which bring about soil degradation.

Soil degradation control measures must focus on different primary farming practices that lead to soil degradation.

Sensitization of the public so as to increase on the awareness of the existence of soil degradation in the area. The public should be educated about the consequences of different farming practices on soil. Seminars, workshops, public lectures, and programmes on both radios and televisions should be organized and promoted by the government. NGOs should also be encouraged to get involved in which would help to promote sustainable farming practices

Therefore organizations such as National Agriculture Research Organization (NARO), National Agriculture Advisory Services (NAADS) must be encouraged to about sustainable agriculture.

In addition to above agriculture as subject must be introduced in primary, secondary as a compulsory subject such that those who may not get chance continue to higher institutions of learning may have the knowledge on how un sustainable farming practices affect soil.

#### **5.4 Suggestions for further research.**

A more statistically significant sample population should be used to investigate these similar issues. These samples must be selected areas in Sub County such that clear strategies can be implemented.

Soil degradation is not only caused mixed farming, therefore more research must be carried out on other causes of soil degradation. Therefore other causes of soil degradation must be identified through further research and this can help in formulating strategies against soil degradation in general



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## APPENDICES

### APPENDIX A

Interview schedule (to be answered by farmers)

Interview schedules (to be answered by farmers, local council chairpersons, extension workers from selected villages in Nyarubuye sub county Kisoro district).

I am Turinayo Gerald, a student pursuing Bachelors Degree of Environmental Management at Kampala International University.

Besides class work, I am here to carry out a research on the relationship between mixed farming and soil degradation. The purpose of the research is purely academic. The interviews seeks for your views on the above topic and answers will be taken confidential and its only through your kind response that the objectives will be attained. Please spare a few minutes of your valuable time and answer the following questions.

#### Section A:

##### Personal data of respondent.

#### SECTION A

1a.Name

(optional).....

Tick where appropriate

b) How old are you?

**Table 1, age category of respondents**

15-30	31-45	46-60	61 and above

c) How many members in a family.

**Table 2, Family size of respondents**

1-3	4-6	7 and above

d) Education level.

**Table 3, education level of respondents**

Informal level	Primary level	Secondary level	Above secondary level

e) What is your source of income (economic activity).

**Table 4, Economic activities of respondents**

Agriculture produce	Employed by government	Both agriculture and government	Non of these

f) What kind of crops do you grow?

**Table 7 Crops grown by respondents**

Cash crops	Food crops	Both food and cash crops

g) How many years have you been in farming?

1-9	10-19	20-29	30 and above

**Section B Mixed practices and their impacts on soil**

2) What are different mixed farming practices in the area?

- a) Mixed cropping
- b) Live stock farming
- c) Food fodder farming

If others specify.....  
.....

3) What are impacts over grazing on soil?

- a) Soil compaction
- b) Soil erosion
- c) Soil pollution.

If others specify.....  
.....S

4) How does use fertilizer affect soil?

- a) Soil pollution
- b) Nutriments depletion.

If others specify.....  
.....

5) What are the impacts farming steep slope?

- a) Land slides
- b) Soil erosion

c) Leaching.

If others specify.....

.....

6) What are different forms of soil degradation experienced in the area?

a) Soil erosion

b) Soil compaction

c) Nutriments depletion

d) If others specify.....

.....

7) What strategies/solutions do you use to control soil degradation?

a) Afforestation and reafforestation

b) Terracing hilly slopes

c) Contour ploughing

d) If others specify.....

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