THE INFLUENCE OF PRIMARY SCHOOL PUPILS' KNOWLEDGE OF AGRICULTURE ON ENVIRONMENTAL CONSERVATION IN AKITHII DIVISION OF NYAMBENE DISTRICT, KENYA

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EGERTON UNIVERSITY

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DECLARATION AND RECOMMENDATION

DECLARATION

I hereby declare that this is my original work and has not been presented before for an award of a Degree or Diploma in this University or any other University:-

Sign..... Date....16/10/08.....

Anastasia .Muiti Maorwe

RECOMMENDATION

This work has been submitted for examination with our Recommendation as University supervisors:-

1. Sign..... Date.....16/10/08.....

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2. Sign..... Date.....16/10/08.....

Dr. W. O. Ochola

2009/79086

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DEDICATION

To my Father Bernard Thilange, and my late mother Monica Kamiri for their sacrifice in my education and teaching me the way of God

To my beloved husband Wilfred Maorwe whose prayers and support is a source of inspiration.

To my sons Eric Muchui, Denis Mutwiri, daughter Lillian Kathomi and niece Rita Mwotune for their patience and understanding during my long stay away from them.

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ABSTRACT

Environmental education is one way of developing an awareness of the environment, its protection and an opportunity of preventing long-term environmental degradation. Environmental degradation and household garbage are of significance concern in Akithii division. The problem would be addressed through pupils' knowledge of agriculture on environmental conservation, which promotes intellectual skills, and knowledge to prevent the long-term environmental degradation. The study was aimed at establishing the influence of primary school pupils' knowledge of agriculture on environmental conservation, and how the knowledge gained by pupils' has been applied in the community for environmental conservation. The study took place in Akithii division of Nyambene District, Kenya. The study used an *ex-post-facto* research design of co-relational nature. The target population was made of all standard seven primary school pupils' and all households in the division. The study used 120 pupils' from 6 schools and heads of their households from the community. Purposive sampling was used to select the locations while schools were randomly selected. Simple random sampling was used to select 20 pupils' in standard 7 in each primary school who were then followed to their households. The research used questionnaires as instruments for data collection from the and household heads and knowledge test for the pupils'. The descriptive statistics used included percentages, means and standard deviation. The inferential statistics used included one way Analysis of Variance (ANOVA) and Pearson's product moment correlation coefficient. The hypotheses were tested at $\alpha = 0.05$ significance level. The results of the study showed that the primary school pupils' gained knowledge from learning agriculture in primary school and that the pupils' practiced environmental conservation in their respective communities. There is a significance difference in level of pupils' knowledge of agriculture related to environmental conservation. There is also a significant difference in level of environmental conservation in different communities and in pupils' involvement in the environmental conservation practices. The results also indicated no relationship between pupils' knowledge of agriculture and environmental conservation and no relationship between pupils' involvement in environmental conservation and levels of environmental conservation in the communities. The findings of the study may to help the Ministry of Education Science and Technology to determine he effectiveness of integrating environmental education in primary school science and agriculture syllabus.

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LIST OF ABBREVIATIONS

ANAFE	Africa News for Agro forestry
ANOVA	Analysis of Variance
EE	Environmental Education
CTE	Career Technical Education
ESD	Education for Sustainable Development
EPA	Environmental Protection Act
FAO	Food and Agriculture Organization
FYM	Farm Yard Manure
ITK	Indigenous Traditional Knowledge
KIE	Kenya Institute of Education
KOEE	Kenya Organization for Environmental information
LSD	Least Significance Difference
MOARD	Ministry of Agriculture and Rural Development
MOEST	Ministry of Education Science and Technology
NAAEE	North America Association for Environmental Education
NCEOP	National Committee on Education Objectives and Policies
NAEP	National Agricultural Extension Policy.
NEAP	National Environmental Action Plan
NEMA	National Environmental Management Act.
NGO	Non-Governmental Organization
SIFE	Students in Free Enterprise
SPSS	Statistical Package for Social Sciences
UN	United Nations
UNDESD	United Nations Decade on Education for Sustainable Development
UNCED	United Nations Conference on Environmental Development
UNEP	United nations Environmental Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNICEF	United Nation International Children's Fund
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The role of science deserves highlighting as it provides people with ways to understand the world and their role in it. The teaching and learning of environmental education is geared towards an increased study of the existing environmental problems in the society such as population control, pollution and environmental conservation; and its knowledge promotes the learners' acquisition of intellectual skills to manipulate the environment (Freeman, 1995). The importance of creating environmental awareness through the primary school channel is accentuated by the fact that for a greater majority of citizens, primary school education is terminal (Kinyua and Murugi, 2003). Therefore, primary education would help in creating environmental awareness, which would go along way in reducing threat to human survival. In view of this, environmental education has been integrated in science and agriculture syllabus so that the learners can understand the principles underlying environmental issues in Kenya (Kenya Institute of Education, 2002). In Agenda 21 chapter 25, the youth are expected to be actively involved in the protection of the environment and the promotion of economic and social development.

Kenya has the opportunity to use the UNESCO Decade of Education for Sustainable (DESD), 2005-2014 to set the pace towards improved delivery of education for sustainable development. This plan presents three key areas of sustainable development – society, environment and economy with culture as an underlying dimension.

- Society: an understanding of social institutions and their role in change and development, as well as the democratic and participatory systems which give opportunity for the expression of opinion, the selection of governments, the forging of consensus and the resolution of differences.
- Environment: awareness of the resources and fragility of the physical environment and the affects on it of human activity and decisions, with a

commitment to factoring environmental concerns into social and economic policy development.

- Economy: a sensitivity to the limits and potential of economic growth and their impact on society and on the environment, with a commitment to assess personal and societal levels of consumption out of concern for the environment and for social justice (United Nations Educational Scientific Cultural Organization (UNESCO, 2006).

Education for Sustainable Development (ESD) needs to provide a scientific understanding of sustainability together with an understanding of the values, principles, and lifestyles that will lead to the transition to sustainable development. The National Environmental Management Authority (NEMA) has recognized the need to develop a national framework: ESD implementation Strategy for Kenya 2005-2010, to mainstream ESD in Kenya's education system. The strategy focuses on key domains of ESD namely; Basic Education, Reorienting Existing Education Programs, developing Public Awareness and understanding of Sustainability and Training in achieving Sustainable development (National Environment Management Authority, NEMA, 2008). The strategy has drawn upon existing educational initiatives in the Kenyan system.

Agenda 21 encourages inclusion of the concepts of environmental awareness and sustainable development throughout the education curricula. The mainstreaming of environmental issues in the curriculum at primary and secondary schools in Kenya dates back to the colonial days (before 1963). The Kenyan government has, since the publication of the Report of the National Committee on Education Objectives and Policies (NCEOP) in 1977 made deliberate attempts to mainstream environmental issues in all curricula at all levels. The commitment was reiterated when parliament adopted Sessional Paper No. 6 of 1988 on Education and Manpower Training for the Next Decade and Beyond with a call to make environmental studies part and parcel of every training and to be integrated at all levels of education (National Environment Management Authority, NEMA, 2008).

The rationale of infusing environmental education (EE) is compelling; it is believed that by incorporating environmental education throughout the total curriculum at every grade, a more comprehensive treatment of environmental issues and concerns can be accomplished. However, the infusion of EE generated concerns and anxieties from the teachers, who viewed the infusion as overloading of the already loaded curricula (Kola-Olusanya, A. 2007). At the primary school level this infusion was successfully implemented in 2000 in the science and agriculture curriculum (Ministry of education Science and Technology, MOEST, 2000a).

According to World Summit for Sustainable Development (WSSD), which took place in Johannesburg, South Africa, education was considered as the key instrument for bringing about changes in values and attitudes, skills, behaviour and lifestyles of sustainable development. It is a tool for addressing issues around the three pillars of sustainable development- society, environment and economy (NEMA, 2008). One of the thrusts of education for sustainable development (ESD) is to enhance the role of education and learning for equitable, efficient and sustainable utilization of the country's resources and to promote quality education through diverse learning and public awareness for improved quality of life and productive livelihoods. Education at all levels can shape the world of tomorrow, equipping individuals and societies with the skills, perspectives, knowledge and values to live and work in a sustainable manner (UNESCO, 2006).

This educational effort will encourage changes in behaviour that will create a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and future generations. Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

In Kenya, realization of the significance of environmental education is related to 1972 Stockholm Environmental Conference, which stated that Environmental Education should be included in the school curriculum. Environmental education had not received much attention at the primary and secondary school levels up to early 1990s, but in 1994, Kenya National Environmental Action Plan (NEAP) recommended that:

i). Environmental education be incorporated in the formal syllabi as an examinable subject at all levels of education.

ii). More youth should be involved in environmental issues.

iii). Training manuals and resource guides should be prepared and updated to sustain environmental education.

iv). Monitor and regularly evaluate the sustainability of environmental education programmes.

v). Upgrade and strengthen the existing institutions to meet the needs of formal and non-formal environmental education.

(Otieno, 2002).

According to Palmer (1995), this has created awareness among the young people about environmental challenges taking place and feasible protective measures that can be applied at both individual and community levels. Environmental Education is expected to help pupils' to acquire skills that help in identifying pertinent environmental problems and find solutions to them. According to Manjegwa (1998), environmental education is critical in acquisition of environmental and ethical awareness of values, attitudes and skills consistent with sustainable development. Agenda 21 highlights the social and economic dimensions of sustainable development, conservation and management of resources for development, strengthening the role of major stakeholder groups.

Cutter (2001) emphasized the need to introduce environmental studies in the syllabi of the formal education sector. Manjegwa (1998) emphasized that if culture and ecology are inseparable, then environmental education should be viewed more seriously as an academic subject, because children have to face the challenges brought about by the environment. This is particularly true for Kenya's badly damaged environment (Ho, 1998). Environmental education is one way of developing amongst Kenyans' an awareness of the environment, its protection and an opportunity for preventing long-term environmental degradation. This is important as research indicates that human activities contribute to severe and potentially irreversible changes in the environment with far

reaching effects on the quality of life (Cutter, 2001). Among environmental challenges in Kenya today are air and water pollution, soil degradation, unmonitored garbage disposal, deforestation, endangered wildlife species, drought, famine and floods among others.

In gauging primary school teachers' environmental literacy, Cutter (2001) stated that environmental education should be viewed as a life-long process encompassing all levels of education, both within and beyond formal school system. Environmental education has an important role to play and pupils' are capable of understanding and be motivated to respond to issues that arise because of environmental crisis (Cutter, 2001). In order to bridge the Environmental knowledge gap in Kenya, environmental education was integrated in primary school science and agriculture syllabus (Ministry of Education Science and Technology, MOEST, 2002a). This was to improve public awareness on environmental problems and possible solutions leading to active participation of individuals in environmental protection and rational use of natural resources (Palmer, 1997). Environmental Conservation issues integrated in science and agriculture syllabus in primary schools include: sources and uses of water, methods of water supply, methods of collecting and storing water; uses of soil, soil characteristics and composition of soil, soil erosion and conservation, soil fertility; types of pollution such as soil, air and water pollution and the environment and its components.

Schools are one of the most important communities in any society, where the attitudes of future generations can be developed and influenced. By encouraging children at an early age to play an active role in cleaning up their surroundings, they will learn about taking responsibility for their environment, and more importantly the consequences of their own actions. This is surely one of the greatest lessons a school can offer. No doubt, many people throw litter on the ground because they think that there will always be someone else to come and pick it up after them (Visvalingam, A.2002).

Environmental deterioration in Kenya originated from lack of a well-developed environmental education curriculum that takes into account the daily experiences of the people, especially children in relation to their environmental concerns (Orodho, 1996).

According to education for sustainable development the environment sector has not been spared. The country has experienced severe environmental challenges including droughts, natural disasters, acute water shortage, climate changes and variability, loss of biodiversity and forest cover, poor waste management systems among others. The above challenges have also been experienced in Akithii division where environmental degradation is a major issue.

1.2 Statement of the Problem

In Kenya the natural resource base is shrinking rapidly, environmental problems are becoming increasingly severe, pushing the country into poverty and associated environmental problems such as deforestation, soil erosion, pollution and health. This is reflected in Akithii division, which has suffered soil erosion due to overgrazing, burning of bushes, over cultivation and deforestation. Environmental pollution and household waste disposal are also of significant environmental concern. The Ministry of Education Science and Technology promotes the teaching of environmental science within the science syllabus in primary schools. One of the objectives of the syllabus is that pupils' should be able to conserve and manage the available natural resources in the environment (MOEST, 2000a). However, it is not clear whether the pupils' knowledge of agriculture has influence on the level of environmental conservation as expected. It is also not clear whether the level of pupils' involvement in environmental conservation activities is influenced by their knowledge of agriculture as it relates to environmental conservation, which the study seeks to find. Akithii division, which had visibly experienced environmental degradation, was used to investigate these relationships.

1.3 Purpose of the Study

The study sought find out whether primary school pupils' knowledge of agriculture related to environmental conservation had influence on levels of environmental conservation in their community. The study also sought to determine how the pupils'

knowledge of agriculture related to environmental conservation influences their involvement in environmental conservation in Akithii division.

1.3 Objectives of the Study

The objectives of the study were:

i). To determine and compare the level of pupils' knowledge of agriculture as it relates to environmental conservation in different primary schools in Akithii division.

ii). To determine and compare the level of environmental conservation in different communities in Akithii division.

iii). To determine and compare the level of pupils' involvement in environmental conservation in different communities in Akithii division.

iv). To establish the relationship between pupils' knowledge of agriculture as it relates to environmental conservation and the level of environmental conservation in different communities in Akithii division.

v). To determine the relationship between pupils' knowledge of agriculture as it relates to environmental conservation and their involvement in environmental conservation practices in different communities in Akithii division.

1.5 Hypotheses

Ho1: There is no statistically significant difference in the level of pupils' knowledge of agriculture related to environmental conservation among different primary schools in Akithii division.

Ho2: There is no statistically significant difference in the level of environmental conservation among different communities in Akithii division

Ho3: There is no statistically significant difference in the level of pupils' involvement in environmental conservation practices among communities in Akithii division.

Ho4: There is no statistically significant relationship between pupils' knowledge of environmental conservation and the levels of environmental conservation among different communities in Akithii division.

Ho5: There is no statistically significant relationship between pupils' knowledge of agriculture related to environmental conservation and their involvement in environmental conservation practices in different communities in Akithii division.

1.6 Significance of the Study

The results may be significant to curriculum developers and Ministry of education to evaluate their work of integrating environmental education in the science and agriculture syllabus, and how knowledge gained in school may be applied to respective communities in which they are located. To the communities around the primary schools, the information may help them appreciate the knowledge the pupils' gain from school and help them utilize it. To the policy may use the results develop appropriate policies for environmental conservation and environmental education. The primary school teachers the results may help them to evaluate their performance in teaching environmental education in primary science and to the learners the results may help them to evaluate their performance and improve on the results obtained.

1.7 Scope of the Study

The study concentrated on the topics of primary school science and agriculture syllabus that are related to environment and are taught up to standard seven level. This is because these learners have been exposed to the new primary science syllabus where environmental education has been included. Only households whose children were selected in the sampled schools were included in the study from the respective communities, since it is expected that these learners will have practiced the issues learnt in school at home. This is because the purpose of the study was to determine whether these pupils' had made any impact in the household/community in the environmental education that has been learnt in school. The aspects of science and agriculture included are those that are included in the primary science from standard one to standard seven. Under this study the aspects of environmental conservation considered are those that are included in the primary school science syllabus.

1.8 Assumptions of the Study

The study assumed that pupils' have all been exposed to knowledge of agriculture related to environmental conservation and that the main source of knowledge for the pupils' is the classroom in the primary school. The study also assumed that the community around the primary schools has equal exposure to other sources of knowledge on environmental conservation. The other assumption was that the learners get information only from science, which may not be the case.

1.9 Definition of Terms

Community: A social group whose members share space, government and social organization. The community refers to either a small group or a large population and may have a common culture and heritage. For the purpose of this study, a community refers to the people living within Akithii division. However, entity for the purpose of this research the community around each school was considered as an independent entity.

Environmental Education: This is an active process that increases awareness, knowledge and skills that result in understanding, commitment, informed decisions and constructive action to ensure stewardship of all interdependent elements of the earth's environment. It involves learning about the natural systems that sustain life and how those systems are affected by human activity. In this study, it refers to education that is useful in identifying environmental problems and the methods of conserving the environment.

Environmental conservation: Refers to all the activities that are aimed at protecting the air, water and all the natural resources from degradation. In this study environmental conservation included aspects of soil and water conservation, pollution control and environmental sanitation.

Influence: Refers to the effect of one thing (or person) on another; the effect of one thing (or person) on another; it is bringing about of an effect, physical or moral, by a gradual process and causing something without any direct or apparent effort. For the purpose of this study influence refers to the learners providing an example for the other household/community to follow and win their admiration in relation to environmental conservation.

Knowledge of agriculture: The knowledge of agriculture contained in the primary school science and agriculture syllabus that is related to environmental conservation issues. This was measured by the mean score pupils' attained in the knowledge test.

Level of knowledge of agriculture: In the study, this refers to the level of knowledge the pupils' have gained in primary school related to environmental conservation. This was measured by the average grades and scores attained by pupils' in the knowledge test.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter highlights the literature to this study. It consists of the conceptual description of agricultural education and environmental education; agricultural education in primary schools; objectives of teaching agriculture and science in primary school; environmental education in primary school; environmental conservation in the community and concludes by presenting the theoretical and conceptual frameworks which shows the interaction of variables considered in the study.

2.2 Basic Concepts in Environmental Education

Agricultural education provides agricultural knowledge to individuals and specifically provides students with the opportunity to participate in coordinated group and individual instructional activities that are focused on preparation for future careers in agriculture. Agriculture encompasses various elements of food, fiber and natural resource systems. The knowledge, skills and attitudes in agriculture are required in producing, managing, processing, marketing, distributing, regulating and in protecting any of the renewable resources (Career Technical Education, CTE, 2000). This study was relating the knowledge of agricultural education in the way it is used in protecting and conserving the renewable natural resources in the community. Integration of environmental education in science and agriculture in primary schools aimed at providing the learners with knowledge and skills on how to conserve and use the environment sustainably (Kenya Institute of Education, KIE, 2002). Environmental education is an active process that increases awareness, knowledge and skills that result in understanding, commitment, informal decisions and constructive action to ensure stewardship of all interdependent parts of the earth's environment.

Environmental education should simultaneously attempt to create awareness, transmit information, teach knowledge, develop habits and skills, promote values, provide criteria and standards and present guidelines for problem-solving and decision-making. The latter necessitates both classroom and field activities. This is an action-orientated, project-centred and participatory process leading to self-confidence, positive attitudes and personal commitment for environmental protection. It has become increasingly fashionable to laud the wonders of environmental education as a tool towards attaining education for sustainable development. Politicians, managers, developers, environmentalists, educators, and others continue to sing its praises. But what exactly is environmental education and what does it entail? According to E. Buchcic & M. Grodzi, 2004, the environmental education is understood to be: Education *about* the environment (building awareness, understanding and skills necessary to obtain this understanding); Education *in* (or from) the environment (where learning occurs in nature, outside of the classroom); Education *for* the environment (the ultimate goal being conservation and sustainable development). Early international consensus regarding the goal of environmental education *for* the environment was expressed in the 1975 Belgrade Charter adopted by the International Workshop on Environmental Education. The following was identified as the goal of environmental education as to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively towards solutions of current problems and the prevention of new ones. (Chatzifotiou and Athanasia, 2006). Four main elements were found to critical in achieving the objectives of environmental education. These are: raising awareness of the need for environmental conservation, developing a deeper understanding of the principles and complex issues involved, building personal and societal commitment to conservation, facilitating changes in behaviour and action that promote sustainable development as a new mode of living.

Agenda 21 chapter 25 on youth and children points out how children not only inherit the responsibility of looking after the Earth, they also comprise nearly half the earth's population. Furthermore, children are also highly vulnerable to the effects of

environmental degradation. The specific interests of children need to be taken fully into account in the participatory process on environment and development in order to safeguard the future sustainability of any actions taken to improve the environment. Mobilizing communities through schools and youth groups is an important so that children and their parents become effective focal points for sensitization of communities to environmental issues. Establish procedures to incorporate children's concerns into all relevant policies and strategies for environment and development at the local, regional and national levels, including those concerning allocation of and entitlement to natural resources, housing and recreation needs, and control of pollution and toxicity in both rural and urban areas (Visvalingam, A. 2002).

Environmental education involves learning about the natural systems that sustain life and how those systems are affected by human activity. It raises public awareness of the environmental consequences of their actions. Everyone including parents, students, farmers, teachers, business peoples, government officials, on job or at home need environmental education. Whether in the city or in the country, one can learn from each other to be better environmental stewards (Palmer, 1997). Environmental education also aims at producing citizens that are knowledgeable and skilled concerning the biophysical environment and its associated problems. One should be aware of how to solve these problems and work actively towards their solutions (Cutter, 2001). According to the State of Environmental Education in Alaska (2003), the goal of environmental education is to develop a world population that is aware of and concerned about the environment and its associated problems. One should also have knowledge, skills, attitudes, motivations, and commitment to work individually and collectively towards solution of current problems and prevention of new ones. Karembu, and Kinyanjui, (1997) pointed out that education provides the people with opportunities and capabilities to acquire knowledge and skills and utilize them to manage, adapt and benefit from the socio-economic, technological and environmental changes going on in our communities.

According to Cutter, (2001) primary school education should endeavor to improve and protect the environment through producing an environmentally informed, committed and

active citizenry. This can be possible if and when primary school pupils' are actively involved in implementing conservation measures learnt in school within their immediate communities. In order to succeed and become attractive environmental education must relate to the grassroot activities and adapt new approaches such as in its integration in science and agriculture in primary schools (Karembu, & Kinyanjui, 1997).

Education for sustainable development (ESD) is a process of learning how to make decisions that consider the long-term future of the environment, economy and society of all communities (UNESCO, 2006). Pursuing sustainable development through education requires educators and learners to reflect critically on their own communities; identify non-viable elements in their lives; and explore tensions among conflicting values and goals. ESD brings a new motivation to learning as pupils' become empowered to develop and evaluate alternative visions of a sustainable future and to work to collectively fulfill these visions (NEMA, 2008).

2.3 Primary School Agriculture

There have been a number of very detailed and thorough reviews of the debate on teaching agriculture in schools. Reidmiller (1994) noted that the development of teaching agriculture in primary schools has been closely linked to political and ideological viewpoints. Primary agriculture was seen as a means of initiating the population into the work ethic under the banner of education with production. Others saw agriculture as a 'relevant subject area', pertinent to the development of the individual and ultimately the nation (Vandenbosch, *et al.*, 2002).

The colonial education system included primary school agriculture as a means of educating the native population for productive work (Reidmiller, 1994). The learning of science and agriculture should therefore ensure that the teachers relate the learning experiences to the children's day-to-day life (KIE, 2002). According to Karembu and Kinyanjui (1997), learning is more than formal education, it involves a process of acquiring knowledge, skills and values in the context of social groups and through the experiential process where learning takes the form of doing for example, when planting

trees and caring for them. This has been made possible by integrating environmental education in science and agriculture in primary science syllabus.

Schools and colleges are not only places of learning about sustainable development, but places where children can actively implement good practices of sustainable development, for example in energy conservation, recycling, productive use of school grounds or compound, use of natural materials and resources (Learning conference, 2008).

2.3.1 Objectives of Teaching Agriculture and Science in Primary Schools

According to the MOEST (2000a), the following are the objectives of teaching science and agriculture in primary schools:

i). To develop the ability to observe and explore the environment.

ii). To develop creativity and critical thinking in addressing new and emerging challenges especially in environmental conservation.

iii). To develop positive attitude about self and the environment.

iv). To manage and conserve the available resources.

v). To identify and utilize opportunities for productive work in the school, home and community.

vi). To acquire basic scientific knowledge.

These objectives have been stipulated in the new primary school curriculum, which has incorporated emerging issues, one of which is environmental education. The rationalization of the primary curriculum has resulted into new learning areas where home science, agriculture and science have been integrated into one study area called science, which includes environmental education (MOEST, 2002b). One of the national goals of education is to foster positive attitude towards environmental development and conservation among the youth and appreciate the need for a healthy environment (MOEST, 2002b). This is only possible if the learners are encouraged to practice some of the activities done at school in their homes and in the community. Such activities may help the pupils' to develop skills for maintaining and using the natural resources found in the environment.

There is conflicting evidence about the popularity of primary school agriculture. Reidmiller (2002) stated clearly that agriculture provides a source of income and food for the pupils', their leaders and the community. Reidmiller, has emphasized that agriculture is unpopular, dirty and a means through which pupils' labour is exploited. Most urban based young people do not see the relevance of agricultural education (Vandenbosch, *et al.,* 2002). However, agricultural education is taken as a prerequisite to sustainable development. Since education addresses the specific needs of the rural population, there is need to integrate rural development with basic education, as done in integrating environmental education in science and agriculture in primary school syllabus (MOEST, 2000a). There is however no clear link between primary school agriculture and rural development activities. There is a lot of potential for agriculture to play a role relevant to this primary schooling, and could be in ways that are innovative, learner-oriented and strongly linked to the realities of pupils', parents and communities (Vandenbosch *et a*l, 2002). In a study conducted in Western Kenya, Vandenbosch *et al* (2002) found out that community member's expressed great satisfaction on the significant role children played in community participation and that they should not be divorced from other activities. Reidmiller (2002) stated that basic science in the primary school curriculum has been rarely challenged, but one reform strategy is that teaching has been made more relevant by integrating science with agriculture. There is a reason then to believe that agriculture can provide knowledge and skills to make teaching of science and environmental education more relevant and effective.

2.4 Environmental Education in Primary School

The role of education in conservation and in addressing the rapidly increasing environmental conservation is well documented by (Tuncer, and Erol, 2001). It is the right of every citizen to live in a healthy and balanced environment, and each individual, including primary school children, has to strive to prevent environmental pollution (Ho, 1998). In Kenya, according to the new curriculum for primary schools, environmental education has been integrated into science and agriculture syllabus (MOEST, 2002a). Topics previously taught in science and agriculture are now taught in science (KIE,

2002). Since the youth make the future extension clients, sustainability of agricultural production depends on how they are introduced to this and efforts should be made to involve pupils' in agricultural activities related to environmental conservation (National Agricultural Extension Policy, NAEP, 2001). Integrating environmental education in the primary school curriculum leads to achieving what the national extension policy recommends.

According to Otieno (2003), Environmental Education achieves the following aims:

i). Enrich the children's experience by developing their imagination, creativity and thinking power, self-reliance sensitivity to and therefore inquisitiveness or investigation into the varied and diverse real world in which we live.

ii). Develop a children's consciousness for safety within the environment and thus acquire positive healthy attitudes and lifestyles.

iii). Promote understanding of the material environment and appreciation for its protection and utilization using scientific and technological knowledge and skills.

iv). Develop within the individual as a member of the society, good social habits, a sense of respect, co-operation and collective responsibility, which is useful for harmony and care of the environment.

v). Strengthen the practical approach to environmental education in schools and establish networks for environmental conservation action between school and the community.

The teaching of environmental education in schools takes place both in the classroom and as outdoor activities. According to Mukabi (2001) in the Mount Elgon Integrated Conservation and Development Project pupils' are involved in environmental field days. in activities such as writing of compositions, poems, and choral verses presented during the field day. Activities that take place within the school include establishment of tree nurseries, afforestation, soil conservation, flower gardening, general school aesthetics and community sensitization, through debates, poems, verses, drama and songs (Mukabi, 2001). It is hoped that these activities will help to protect the already threatened ecosystem, which is only possible if pupils' participate in environmental conservation

activities as part of their social responsibilities (Ho, 1998). Schools are expected to promote primary environmental care activities that address the basic needs of community; this will improve the environment for children at the household and community level. Schools should also encourage the participation and empowerment of local populations, including women, youth, children and indigenous people, towards the objective of integrated community management of resources through integrating learning activities with the community environmental activities. Through networking and school community cooperation, they can get relevant technical guidance (KOEE, 2004).

Schools are one of the most important communities in any society, where the attitudes of future generations can be developed and influenced. By encouraging children at an early age to play an active role in cleaning up their surroundings, they will learn about taking responsibility for their environment, and more importantly the consequences of their own actions. This is surely one of the greatest lessons a school can offer. No doubt, many people throw litter on the ground because they think that there will always be someone else to come and pick it up after them (Learning Conference, 2008).

2.5 The Primary School Science and Environmental Education

The primary school science syllabus has topics related to environmental conservation such as water, air, animals, pollution of air, water, soil, and light (MOEST, 2000a). These topics if well taught may lead to achievement of some of the national goals of education such as, fostering positive attitude towards environmental development, conservation and appreciation of the need for a healthy environment. Most of the general objectives related to environmental conservation such as developing the ability to observe and explore the environment, manage and conserve the available resources among others may be achieved (MOEST, 2000a). Simply increasing basic literacy, as it is currently taught in most countries, will not advance sustainable societies. Indeed, if communities and nations hope to identify sustainability goals and work toward them, they must focus on skills, values, and perspectives that encourage and support public participation and community

decision-making (Mckeown, R. 2002). To achieve this, basic education must be reoriented to address sustainability issues.

The eco-schools programme in Kenya with funding from DANIDA established schools micro-projects geared towards addressing poverty related issues while at the same time promoting environmental conservation. Schools came up with proposals for micro-projects as per their identified needs and problems. These included among others, horticulture, agro-forestry, dairy farming, poultry farming, energy alternatives and waste management. It was envisaged that once the micro-projects pick up, the local communities would learn from the experiences at school level and replicate the same. During the initial stages of micro-project establishment, a survey was done that showed extreme lack of local initiatives despite the fact that communities were gifted with abundant natural resources (KOEE, 2005)

There is much talk about the major environmental problems facing 'the planet', yet the planet could be viewed simply as all the local places grouped together. Global problems result from local problems. Were each locality, school or individual to find out how they contribute to global problems and then set out to reduce their environmental impact, many of the global problems would diminish (Visvalingam 2002). Environmental education is a responsibility of the whole school community this makes it more than a curriculum issue. It involves schools in managing natural resources in a way that causes no significant damage to the environment and considers the needs of future generations. (Otieno, 2003). It is vital that, from an early age, children acquire a good knowledge and understanding of their surroundings and the natural resources there. Only then will they gain respect for the environment and a desire to take care of it. This is the key to a sustainable development and the future of the society. Though environmental education is very important in itself, there is also a great potential to use it to teach standard curricular. Nature can be a great teaching tool to deepen children's understanding of science and other related subjects'. The emphasis should be on using environmental education as a tool for interdisciplinary hands-on teaching. For the young age, education should be experiential, interactive and creative in order to stimulate interest in and excitement about

learning. Only then will children gain the motivation, confidence and independence necessary to achieve their full potential (Visvalingan, 2002).

Environmental education has its earliest roots in humans trying to understand the environment in which they lived. Over time it has evolved to address the urgent crisis of environmental degradation that severely threatens human quality of life Otieno, 2003.
The Kenya Organization for Environmental Education (KOEE) has implemented a number of programmes that are aimed at building the capacity of schools and communities to conserve their environments. The eco-Schools have adopted Environmental action learning principles in guiding all their school activities and incorporated environmental issues in the school curriculum (Otieno, 2002). The eco-schools programme applies five key components: environmental policy, cross curriculum teaching and learning, micro-projects and school-community partnerships networking. The Eco-school has local community participation, learner empowerment to actively resolve environmental problems and school community networks and partnerships.
The eco-schools strategy applies the components of environmental action learning, these are:

- An Environmental Audit: The audit acts as a starting point for the school and community to enable them to set practical and realizable objective goal towards solving school community environment development programmes.
- Establishment of a plan of action: The committee in consultation with other stakeholders formulates the projects as well as the implementation and management strategies.

  (Otieno, 2003).

In addition to the environmental action plans schools need to: develop a School environmental policy within the schools development plan, develop an eco-code to demonstrate the commitment of the schools and the communities surrounding them to environmentally friendly actions, develop local curriculum teaching and learning resources within the context of school syllabi and encourage school-community cooperation aimed at promoting collaborative efforts in solving common problems

through local environmental projects. This will also build the capacity of communities to implement Agenda 21 (KOEE, 2005).

The environmental education policy requires schools to develop a school environmental management plan that addresses three focal areas. These are curriculum, management of school grounds and management of natural resources. When environmental education is incorporated into the school curriculum, pupils' learn about the environment, develop skills to investigate and solve issues in the environment, acquire attitudes to care, and concern for the environment (Smith, 2001). They understand the principles of ecologically sustainable development and adopt behavior and practices that protect the environment (Otieno, 2003). For a school to achieve the objectives in the three focal areas, all must develop their own school environmental management plan that incorporates the three areas as shown in figure 1.

2.6 Whole-School Plan

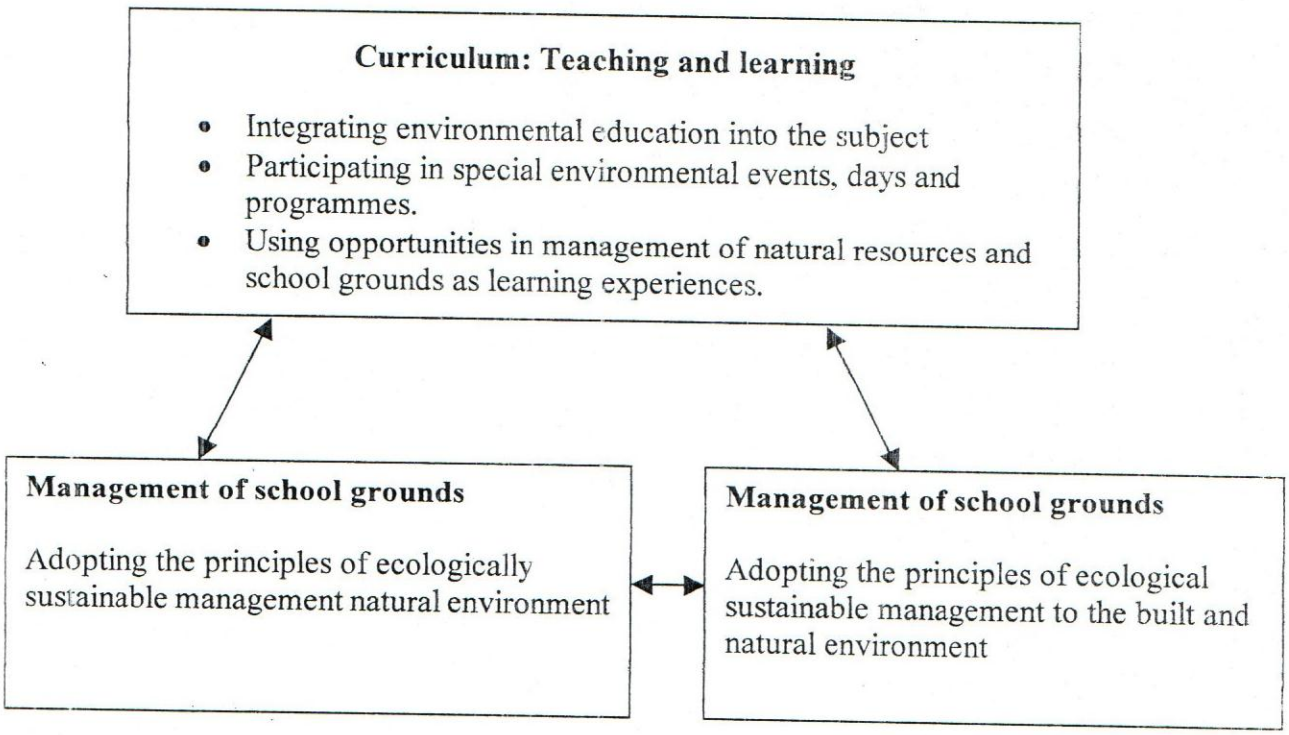

Figure 1: The school environmental management plan

Source: Otieno, 2003.

Children can be exposed to appropriate environmental education to achieve the objectives of sustainable development in Kenya. According to Orodho (1996), there is need to articulate environmental concerns in a development perspective. Sustainable development is the development that meets the needs of the present generation without compromising the ability of future generation to meet their own needs. It involves people identifying their own needs, then development experts (environmentalists and educationists), assist them to plan and implement viable programmes and projects to meet the defined needs (Orodho, 1996). In communities where people were able to come together to protect their ecosystems, they have better schools, health care and economies. There is no more direct route to environmental well being other than investments in young people; they need to be considered not only as leaders of tomorrow, but as partners of today as expressed in Students in Free Enterprise (SIFE, 2002).

Unfortunately, many environmental education programmes are incomplete in that they only focus on developing awareness and knowledge, and do not take the learner through to the ultimate objectives of building that personal commitment to act in a sustainable development concept (Visvalingan, 2002). There is evidence of growing public and government concern for protecting the environment and particularly safeguarding of the environment for future generations. Young people must be equipped with an understanding of their natural environment so that they become guardians of the earth's future (Freeman, 1995). For them to be effective guardians they need the opportunity to increase their knowledge of nature and the environment. Environmental education can only be made meaningful if it integrates with the pupils' home experiences. If confined to school, environmental education has limited relevance, no matter how many trips there are to nature reserve or how many school nature areas are built. Children learn most effectively through their informal play activities (Freeman, 1995). This is easily achieved when pupils' carry out environmental conservation activities in their communities (Åhlberg, M. 2004).

2.6.1 Environmental Education as an Integrating Concept

Environmental education (EE) is a lifelong process with the objective of imparting to its target groups in the formal and non-formal education sectors environmental awareness, ecological knowledge, attitudes, values, commitments for actions, and ethical responsibilities for the rational use of resources and for sound and sustainable development. Environmental education emphasises the teaching of the holistic nature of the environment through interdisciplinary and problem-solving approaches. This has to start as early in education as possible. The primary school is the natural place to introduce children to environmental education, since at this level they instinctively have a holistic view of the environment; they have not yet been trained to compartmentalise their learning into separate subject, as they will have to do in secondary and higher education. Introducing critical thinking and problem-solving approaches in EE, especially at primary school level, is fundamental if students are to become skillful in the identification and solution of environmental problems as students and later on as adult citizens and possibly decision makers (UNESCO, 2006)

At early childhood education level, EE is integrated in the curriculum using a thematic approach. At the primary and secondary school level, environmental issues are mainstreamed in the existing subjects using a multidisciplinary approach (Otieno, 2003). Outreach programmes to schools, communities and other target groups need to be encouraged to integrate the concept of environmental education to all sectors of the society. This includes:

- Pupils' field trips and weekend eco-camps to promote appreciation and understanding of our natural environment.

- Public awareness events (fairs, exhibitions, etc.) for World Environment Day, World Wetlands Day, etc.
- Participation in trade fairs and shows by exhibiting what the school is doing on environmental education and showing ways in which the school can develop partnership with community on environmental conservation matters.

In the integration concept interdisciplinary approaches in Environmental Action Learning provide an open-ended learning and problem solving process to all sectors and learner groups:

- Putting local environment, action and learning at the centre of education, to enhance sustainable lifestyles.
- Taking action for the environment as an essential part of learning, while solving environmental problems.
- Utilizing micro-projects as learning aids and as linkages for dynamic community partnerships and networks.
- Enhancing democracy and participation opportunities for communities to experience environmental citizenship.
- Students' active role in their own learning and in their communities enhances experiential opportunities in the natural environment and in the community and develops skills and characteristics of quality work and citizenship.
- Solving environmental problems and providing basic knowledge and skills for optimizing the learning environment is key to mobilizing resources and meeting the needs of the learners (Buchcic, E. and Grodzi, M. 2004)

At primary school – the second stage of education – ecological issues appear to different extent in many subjects and subject blocks. The aims, contents, tasks, achievements and the organizational method of school lessons are specified in the primary school curriculum (MOEST, 2000). The science subject combines content and skills from different fields of knowledge. Integration demands that teachers create and implement the teaching process in a flexible manner; it calls for the ability to work with others to show the complexity of the phenomena (Buchcic E. and Grodzi, M. 2004). Furthermore, the process should be implemented through an interdisciplinary approach. Whilst this interdisciplinary approach links closely with many aspects of geography and natural science, it should lead on to participation in practical environmental education activities orientated towards a solution of the problems facing the global environment (Visvalingam, A., 2003). Environmental education is a process that helps to develop the

skills and attitudes needed to understand the relationships between human beings, their-cultures, and the biophysical world. All programmes of environmental education will therefore include the acquisition of knowledge and understanding and the development of skills. However they should also encourage curiosity, foster awareness and lead to an informed concern, which will eventually be expressed in terms of positive action.

Environmental education builds from a core of key principles that inform its approach to education. Such principles as integration and infusion of disciplines from natural sciences through social sciences to humanities and are connected through the medium of agriculture and environmental issues. Environmental education offers opportunities for integration and works best when infused across the curriculum rather than being treated as a separate discipline or subject area as expressed by North American Association for Environmental Education (NAAEE, 1998). Environmental education cannot be left to a few teachers in schools. All teachers and subjects have to teach it in a multi-disciplinary approach, where integration is done in subjects such as science, agriculture and geography, history and civics (Ngumy, 2001).

Environmental education has been used as an integrating concept within the curriculum to improve students learning. This helps students to understand the environment upon which they depend. In order to help the environment improve, considerations for the environment must be increasingly integrated into the strategies addressing childhood development at the international, regional, national and local levels. Environmental Education if tailored to local situations will increase children's knowledge and ability to protect themselves from environmental hazards (UNEP, UNICEF, & WHO, 2002). The school environment should be set in such a way as to provide opportunities to deal with a variety of issues and contexts, such as home and community, local industry and the natural and man-made environment.

The goal of the United Nations Decade of Education for Sustainable Development (2005-2014, DESD), for which UNESCO is the lead agency, is to integrate the principles, values, and practices of sustainable development into all aspects of education and

learning (UNESCO, 2006). It aims at ensuring access for all youth to all types of education, wherever appropriate, providing alternative learning structures, ensuring that education reflects the economic and social needs and incorporates the concepts of environmental awareness and sustainable development throughout the curricula and also aims at expanding vocational training, implementing innovative methods aimed at increasing practical skills, such as environmental scouting (UNESCO, 2006).

2.6.2 Environmental Conservation Efforts in the Communities

Farmers are the chief stewards and managers of extensive natural resources, owners and architect of the landscape and protectors of precious soil resource (UN, 2002). Thus, management of natural resources such as water, soil, and protection of forests should be based on a participatory approach involving different stakeholders including school children. The local communities are the immediate victims of environmental problems and are motivated as interested parties when their livelihoods are threatened. Pupils' and students are involved in environmental conservation activities by linking with the local community especially in agriculture and horticulture (Caody, 2002). According to Caody (2002), the students act as role models in environmental leadership by acting as guides for visitors from other schools who visit to observe the latest practices in sustainable agriculture, land care, conservation and rehabilitation. Education plays a key role in motivation and adoption and requires tailored, credible, appropriate information and experience that is communicated through the proper channels (FAO, 2002). In this case, extension provides the information, but pupils' could also be another source of information on conservation agriculture and environmental conservation. UNEP (2000) advocated that environmental education for school children provides basic information about environmental protection, aquatic ecology and the relationship between human activity and water quality. Farmers need good information on habitant protection and on the factors needed to protect the environment. Primary school education should make use of the natural curiosity of children and stimulate it accordingly. UNEP (2000) recommended that an educational project should have the following guidelines.

- The student should not only be a receiver of the information, but exchange of information is reciprocal.
- The exchange of information between the students and their communities should be promoted.
- The material should be specific to the children and their communities.

The capacity-building needs of the farmer are immense and most development assistance should be directed to strengthening the ability of communities to participate in their own development through organizations (UN, 2002). Mosely (2003), stated that community- based conservation is highly participatory at the local level and the most effective environmental education and communication activities should be made to the widest possible audience including pupils' and students. The communities learn from local agencies by having access to environmental projects, which increase their understanding of the importance of ecologically sustainable development. The UN (2002) advocated that there may be measures in traditional farming to achieve environmental benefits, but this should start bottom up involving producers who have intimate knowledge of the conditions and challenges of their particular farming systems. According to UNEP (2000), the use of parent- teacher associations in schools to enhance the link between children and their communities can increase the dissemination of environmental issues and create public awareness. UNEP (2000) further stated that education that produces the best results regardless of age is one that is conducted in direct contact with nature, enabling emotional needs to develop. Education within the environment is essential for developing a sense of responsibility in children for the environment (Ho, 1998). For the school–community interaction to exist successfully the following points are suggested by Karembu and Kinyanjui (1997).

- The community and the school must be convinced of the necessity for the interaction, for instance what is lost or gained.
- The community must develop the sense of ownership of the school and its activities, while the school and its leadership should have the sense of belonging to the community.

- Realization of the immediate and long term benefits arising from the interaction.
- Common understanding of the situation confronting both the school and the community and the vision of the future.
- Strong local and school leadership to take decisions and guide the community and the school activities.

However in Kenya the teaching of environmental education is towards gaining of knowledge for purposes of passing exams and not for practicing what has been learnt especially in the conservation of the environment. The environmental problems that are experienced in Kenya such as environmental pollution, soil degradation, and solid waste among others are also prevalent in Akithii division.

2.6.2. Theoretical Basis for the Study

The theoretical basis for this study was taken from work done by Taylor and Mulhall, (1997); on the relationship between the learner, the school and the community, as the learner is the integrating factor in the learner centred approaches to learning (Figure 2). Improved linkages between school, parents and community are an important measure in moving towards a participatory environment required for learning. Linking the three is difficult, but the common factor and the most valuable of all is the learner. This is advocated in child-centered approaches to learning because primary education becomes more effective if it is linked to things that matter to both children and their families. The learner acts as the focal point for this tri-partite structure. The learner brings the three environments together, enabling the pupils' to integrate their learning experiences inside and outside school.

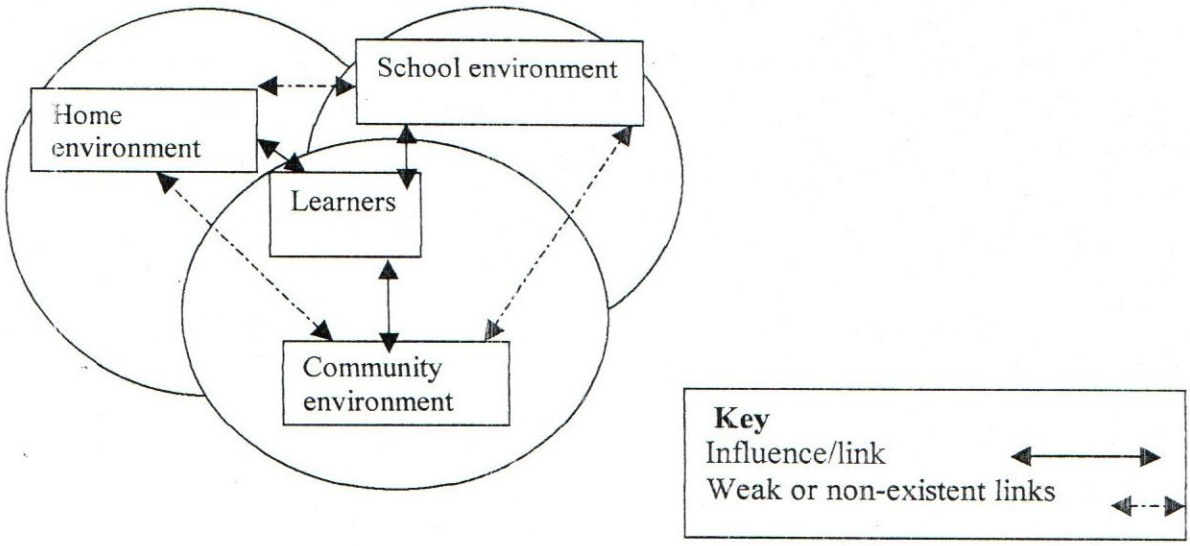

Figure 2: The linkages between the school, home and community environment (Adapted from Taylor and Mulhall, 1997).

The linkages among the environment themselves may be comparatively weak especially in such a study where the link is the learner. There is need for learners to gain knowledge from school and pass the same knowledge to the community and home environment. This means the learner is the link of the three parties involved. The link between the community, home environment and school is very weak it is only strengthened through the learner. Taylor & Muhall (1997) advocated for the need to develop an education system, which would develop the learning potential, and care for rural needs in relation to resources and future chances. The integration of environmental education in the school curriculum improves the learner's knowledge and skills of environmental conservation. UNESCO (1994) asserts that the purpose of education needs to be defined, as education should not be for giving jobs, but for providing better ways of improving the situation. This means that it is necessary to create conditions where the curriculum and teaching-learning practices are influenced by experience and the environment of the pupils' enabling children to integrate their learning experience inside and outside the school (UNESCO, 1994). Taylor & Mulhall (1997) pointed out that most learning in our lives is along the lines of an integrated curriculum, which is a combination of several components of our object, organization or system into a whole in order to make it complete. This means the learners can relate learning much more closely to the local

environment. Caody (2001) found out that through environmental projects there are raised awareness, knowledge and understanding of environmental issues and sustainable solutions among students and community.

2.7. Conceptual Framework

The conceptual framework was developed to show the relationship between the independent, dependent variables. This is related to the theoretical framework in that it relates the independent variable who is the learner and the dependent variables found in the environment where the learner is expected to influence. The variables are interacting in relation to the relationship between the learner who is at the centre, the school and the community. The independent variable, the pupils' knowledge related to environmental conservation was determined by the knowledge test on environmental conservation and practices. The dependent variable consisted of the existence of conservation measures, their quantities, frequencies and pupils' involvement in the conservation practices. The three types of variables have a relationship within the study as illustrated in Figure 3. The pupils' knowledge of agriculture related to environmental conservation is the independent variable, which was affecting the dependent variable, the environmental conservation. The moderator variables were affecting the dependent variable other than the independent variable. Thus environmental conservation assumed to be the effect, was as a result of not only the independent variable but also the moderator variables.

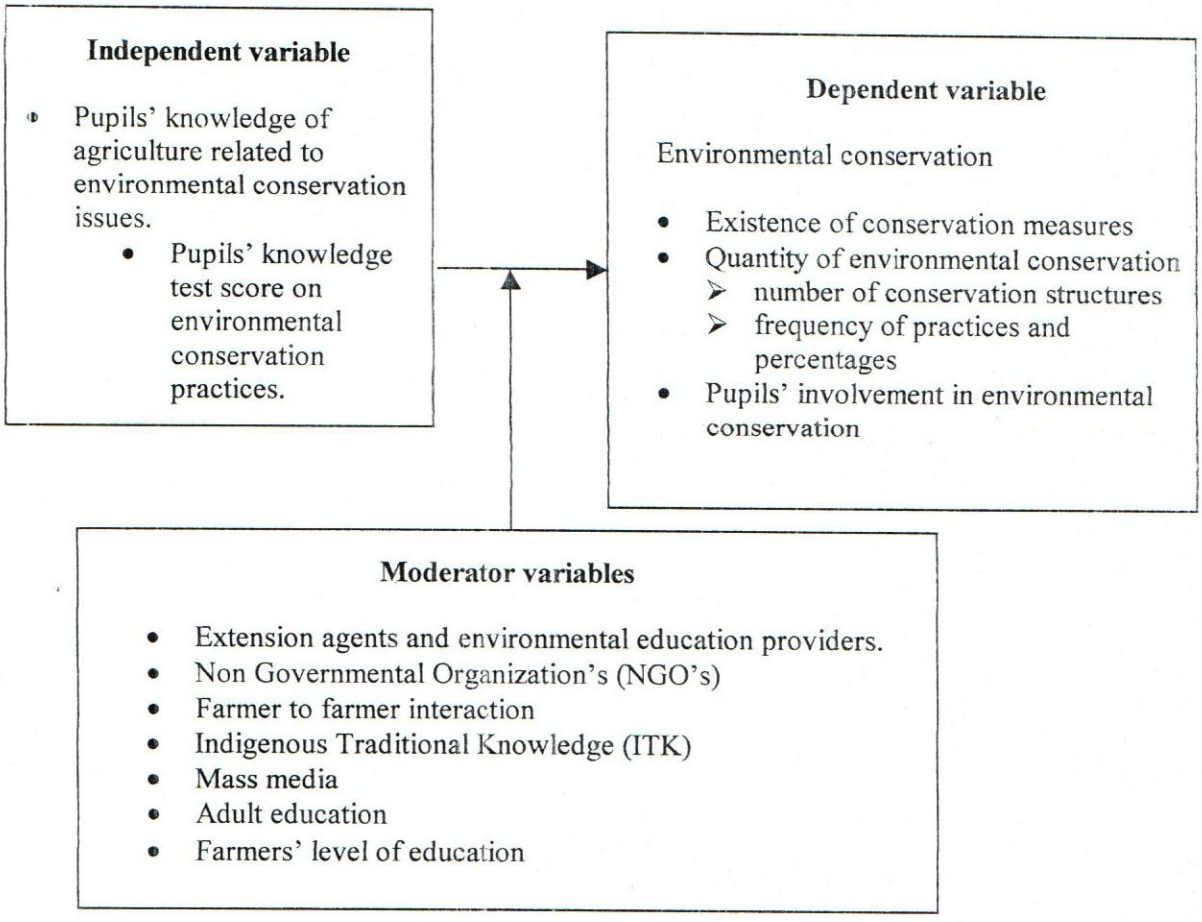

Figure 3: Conceptual framework showing the relationships among the study variables

In order to study the influence of pupils' on environmental conservation the three types of variables interact namely, independent, dependent and moderator variables. Figure 3 shows how the three variables interact. The independent variables consist of the pupils' knowledge of agriculture related to environmental conservation issues. The variable is causing the effects on the dependent variable, which are the environmental conservation practices and pupils' involvement in environmental conservation. The moderator variables are assumed to affect the dependent variable, and hence were included in the study. The study is aimed at finding out the impact the learners have on the community after learning environmental education in school. The independent variable gives the knowledge base which the learners have acquired as result of the learning process during the primary school schooling period up to standard seven. The knowledge is expected to be used to influence the community in environmental conservation practices.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The main purpose of this study was to find out the influence of primary school pupils' knowledge of agriculture on environmental conservation. This chapter deals with the research design adopted for the study. It also describes the study location, sampling size, sampling procedures, and instrumentation and data collection procedures and data analysis.

3.2 Research Design

The study research design was co-relational ex-post-facto was designed to determine the degree and direction of relationship between two or more variables or measures of behavior. The strength of this method lies in the fact that it can be used to determine if there is a relationship between two variables without having to directly manipulate those variables. This involved collecting two sets of data, one of which is retrospective, with a view of determining the relationship between them (Cohen, and Manion, 2000). The design was selected for this study because the pupils' had already been taught the information on environmental conservation without the researcher manipulating them. Kathuri and Pals (1993) recommend this type of research for a study in which the researcher examines the effects of a naturally occurring treatment after the treatment has occurred. The strength of this method lies in the fact that it can be used to determine if there is a relationship between two variables without having to directly manipulate those variables. Correlation can be used when it is impractical and/or unethical to manipulate the variables. The main limitation of the design is that it does not tell researcher whether or not the relationship is causal. In other words, the correlation does not prove causation of the relationship being determined.

The key dependent variable was environmental conservation, which was measured by number of conservation structures, frequency of practice and concentration of practice. The study involved investigating the relationships between pupils' knowledge of agriculture related to environmental conservation and the level of conservation practiced at school and in respective communities generally, as well as the level of pupils' involvement in environmental conservation.

3.3 Study Location

The study was carried out in Akithii division of Nyambene District. The division suffers a high degree of environmental degradation despite soil and water conservation efforts of communities and the inclusion of environmental education in the primary school science and agriculture syllabus. The division covers an area of 162.2sq kilometers with a population density of 266 persons per square kilometer (Ministry of Planning and Finance, 2001). The division has a potential for growing various cash and food crops. Maize and tea are the main food and cash crops respectively grown. The division receives an average annual rainfall of between 700-1500mm per annum. The farm sizes range between 0.25 to 7 acres.

3.4 Population

The target population of the study was all the standard seven pupils' in the 29 primary schools in the division who total is 1,113 pupils' in standard seven.

3.5 Sample Size and Sampling procedure

The study adopted a multi-stage sampling procedure where purposive sampling was applied to get two locations used in the study these were Ncooro and Thinyaine locations. Then simple random sampling was used to select 6 schools, 3 from each location where 20 standard seven pupils' from each school were selected through random sampling. The households heads related to the sampled pupils' were correspondly used for the study. A

total of120 pupils' in standard seven were selected from six primary schools in the division and 120 households related to the sampled pupils' were selected were also used for the study. According to Kathuri and Pals (1993) the sample size should be large enough to allow an accurate interpretation of the results and at the same time ensure that the data is manageable. They recommend thresholds of 100 subjects in each major group in a population and 20-50 subjects in each minor group. Each school had a minimum of 20 pupils'. They indicate that the choice of a reasonable sample size saved time and limited resources. Table1 shows the breakdown of the sample sizes.

Table 1:Breakdown of sample sizes

Name of Location	Number of schools sampled	Number of pupils' sampled	Number of households
Thinyaine	3	60	60
Karii	3	60	60
Totals	**6**	**120**	**120**

3.6 Instrumentation

Data was collected using two questionnaires and the pupils' answered one knowledge test, which consisted of ten simple multiple-choice questions. The knowledge test was to assess pupils' knowledge of agriculture related to environmental conservation as shown in Appendix A. This helped to find out the level of knowledge of the learners of agriculture on environmental conservation. The first questionnaire was to obtain information on pupils' involvement in environmental conservation practices in the community as shown in Appendix B. This questionnaire helped to get information on pupils' involvement in environmental conservation in the community and the school. The second questionnaire shown in Appendix C was to find out community environmental conservation practices, levels of environmental conservation community, and sources of community knowledge on environmental conservation. The instruments were developed based on the objectives of the study and hypotheses to be tested

3.7 Validity and Reliability

3.7.1 Validity

The instruments were validated through discussions with the two supervisors, Professor C. Onyango and Dr. W. Ochola. All useful comments and suggestions were incorporated to further improve the instruments. This was done before the pilot-test and after which helped to ensure validity in content of the instruments.

3.7.2 Reliability

The instruments were pilot-tested with 20 pupils' and 20 heads of the households where the pupils' came from, this was in Kianjai Location, a neighbouring location which had the same characteristics as the study area. The reliability coefficient obtained was 0.7030 and 0.732 for the structured questionnaires using Cronbach's alpha coefficient. The reliability coefficient for the knowledge test was computed using the Spearman Brown coefficient and showed a coefficient of 0.720. The researcher had set the minimum acceptable reliability coefficient at 0.7; this is set as the threshold for this study, Fraeckel and Wallen (2000), indicated that the level acceptable of an instrument for social science research is set at 0.7 alpha coefficient.

3.8 Data Collection Procedure

The researcher obtained the letter of introduction from Egerton University Graduate School to help obtain a research permit from the Ministry of Education Science and Technology in order to get assistance and cooperation from the Provincial Administration, as well as schools and communities targeted for this research. The arrangements were made with the heads of the selected schools both teachers and parents were informed. The questionnaires were administered to the pupils' in their individual schools in groups. The parents' questionnaires were administered on a face-to-face basis with household heads. Only households from where the sampled pupils' come were visited. The non-response problems were dealt with by making sure the questionnaire

was administered in similar circumstances for each individual in the sample, and callbacks were made to households where the household head was not available (Fraenkel and Wallen, 2000).

3.9 Data Analysis

After data collection, the responses to the questionnaire were coded, and then data was entered into the computer for analysis. Data collected from the respondents was analyzed using both descriptive and inferential statistics. The descriptive statistics include frequency, percentage, means and standard deviation, all of which were used to describe the data collected. Inferential statistics used included one-way ANOVA to test hypothesis 1, 2, 3 and post Hoc analysis using LSD. Pearson's product moment correlation coefficient was used for inferential statistics to test hypothesis 4, 5 as indicated in Table 2. The level of pupils' knowledge was obtained using the knowledge test and the level of environmental conservation and pupils' involvement was obtained from the items in the questionnaires. The items in the questionnaire were scored in conformity with the hypotheses and the objectives. The computer programme used for analysis was Statistical Package for Social Sciences (SPSS) version 11.5. All hypotheses were tested at 5% level of significance. One-way ANOVA and Pearson's product moment correlation coefficient were used to analyze the differences between the various groups. Multiple comparisons were done through *post-hoc analysis* using least significant difference (LSD) technique (Table 2). This analysis was to allow the researcher to determine whether the various groups have any significant difference. Table 2 shows the summary of the statistical procedures and data analysis.

Table 2: Summary of statistical procedures and data analysis

Hypothesis to be tested	Independent variable	Dependent variable	Statistical procedures and data analysis.
Ho1: There is no statistically significant difference in the level of pupils' knowledge of agriculture related to environmental conservation among different primary schools in Akithii Division.	Different Primary schools in the division (Mwanika, Maathi, Thinyaine, Mwili, Limbine and Lumbi).	Level of pupils' knowledge of agriculture related to environmental conservation.	Means, standard deviation, and percentages. ANOVA, Post hoc (LSD)
Ho2: There is no statistically significant difference in the level of environmental conservation among different communities in Akithii division	Community around Primary schools (stated above)	Level of environmental conservation in the community around primary school.	Frequency, mean standard deviation and percentages ANOVA Post hoc (LSD)
Ho3. There is no statistically significant difference between the levels of pupils' involvement in environmental conservation practices among communities in Akithii division.	Community around primary schools in Akithii division (stated above).	Level of pupils' involvement in environmental conservation in the communities.	Frequency, mean standard deviation and percentages. ANOVA, post hoc (LSD)
Ho4: There is no statistically significant relationship between pupils' knowledge of agriculture and the levels of environmental conservation practices among communities in Akithii division.	Pupils' knowledge of agriculture related to environmental conservation, shown test scores	Environmental conservation. - number of conservation structures. -Frequency of conservation practices.	Means, standard deviation standard error of the mean. Pearson's product moment correlation coefficient.
Ho5: There is no statistically significant influence of the level of pupils' knowledge of agriculture related to environmental conservation and their involvement in environmental conservation practices in different communities in Akithii division.	Pupils' knowledge of agriculture related to environmental conservation. Shown by test scores	Pupils' involvement in environmental conservation. Measured by frequency of involvement.	Frequency and percentages. Pearson's product moment correlation coefficient

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This study investigated the influence of primary school pupils' knowledge of agriculture as it relates to environmental conservation in Akithii division and how this influenced environmental conservation practices in the division. The results are presented in this chapter according to each of the study objectives and hypotheses. Descriptive statistics are used to describe the findings of each objective, and the hypotheses are tested using analysis of variance (ANOVA) and Pearson's product moment correlation coefficient.

The study sought to achieve the following objectives:

i). to determine the level of primary school pupils' knowledge of agriculture as it relates to environmental conservation in Akithii division;

ii). to determine the level of environmental conservation in different communities in the division;

iii). to determine the level of primary school pupils' involvement in environmental conservation in the division;

iv). to establish the relationship between pupils' knowledge of agriculture as it relates to environmental conservation and environmental conservation in the communities within the division; and

v). to establish the relationship between pupils' knowledge of agriculture as it relates to environmental conservation and their involvement in environmental conservation practices in the division.

4.2 Description of Study Subjects

The subjects of the study were standard seven primary school pupils' m m and the heads of the households from which the pupils' hailed. The standard seven pupils' were selected because they had been exposed to the new primary school syllabus, which has elements of environmental conservation. The study required the learners to

have been exposed to the syllabus so that they would practice environmental conservation in school, in their households and in the communities as stated in the objectives in the syllabus and supported by documentation. The heads of the households were required, for the study, to determine the level of environmental conservation in the community. The following sub-sections provide the detailed description of the subjects based upon selected variables namely; household head characteristics (age, gender, level of education and farm size) and pupils' characteristics.

4.2.1 Household Head Personal Characteristics

The household heads' personal characteristics studied here were age, gender, level of education, and farm size.

Age of the household head

The age of the household heads ranged from 20 to 70 years with a mean of the household head being 40 years and a standard deviation of 10.7. This may have an implication on the level of environmental conservation since some environmental conservation practices are labour intensive. The mean age was 40 years, which may imply that the expected environmental conservation could be high. Nevertheless age and experience are difficult factors to link to conservation agriculture since studies have shown both have a positive and negative correlation (FAO, 2002). FAO also found out that the older and more experienced farmers were, the more likely they were to recognize soil problems. However, they are less likely than their younger colleagues to address the problems once recognized. The age of the household head would affect the involvement of the pupils' in environmental conservation in the communities.

Gender

Gender was considered an important variable within the household because gender determines property ownership and the way natural resources are used. This is due to

socio-cultural factors that create differentiated impact on male and female farmers' access to agricultural extension programmes and property ownership (Orodho, 1996). Where land is in the hands of the local elites, other parties such as dependant groups and women have few opportunities to gain access to land and this hinders sustainable land management (Ott, 2002). A study carried out in Githunguri, Central province, Kenya found out that 83% of decisions on natural resource conservation work such as afforestation and soil conservation are made by men (Ott, 2002). Thus the decisions related to natural resource management are basically made by men and majority of the household representatives in this study were women. The data shows that there were more women (58%) than men (42%) in the study as shown in Table 3.

Table 3: Gender of the household head

Gender	Frequency	Percentage
Male	51	42.0
Female	69	58.0
Total	**120**	**100.0**

The difference in gender composition has an implication on environmental conservation because gender differences have different impacts on the use of the environmental resources due to control, access and property rights. Orodho (2003) showed that women's no property rights work against their capacity to apply whatever knowledge they gain from agricultural extension. This may affect results of this study as both men and women were involved in the study with respect to involvement in environmental conservation. Zuckerman (2002) found out that women were the key to agricultural growth and were custodians of traditional knowledge and were direct users of bio-diversity. Therefore gender equity and women's empowerment are important for achieving sustainable development in natural resource management. There is need to ensure that agricultural research and extension service providers recognize and respond to gender differentiated roles. This was not the case in this study due to gender inequalities that exist in the community in relation to property ownership and use. Thus, it is expected that the level

of environmental conservation could be affected by the way gender issues are related to environmental conservation. This would further affect the pupils' involvement in environmental conservation in the communities within the division.

Formal Education

Education is essential for empowering the people. Basic education in particular affects small landholders and subsistence farmers' productivity. The education level was relevant in this study because education is the way people gain knowledge and adoption levels are related to the level of education of the persons concerned. UNEP (1996) found out that a farmer with four years of elementary education is on average 8.7% more productive than a farmer with no education. This indicates that developments require adaptive and practice of environmental conservation. In this study 7% of the farmers had no education while 1% had post secondary education. This could have an implication on the levels of environmental conservation and further implication on the pupils' involvement on environmental conservation in the communities. Table 4 shows the various levels of education attained by household heads in the study.

Table 4: Formal education of household head

Level of Education	Frequency	Percentage
None	13	7.0
Primary	71	61.7
Secondary	34	29.6
Post secondary	10	1.7

Education level of the household heads varied from no education to post secondary. The highest percentage of the respondents had primary school education (61.7%) while the lowest (7.0%) had no formal education. This has an implication on environmental conservation in the community, since the level of education of the household head might determine the level of environmental conservation. Most farmers have basic primary school education and soil and water conservation practices are knowledge intensive.

According to Amri *et al.* (2003), extension services have a significant influence on adoption of land improving technologies and low adoption may be due to high levels of illiteracy amongst the farmers.

Farm Size

Studies on adoption of environmental conservation practices have often given significant attention to farm size and have found farm size to positively correlate with adoption (FAO, 2002). The larger the farm the more the conservation structures constructed in the farm. In the study, the average farm size was 1.9 acres, with a range of 0.25 to 7 acres and a standard deviation of 1.7. In the study, farm size could have an implication because structures used in soil and water conservation are related to the farm size. Equally it is expected that the pupils' involvement would be affected by their households' farm size.

4.2.2 Pupils' Characteristics

The study involved standard seven primary school pupils'. These are the learners who have been exposed to the new primary school science syllabus where environmental education has been integrated in the curriculum. It is assumed that the learners have been taught issues related to agriculture in line with environmental conservation. These issues are: soil and water conservation, the environment and its components and pollution of water and air. The pupils' are expected to practice environmental conservation activities in their homes.

A research carried out by FAO (2002) in Ethiopia found out that the youth were a valuable asset in the community and should be engaged in school garden activities and build capacity for children, that is shared with families and community members. The schools also play a bigger role in educating the communities about sustainable living and serve as role models, thus environmental education brings communities closer to schools. This can be possible if and when primary school pupils' are actively involved in implementing conservation measures learnt in school within their immediate communities. In order to succeed and become attractive, Environmental Education must

relate to the grass_ roots activities and adapt new approaches such as in its integration in science and agriculture in primary schools (Karembu, and Kinyanjui, 1997).

According to Agenda 21, schools are expected to promote primary environmental care activities that address the basic needs of the community; this will improve the environment for children at the household and community levels. Schools should also encourage the participation and empowerment of local populations, including women, youth, children and indigenous people, towards the objective of integrated community management of resources through integrating learning activities with the community environmental activities.

4.3 Pupils' Knowledge of Agriculture Related to Environmental Conservation

The first objective sought to determine the level of pupils' awareness of environmental conservation. The knowledge/content considered was on soil and water conservation, air and water pollution and general conservation measures at the farm level. The knowledge test was designed to find out the level of the learners' understanding of agriculture as it relates to environmental conservation and was measured by getting the averages and percentages of the raw scores obtained by the pupils' in the knowledge test. The results of the knowledge test from different schools are presented in Table 5.

Table 5: Level of pupils' knowledge of agriculture as it relates to environmental conservation

School	N	Mean	Std Deviation	Coefficient of variation
1. Mwanika	20	45.50	23.050	0.5065
2. Maanthi	20	57.00	16.890	0.2963
3. Limbine	20	50.00	19.735	0.3946
4. Lumbi	20	54.50	16.376	0.3006
5. Thinyaine	21	62.38	19.469	0.3119
6. Mwili	19	46.32	14.225	0.3071
Total	**120**	**52.75**	**19.140**	**0.3628**

The results show that Thinyaine has the highest mean score (62.38%) while Mwanika has the lowest (45.5%); however the overall mean score was 52.75%. Mwanika had the highest standard deviation (23.05%) and Mwili had the lowest standard deviation (14.225). However, considering the overall mean score (52.75) it shows that the pupils' have average knowledge of environmental issues. Reidemiller (2002) in a study conducted in western Kenya found that there is need to believe that the subject provides agriculture knowledge and skills that are relevant and effective for environmental conservation. There is need to enhance ways of making sure that the pupils' gain more knowledge on environmental issues. This implies that the community of Thinyaine is

expected to conserve the environment better than the other communities since the pupils' mean score is higher than the other schools. This will be ascertained in later findings and discussions. The pupils' performance could have been affected by various factors such as the teachers' methods of teaching (Brown, 2001). Karembu, and Kinyanjui (1997) pointed out that education provided the people with opportunities and capacities to acquire knowledge and skills and utilize them to manage, adopt and benefit from the environmental changes that are taking place. It is expected that the pupils' in Akithii will pass the environmental knowledge, skills and values acquired to protect and enrich their immediate environment. It is also assumed that the knowledge and skills imparted may benefit the communities neighbouring the schools by admiring and emulating what the pupils' are doing to improve the state of the environment (ANAFE, 2003).

4.4 Levels of Environmental Conservation

Environmental conservation refers to all the activities that are aimed at protecting the air, water and all the natural resources from degradation and from pollution. The aspects of environmental conservation include soil and water conservation, environmental pollution, control and environmental waste management. These aspects of environmental conservation were included in this study, and information about them is presented in the following sub-sections.

4.4.1 Soil Conservation Structures and Practices

The structures considered in the study were terracing, bench terraces, *Fanya juu, Fanya chini* and cut off drains. The main purpose was to find out the various conservation structures that the communities use in order to conserve the environment. The study used the frequency of occurrence of the structures in the sample households in order to establish the level of environmental conservation. Table 6 shows the frequencies of the structures among communities around the primary schools.

Table 6: Conservation structures by different communities

Practice	Community (school)												Total	
	Mwanika		Manthi		Limbine		Lumbi		Thinyaine		Mwili			
	F	%	F	%	F	%	F	%	F	%	F	%		
Terraces	11	19.0	12	20.7	8	13.8	11	19.1	9	15.5	7	12.1	58	100
Benches	11	22.0	6	12.0	9	18.0	7	14.0	10	20.0	7	14.0	50	100
Fanya juu	10	18.9	13	24.5	7	13.2	14	26.4	4	7.5	5	9.4	53	100
Fanya chini	1	3.3	7	23.3	7	23.3	7	23.3	4	13.3	4	13.3	30	100
Cut off drains	8	15.1	9	17.0	6	11.3	8	15.1	14	26.4	8	15.1	53	100

The respondents were required to state whether they used the conservation structures and the frequency of use. All the community (schools) indicated that they used the different structures at different frequencies (Table 6). However, general terraces were used more than others with a frequency of 58% and the lowest used were *fanya juu* (33%). The structures are those recommended by the extension agents for soil conservation and all communities seem to have an idea of the various structures and have practiced them at various levels. The differences in the physical features of the area could be the cause of the differences in the soil conservation structures shown in the table. Mosely (2003) argued that when trying to understand community based natural resource management one has to focus on the environmental outcomes. These could be the number of acres acted upon or number of structures built and this could be a sign of success of a particular collaborative effort by the achievements on the ground.

The respondents were required to indicate the frequency of applying the soil conservation practices each year. The aim was to find other conservation practices that the communities used for soil and water conservation and the extent of use. The practices suggested by communities were mulching, cover cropping, contour ploughing, tree planting, trash lines and crop rotation. These are the practices that are commonly used in

soil and water conservation as recommended by the Ministry of Agriculture (MAO and RD, 1991). The summary of the practices is shown in Table 7.

Table 7: Frequency of using other soil conservation practices per year

	Frequency											
	None		Once		Twice		Thrice		>Thrice			
Practice	F	%	F	%	F	%	F	%	F	%	**Total**	
Mulching	39	32.5	22	18.3	53	44.2	2	1.7	4	3.3	120	100
Cover crop	12	10.0	70	58.3	27	22.5	5	4.2	6	5.0	120	100
Contour ploughing	10	8.3	72	60.0	35	28.2	2	1.7	1	0.8	120	100
Tree planting	4	3.3	93	77.5	19	15.8	3	2.5	1	0.8	120	100
Trash lines	31	25.8	29	24.2	56	46.7	2	1.7	2	1.7	120	100
Crop rotation	22	18.3	28	23.3	69	57.5	1	0.8	0	0.0	120	100

Most of the practices were used once a year as indicated in Table 7. The highest practice was tree planting done once a year at 77.5%, and contour ploughing done once a year at 60% closely followed it. According to FAO (2002), better use of agricultural resources is through the integrated management of available soil, water and biological resources combined with the limited external inputs. It contributes to environmental conservation and to sustainable agricultural production by maintaining a permanent or semi_ permanent organic soil cover. FAO considers the above practices to be relevant for soil conservation. Thus the households within these communities are adopting the practices that are relevant for good integrated soil management. According to Rugumamu (2000), it is common knowledge that undesirable environmental impacts caused by continued annual food and cash crop production can be mitigated by inter-cropping, and use of ground cover of legumes to reduce erosion and conserve organic matter. The practice of ploughing of plant residues by non-livestock owners may raise soil productivity. It is

considered that maintaining a permanent or semi-permanent soil cover improves soil conservation.

4.4.2 Pupils' Involvement in other Soil and Water Conservation Practices

The study also determined pupils' involvement in the other soil and water conservation practices. These practices were mulching, cover cropping, and contour ploughing, tree planting, trash lines and crop rotation. The MOEST (2002a) and MOA&RD (1991) recommended that pupils' should be able to identify suitable areas in the school compound and at home where to plant trees and practice various conservation practices such as mulching and cover cropping. This was measured by getting the frequencies of the practices and the results are shown in Table 8.

Table 8: Frequency of pupils' involvement in soil and water conservation practices

	Frequency											
	None		Once		Twice		Thrice		>Thrice			
Practice	F	%	F	%	F	%	F	%	F	%	**Total**	
Mulching	25	20.0	34	28.3	33	27.5	11	9.2	17	14.2	120	100
Cover crop	11	9.2	43	35.8	37	30.8	17	14.2	12	10.0	120	100
Contour ploughing	18	15.0	54	45.0	27	22.5	15	12.5	6	6.0	120	100
Tree planting	9	7.5	44	36.7	43	35.8	4	3.3	20	16.7	120	100
Trash lines	9	7.5	39	32.5	47	39.2	22	18.3	2	1.7	120	100
Crop rotation	8	15.0	23	19.2	53	44.2	17	14.2	9	7.5	120	100

Most of the practices were carried out once or twice a year with the highest being contour ploughing (45%). This corresponds with the objectives of teaching science in primary school, that the learner should be able to manage and conserve the available resources and foster positive attitude towards environmental conservation and appreciate the need for a healthy environment (MOEST, 2002a). The teacher is expected to encourage the

children to practice some of the activities done in school, in their homes and in the community. Such activities help the children to develop skills for maintaining and using the resources found in the environment. FAO (2002) recommended that the pupils' be trained in agricultural skills and soil conservation. Such will build capacity for children to be shared with families and community members.

4.4.3 Manure and Fertilizer Application

The use of different types of manure and fertilizers was considered to be an aspect of environmental conservation. The study required the respondents to indicate the type of manure and fertilizers they used and frequency of use. The types of manure considered were farmyard manure (FYM), compost and chemical fertilizer. The summary of the results is shown in Table 9.

Table 9: Frequency of different types of manure and fertilizer application per year

Manure/Fertilizer	Frequency											
	None		Once		Twice		Thrice		>Thrice			
	F	%	F	%	F	%	F	%	F	%	**Total**	
FYM	10	8.3	39	32.5	50	41.7	3	2.5	18	15.0	120	100
Compost	12	10.0	42	35.0	47	39.2	3	2.5	16	13.3	120	100
Commercial fertilizers.	25	20.8	13	10.8	80	66.7	0	0.0	2	1.7	120	100

Table 9 shows the results of the frequencies obtained for the use of different manures and fertilizers. Those included are the basic common chemical fertilizers and organic manures that are used to improve soil fertility and water conservation in the study area. The Ministry of Agriculture and Rural Development (1991) recommended the use of manure and fertilizer to replace the plant nutrients that are depleted due to continuous cultivation. Addition of manure in the soil helps in water retention and improves the soil texture. This

implies that the practices have an impact later since the pupils' are expected to practice these activities in the community in order to determine their influence on environmental conservation.

4.4.4 Pupils' Involvement in Manure and Fertilizer Application

The study investigated the pupils' involvement on use of manure and fertilizers and was to indicate which manures and fertilizers they used and the frequency of use. The manures were the farmyard manure (FYM), compost manure and chemical fertilizers. The results of the analysis are shown in Table 10.

Table 10: Pupils' involvement in application of manures and fertilizers

Manure/ Fertilizer	Frequency											
	None		Once		Twice		Thrice		>Thrice		Total	
	F	%	F	%	F	%	F	%	F	%		
FYM	20	16.7	18	15.0	49	40.8	12	10.0	21	17.5	120	100
Compost	9	7.5	16	13.3	61	50.8	19	15.8	15	12.5	120	100
Chemical fertilizers.	4	3.3	18	15.0	70	58.3	23	19.2	5	4.2	120	100

The results show that the manure and fertilizers are used at varying frequencies. Pupils' are used in applying the manures at various frequencies and the results show that the frequency of two is highly used in all the manures and chemical fertilizers (58.8%), compost (50.8%), and FMY (40.8%). Thus more manure is applied twice a year and the learners are able to practice manure application practices. This shows that pupils' were able to practice the activities that they learn in school, in their home and in the community. MOEST (2002a) recommends such activities that help the children to develop skills for maintaining and using the resources found in the environment.

The study investigated the pupils' involvement in application of manure and fertilizer either by measuring the amount of manure or fertilizer, spreading in the field or mixing with the soil. The results of the analysis were as presented in Table 11.

Table 11: Pupils' involvement in manure application activities

	Frequency											
	None		Once		Twice		Thrice		>Thrice			
Activity	F	%	F	%	F	%	F	%	F	%	**Total**	
Measuring amount	7	5.8	34	28.3	67	55.8	6	5.0	6	5.0	120	100
Spreading in field	6	5.0	31	25.8	56	44.7	17	14.2	10	8.3	120	100
Mixing with soil	6	5.0	30	25.0	64	53.3	11	9.2	9	7.5	120	100

The pupils' were asked to indicate the specific practices they are involved in manure and fertilizer application; such practices as measuring the amount of manure or fertilizer; spreading the fertilizer/manure in the field, and mixing with the soil. The results show that most of the activities were carried out once and twice a year, with the greatest frequency at twice a year, measuring amount (55.8%) spreading in the field (44.7%) and mixing with soil (53.3%). Thus the pupils' are involved appropriately in these activities of applying manures. This shows that the objectives of MOEST to help children learn by doing or carrying out activities rather than giving facts are achieved.

Agro-forestry Practices

Agro-forestry is a method in farming in which a farmer grows crops and trees on the same piece of land. The Ministry of Agriculture & Rural Development (1991) identified agro-forestry as one way that a farmer makes maximum use of the soil and protects it from erosion. The study required the respondents to indicate the kinds of agro-forestry practices used and the frequency of use. These practices were trees and cover crops, trees

and pasture, crops and pasture, boundary planting and hedgerows. All the communities indicated that they use all the above practices at different frequencies as shown in Table 12.

Table 12: Agro-forestry practices

Practice	Community												Total
	Mwanika		Manthi		Limbine		Lumbi		Thinyaine		Mwili		
	F	%	F	%	F	%	F	%	F	%	F	%	%
Trees & crops	17	21.8	18	23.1	10	12.8	12	15.4	6	7.7	15	19.2	78 %
Trees & pasture	3	9.1	8	24.2	9	27.3	1	3.0	5	15.2	7	21.2	33 %
Crops & pasture	16	24.6	13	20.0	9	13.8	8	12.3	8	12.3	11	16.9	65 %
Boundary	18	16.5	17	15.6	20	18.3	18	16.5	19	17.4	17	15.6	91%
Hedgerows	16	21.3	11	14.7	7	9.3	13	17.3	11	14.7	17	22.7	75 %

The commonest forms of agro-forestry practiced are boundary planting (91%) and tree/crops growing (78%), while the lowest was trees and pasture (33%). The various communities practice agro-forestry as shown in Table 12. It is expected that if the communities practice agro-forestry, then pupils' are involved in these practices. Food and Agricultural Organization (1996) noted that parents participate in environmental projects and field trips with their children and share the expertise with pupils' in environmental initiatives. This implies that there is learning that takes place between the children and the guardians and should be encouraged for easier integration of the information.

4.4.5 Pupils' Involvement in Soil Conservation Structures

The study expected the pupils' to indicate their involvement in construction of soil conservation structures. The respondents were expected to indicate whether they were involved in construction of soil conservation, maintenance or both or not at all. The structures included were benches, *Fanya Juu, Fanya Chini* cut off drains and general terraces. This was to find out whether the pupils' were involved in the construction, maintenance, or both, since the study was to find out the pupils' involvement in environmental conservation practices. The results are shown in Table 13.

Table 13: Pupils' involvement in construction and maintenance of soil conservation structures

	Frequency									
	Construction		Maintenance		Construction and maintenance		Not involved			
Structure	F	%	F	%	F	%	F	%	**Total**	
Benches	17	14.2	21	17.5	54	45.0	28	23.3	120	100
Fanya juu	11	9.2	10	8.3	34	28.3	65	54.2	120	100
Fanya chini	17	14.2	14	11.7	41	34.2	48	40.0	120	100
Cut off drains	11	9.2	19	15.8	44	36.7	46	38.3	120	100
Terraces.	16	13.3	8	6.7	43	35.8	53	44.2	120	100

The results show that the pupils' are involved in both construction and maintenance but at low levels. This could be attributed to the fact that the construction and maintenance of these structures require a lot of energy, which the pupils' may not have. This accounts for the large number of respondents not involved in both maintenance and construction. However, MOEST (2002a) and MOA and RD (1991) require that the pupils' be able to identify where soil conservation is required and take necessary measures.

4.4.6 Pupils' Involvement in Solid Waste Management

The study required information on the aspects of pupils' involvement in management of solid waste. The aspects of solid waste management considered were sweeping, collection of rubbish, burning of litter and cutting of grass to clean the environment; both in school and at home. The results are presented in Table 14.

Table 14: Pupils' involvement in environmental cleanliness (home and school)

	Community												
	Mwanika		Manthi		Limbine		Lumbi		Thinyaine		Mwili		Total
Practice	F	%	F	%	F	%	F	%	F	%	F	%	%
Sweeping	20	16.8	19	16.0	20	16.8	20	16.8	21	17.6	19	16.0	99
Collect litter	20	17.9	14	12.5	20	17.9	20	17.9	21	18.8	17	15.2	93
Burning	20	17.7	20	17.7	17	15.0	19	16.8	20	17.7	17	15.0	94
Cutting grass	17	15.9	17	15.9	17	15.9	17	15.9	20	18.7	19	17.8	89

The frequencies show that the pupil' are involved in activities that make the environment clean. All activities show very high percentages ranging from 89% in cutting grass to 99% in sweeping. This has been found practical in cases where pupils' learn ways to reduce or eliminate pollution by applying classroom theory into practice. This is important as stated by Manjegwa (1998) that children have to face the challenges brought about by the environment after leaving school. The study points out that the syllabus should emphasize the need for pupils' to learn about environmental management and be able to determine the relationship between human hygiene and the environment. The same has been exhibited by environmental conservation practices shown by the pupils' (Ngumy, 2002). Most of the participating schools demonstrated reductions in the incidence of littering and improvements in the overall management of solid waste. The

challenge for the future is that of achieving further improvements outside of a competitive environment and more importantly, to reinforce the positive attitudes developed by the students.

The Ministry of Agriculture and Rural Development (1991) noted that in order to control land pollution, careless dumping should be avoided. All rubbish in the school compound and homesteads should be collected and sorted before putting in a rubbish pit. This is an indicator of pupils' involvement in controlling pollution around the school compound and in their homesteads. The results show a high percentage of involvement in all the activities in solid waste management. The pupils' were expected to indicate the practices they carry out per week on solid waste management both in school and at home. The waste disposal mechanisms were burning rubbish, dumping in pits and recycling. The results are presented in Table 15.

Table 15: Weekly involvement of pupils' in solid waste management

	Frequency											
	None		Once		Twice		Thrice		>Thrice			
Practice	F	%	F	%	F	%	F	%	F	%	**Total**	
Burning rubbish	3	2.5	15	12.5	25	20.8	26	21.7	51	42.5	120	100
Dumping in pits	9	7.5	12	14.2	26	21.7	13	10.8	55	45.8	120	100
Recycling	14	11.1	10	8.3	23	19.2	12	10.0	61	50.8	120	100

The results show that pupils' practiced the activities in various frequencies per week. Most of them were practiced more than three times a week, for instance burning of litter (42.5%), dumping in pits (45.8%) and recycling (50.8%). The pupils' were involved in solid waste management as advocated by Ngumy (2002) that primary school pupils' be involved in managing their own environment to reduce environmental pollution, especially due to plastic paper bags that have polluted the environment. Recycling is a practice that needs to be encouraged so the waste can be put to good use. The MOA and RD (1991) recommends that pupils' should be able to identify various pollutants in the

school compound, surroundings and their respective home areas, collect them and dump appropriately. The pupils' are also required to collect waste paper, metals, and bottles and use them to make items such as pots, toys and decorations, thus recycling the waste products.

4.5 Sources of Community Knowledge

The study recognized that the level of conservation may not only be from pupils'. awareness of environmental conservation, but also from other sources of knowledge. This was found necessary as shown in the conceptual framework that the dependent variable does not only depend on the independent variable but also the moderator variables. Such include farmer's level of education, extension agents and environmental education providers, mass media, non-governmental organization, farmer- to- farmer interaction and indigenous knowledge. These were expected to influence the level of environmental conservation in the communities on aspects such as methods of soil conservation, rates and frequency of fertilizer/manure application, water conservation, afforestation and sources of tree seedlings, pollution and its control. Table 16 shows the various sources of knowledge on environmental conservation that could affect environmental conservation among the various communities.

Table 16: Source of knowledge on environmental conservation for the communities

Knowledge statement	Source of information												Total	
	Formal education (Farmer)		Pry. Pupils' kng		Exten Agents		NGOs		F to F Inter.		IKS			
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Soil conservation	36	36.7	6	6.1	25	25.4	8	8.2	17	17.3	6	6.1	92	76
Application of fertilizer and manure	25	22.3	7	6.3	35	31.3	9	8.3	29	25.9	7	6.3	105	87.5
Water conservation	12	12.8	26	27.4	18	19.1	10	10.6	20	21.3	8	8.5	68	56
Afforestation	10	9.3	39	36.4	16	15.0	11	10.3	18	16.8	3	12.1	68	56
Sources of tree seedlings	11	10.2	60	55.6	15	13.9	5	4.6	12	11.1	5	4.6	48	40
Types of pollution	9	8.5	53	50.0	9	8.5	3	2.8	3	2.8	29	27.4	53	44
Pollution control	4	3.7	49	45.4	1	10.2	4	3.7	3	2.8	37	34.3	59	49

Key:

Pry pupils' kng	Primary school pupils' knowledge
Extn Agents	Extension Agents
NGO	Non-Governmental Organization
F to F Inter	Farmer-to-Farmer Interaction
IKS	Indigenous Knowledge Systems

The various sources of knowledge on environmental conservation show that the communities gain knowledge not only from the pupils' but also from other sources.

Farmer's formal education is one source of knowledge on soil conservation at 36.7% and application of manures and fertilizers at 22.3%. According to FAO (2002) the level of education of a farm operator has a positive correlation with adoption of technologies. FAO continued to say that education, whether specific or general, correlates positively with the adoption of conservation agriculture.

Extension agents and other environmental education providers were found to have an effect on how the communities conserve the soils (25.4%), use of fertilizer (31.3%) and water conservation (19.1%) the lowest being pollution control (1%). The Ministry of Agriculture has extension agents who are able to pass the knowledge on soil conservation to the farmers. They have a big role to play in how soil and water conservation structures are constructed and utilized. Extension networks are among the most effective means of reaching rural household and farmer to farmer training enables researchers and extension agents to adopt technical packages to meet farmers' needs.

Farmer-to-farmer interaction was found to give knowledge on application of manures and fertilizers (25.9%), water conservation (21%) and the least was on pollution and its control (3%). ANAFE (2003) found out that farmers exchange views on agro-forestry across families and communities and that the two are more reliable in identifying specific problems and solutions. ANAFE also found out that the formation of farmers groups around specific enterprises was very effective in reinforcing farmer-to-farmer learning processes.

Indigenous knowledge systems (IKS) were found to have an effect on types of pollution (27.4%) and its control (34.3%). According to ANAFE (2003), there is need for an attitude change towards the natural environment through empowering local communities on how to use indigenous knowledge in natural resource management. The communities were able to use indigenous knowledge in environmental conservation.

In relation to Non- Governmental Organizations (NGOs), ANAFE (2003) found out that their efforts were uncoordinated and their combined results were hard to document. This is shown in Table18 by the low frequencies that were recorded. Extension networks are among the most effective means of reaching rural household and farmer-to-farmer training enables researchers and extension workers to adopt technical packages to meet farmers' needs. As the results above shows, FAO found out that rural households could potentially and significantly reduce pollution and toxic runoff from agriculture as well as household wastes.

As table 16 shows pupils' have great influence in issues that are related to environmental pollution. Pupils' knowledge was also found to have an effect on the way water is conserved (27.4%), afforestation (36.4%), sources of tree seedlings (55.6%), types of pollution (50%) and pollution control (45.4%). The knowledge on environmental conservation gained by primary school pupils' is to equip the community with the relevant skills and knowledge in natural resource management, to prepare them for possible roles as farmers in future. It is hoped that the knowledge and skills imparted will benefit communities neighbouring the schools and thus improve the state of environment and natural resource management in those communities (ANAFE 2003). This can be seen in the results where the frequency for pupils' knowledge was high in afforestation (36.4%), sources of tree seedlings (55.6%) and in types of pollution (50%) and its control (45.4%). Thus the results show that environmental conservation among pupils' in primary school has an impact on the environment because the communities showed that they learnt some information from the primary school pupils'.

4.5 Test of Hypotheses

There were five hypotheses tested, to establish if there was any significant relationship between pupils' performance, their involvement and the level of environmental conservation in communities around the schools involved in the study.

4.6.1 Difference in Level of Pupils' Knowledge of Environmental Conservation

To determine whether there is any statistically significant difference between and among the groups, the null hypothesis was tested. Hypothesis 1 was developed from objective 1 as stated:

Ho1, *"There is no statistically significant difference in the level of pupil awareness of environmental conservation among different primary schools."* A knowledge test was used to find the level of awareness of environmental conservation that the learners were able to gain from primary school learning of science. Analysis was done to calculate the means, which were used for further analysis. Table 17 shows the results obtained.

Table 17: Level of pupils' awareness of environmental conservation

School	N	Mean	Std Deviation	Coefficient of variation
1. Mwanika	20	45.50	23.050	0.5065
2. Maanthi	20	57.00	16.890	0.2963
3. Limbine	20	50.00	19.735	0.3946
4. Lumbi	20	54.50	16.376	0.3006
5. Thinyaine	21	62.38	19.469	0.3119
6. Mwili	19	46.32	14.225	0.3071
Total	**120**	**52.75**	**19.140**	**0.3628**

A one-way ANOVA was used for analysis based on the mean scores of the pupils' knowledge test. This was to find out whether there was any significant difference among the pupils' in the various communities around the schools in level of awareness of environmental conservation. The results obtained from the analysis are shown in Table 18.

Table 18: Analysis of Variance (ANOVA) for difference in level of awareness of environmental conservation among primary schools

Sources	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4359.442	5	871.888	2.533	.033
Within Groups	39233.058	114	344.150		
Total	**43592.500**	**119**			

*Significant at $p < 0.05$

There is a significant difference in level of pupils' knowledge of agriculture related to environmental conservation among the six schools involved in the study. The null hypothesis is rejected (P value = 0.033 < 0.05) and F = 3.804, d f = 5, 114). This means a possible influence of the level of pupils' knowledge of agriculture related to environmental conservation among the communities on environmental conservation around the primary schools. This is because it is assumed that the knowledge gained in school directly impacts in the pupils' community. A link may be realized if the learners are involved in the conservation practices. The difference may come about as a result of the differences in the learning environment, different methods of teaching used by the teachers or individual differences among the pupils' themselves. To establish the rankings, a post hoc (multiple comparison analysis) was performed using the least significant difference (LSD) technique. The results of the analysis are shown in Table 19.

Table 19: LSD post hoc analysis for difference in mean level of awareness of environmental conservation among the schools

(I) School name	(J) School name	Mean Difference (I-J)	Std. Error	Sig.
Mwanika	Maanthi	-11.50	5.866	.052
	Limbine	-4.50	5.866	.445
	Lumbi	-9.00	5.866	.128
	Thinyaine	-16.88(*)	5.796	.004
	Mwili	-.82	5.943	.891
Maanthi	Mwanika	11.50	5.866	.052
	Limbine	7.00	5.866	.235
	Lumbi	2.50	5.866	.671
	Thinyaine	-5.38	5.796	.355
	Mwili	10.68	5.943	.075
Limbine	Mwanika	4.50	5.866	.445
	Maanthi	-7.00	5.866	.235
	Lumbi	-4.50	5.866	.445
	Thinyaine	-12.38(*)	5.796	.035
	Mwili	3.68	5.943	.537
Lumbi	Mwanika	9.00	5.866	.128
	Maanthi	-2.50	5.866	.671
	Limbine	4.50	5.866	.445
	Thinyaine	-7.88	5.796	.177
	Mwili	8.18	5.943	.171
Thinyaine	Mwanika	16.88(*)	5.796	.004
	Maanthi	5.38	5.796	.355
	Limbine	12.38(*)	5.796	.035
	Lumbi	7.88	5.796	.177
	Mwili	16.07(*)	5.874	.007
Mwili	Mwanika	.82	5.943	.891
	Maanthi	-10.68	5.943	.075
	Limbine	-3.68	5.943	.537
	Lumbi	-8.18	5.943	.171
	Thinyaine	-16.07(*)	5.874	.007

* The mean difference is significant at the .05 level.

The post hoc analysis were carried out to find out if there were any differences among individual schools and thus make a ranking on which one is better than the other. There is a significant difference found between Mwanika and Thinyaine, Limbine and Mwili.

Others had no major significant difference. If awareness was to influence environmental conservation, then we expect similar influence in the levels of conservation in the community. This will be determined in the subsequent analysis. This would mean differences in environmental conservation among the different communities due to the difference in the pupils' influence.

4.6.2 Difference in Levels of Environmental Conservation among the Communities around Different Schools

To determine whether there was any statistically significant difference between and among the groups the null hypothesis was tested. Hypothesis 2 was developed from objective 2 as stated:

Ho2, "*There is no statistically significant difference in the level of environmental conservation among different community in Akithii division.*" Different environmental conservation practices were analyzed such as different conservation structures and their frequencies in the different communities. A One way ANOVA was used to test the hypothesis to determine the significant difference in level of environmental conservation. This was to determine whether there is any significant difference in the levels of environmental conservation among the communities around primary schools. The results of the analysis are shown in Table 20.

Table 20: ANOVA table for difference in mean level of environmental conservation among different communities

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	531.875	5	106.375	3.804	0.003*
Within Groups	3131.955	112	27.964		
Total	**3663.831**	**117**			

*Significant at $p < 0.05$

According to the analysis, there is a significant difference in the level of environmental conservation among different communities around the primary schools involved in the study. (P value = 0.003 < 0.05) and F = 3.804, d f = 5, 112). Therefore, the null hypothesis was retained. In the study this would mean that there is a difference in environmental conservation among the different communities. This may be due to the influence of the pupils' knowledge of agriculture related to environmental conservation or any other reason to be determined later in the analysis. This is discussed and established in subsequent hypothesis. A link will be realized if the pupils' are involved in the conservation practices in the households and the community. To establish the rankings, a post hoc analysis (multiple comparison analysis) using LSD was performed.

Table 21: LSD post hoc test analysis for difference in mean level of environmental conservation among different communities

(I) School name	(J) School name	Mean Difference (I-J)	Std. Error	Sig.
Mwanika	Maanthi	-1.7500	1.67224	.298
	Limbine	-2.1500	1.67224	.201
	Lumbi	.2895	1.69410	.865
	Thinyaine	3.1500	1.67224	.062
	Mwili	-3.4474(*)	1.69410	.044
Maanthi	Mwanika	1.7500	1.67224	.298
	Limbine	-.4000	1.67224	.811
	Lumbi	2.0395	1.69410	.231
	Thinyaine	4.9000(*)	1.67224	.004
	Mwili	-1.6974	1.69410	.319
Limbine	Mwanika	2.1500	1.67224	.201
	Maanthi	.4000	1.67224	.811
	Lumbi	2.4395	1.69410	.153
	Thinyaine	5.3000(*)	1.67224	.002
	Mwili	-1.2974	1.69410	.445
Lumbi	Mwanika	-.2895	1.69410	.865
	Maanthi	-2.0395	1.69410	.231
	Limbine	-2.4395	1.69410	.153
	Thinyaine	2.8605	1.69410	.094
	Mwili	-3.7368(*)	1.71568	.031
Thinyaine	Mwanika	-3.1500	1.67224	.062
	Maanthi	-4.9000(*)	1.67224	.004
	Limbine	-5.3000(*)	1.67224	.002
	Lumbi	-2.8605	1.69410	.094
	Mwili	-6.5974(*)	1.69410	.000
Mwili	Mwanika	3.4474(*)	1.69410	.044
	Maanthi	1.6974	1.69410	.319
	Limbine	1.2974	1.69410	.445
	Lumbi	3.7368(*)	1.71568	.031
	Thinyaine	6.5974(*)	1.69410	.000

* The mean difference is significant at the .05 level.

Table 21 presents the results of the analysis. There is a significant difference found between Thinyaine, Maathi, Limbine, Mwili and Mwanika. The others had no major significant difference. The differences may be as a result of the differences in the pupils' knowledge of agriculture or other sources of knowledge as will be determined in later

analysis. This shows that pupils' knowledge is not the single determining factor of level of conservation. This could also be influenced by their extent in involvement in environmental conservation and the related hypothesis as tested with results shown in subsequent sections.

4.6.3 Differences in Pupils' Involvement in Environmental Conservation Among Communities Around the Primary Schools

To determine whether there is any statistically significant difference between and among the groups the null hypothesis was tested. Hypothesis 3 was developed from objective 3 as stated:

Ho3. *"There is no statistically significant difference in the level of environmental conservation among different communities around primary schools in Akithii division."*

Pupils' were required to indicate the ways of involvement and in what frequencies in various environmental conservation practices. A one way ANOVA was used to show the difference in the level of pupils' involvement in environmental conservation. This was to find out whether there were any differences in pupils' involvement in environmental conservation in different communities. The data was subjected to statistical analysis and the results shown on Table 22.

Table 22: ANOVA table for differences in pupils' level of involvement in environmental conservation in the community around different primary schools

Source	Sum of Squares	d f	Mean Square	F	Sig.
Between Groups	868.905	5	173.781	4.522	.001
Within Groups	4380.687	114	38.427		
Total	**5249.592**	**119**			

The results of the analysis indicate a significant difference in the level of pupils' involvement in environmental conservation among different communities. (P value =

0.001 < 0.05 and f = 4.522; df = 5,114). Therefore, the hypothesis was rejected. For this study the difference could be as a result of factors other than pupils' knowledge of agriculture related to environmental conservation. FAO (1994) found out that indigenous knowledge has been useful in the conservation of soil and water resources. The level of degradation in the communities is different and the efforts needed in each of these communities are different. The effort taken mean the quality of the practices such as terracing, solid waste management and water conservation are also different. The differences could be due to farmers' knowledge of environmental conservation, their ability to implement various conservation measures, the sources of knowledge about environmental conservation and the nature of the environment. The sources of knowledge investigated in this study as presented in section 4.5 include knowledge of pupils' attending local primary schools where environmental conservation is taught. To establish the rankings, a post hoc analysis (multiple comparison analysis) using LSD was performed. Table 23 presents the results of the analysis.

Table 23: LSD post hoc analysis of the differences in pupils' level of involvement in environmental conservation among the communities

(I) School name	(J) School name	Mean Difference (I-J)	Std. Error	Sig.
Mwanika	Maanthi	3.4500	1.96028	.081
	Limbine	-.1000	1.96028	.959
	Lumbi	-.4000	1.96028	.839
	Thinyaine	5.8976(*)	1.93681	.003
	Mwili	5.5868(*)	1.98591	.006
Maanthi	Mwanika	-3.4500	1.96028	.081
	Limbine	-3.5500	1.96028	.073
	Lumbi	-3.8500	1.96028	.052
	Thinyaine	2.4476	1.93681	.209
	Mwili	2.1368	1.98591	.284
Limbine	Mwanika	.1000	1.96028	.959
	Maanthi	3.5500	1.96028	.073
	Lumbi	-.3000	1.96028	.879
	Thinyaine	5.9976(*)	1.93681	.002
	Mwili	5.6868(*)	1.98591	.005
Lumbi	Mwanika	.4000	1.96028	.839
	Maanthi	3.8500	1.96028	.052
	Limbine	.3000	1.96028	.879
	Thinyaine	6.2976(*)	1.93681	.002
	Mwili	5.9868(*)	1.98591	.003
Thinyaine	Mwanika	-5.8976(*)	1.93681	.003
	Maanthi	-2.4476	1.93681	.209
	Limbine	-5.9976(*)	1.93681	.002
	Lumbi	-6.2976(*)	1.93681	.002
	Mwili	-.3108	1.96274	.874
Mwili	Mwanika	-5.5868(*)	1.98591	.006
	Maanthi	-2.1368	1.98591	.284
	Limbine	-5.6868(*)	1.98591	.005
	Lumbi	-5.9868(*)	1.98591	.003
	Thinyaine	.3108	1.96274	.874

* The mean difference is significant at the .05 level.

The post hoc analysis shows that there is a significant difference between Mwanika, Mwili, Limbine and Thinyaine. This may be as a result of the differences in the

knowledge on environmental conservation that the pupils' have acquired in school or any other knowledge that is beyond the scope of this study.

4.6.4 Relationship between Pupils' Awareness of Environmental Conservation and Level of Environmental Conservation among Communities

To determine whether there is any statistically significant difference between and among the groups the null hypothesis was tested. Hypothesis 4 was developed from objective 4 as stated:

Ho4, *"There is no statistically significant relationship between pupils' knowledge of agriculture related to environmental conservation and the levels of environmental conservation among communities."* This was tested using Pearson's product moment correlation coefficient. This was based on the raw scores of pupils' knowledge test and the frequencies of levels of conservation. This was to find out the relationship between pupils' knowledge of agriculture and the level of environmental conservation in the communities. The results of the analysis are shown in Table 24.

Table 24: Correlation between level of pupils' knowledge of agriculture related to environmental conservation and level of environmental conservation

		Knowledge test	Level of environmental conservation
Knowledge test	Pearson's Correlation	1	-0.035
	Sig. (2-tailed)	.	0.707
	N	120	118
Level of conservation	Pearson's Correlation	-0.035	1
	Sig. (2-tailed)	0.707	.
	N	118	118

The analysis show that there was no significant relationship between pupils' knowledge of agriculture and the level of environmental conservation practices among communities. Correlation coefficient ($r = -0.035$) was obtained, this is not significant at $\alpha = 0.05$. Therefore, the hypothesis was retained. This shows that there is a negative correlation/

relationship between pupils' knowledge and level of environmental conservation. This implies pupils' knowledge has no influence in the level of environmental conservation in Akithii division.

4.6.5. Relationship between Pupils' Awareness and their Involvement in Environmental Conservation Practices

To determine whether there was any statistically significant difference between and among the groups, the null hypothesis was tested. Hypothesis 5 was developed from objective 5 as stated:

Ho5, "*There is no statistically significant relationship between pupils' awareness of environmental conservation and their involvement in environmental conservation practices.*" The hypothesis was tested using Pearson's correlation coefficient based on the knowledge test scores and frequencies of pupils' involvement in environmental conservation practices.

Table 25: Relationship between pupils' knowledge and their involvement in environmental conservation practices

		Knowledge test	Pupils' involvement in environmental conservation practices
Knowledge test	Pearson's Correlation	1	-.001
	Sig. (2-tailed)	.	0.991
	N	120	120
Pupils' involvement	Pearson's Correlation	-.001	1
	Sig. (2-tailed)	0.991	.
	N	120	120

The correlation coefficient was found to be r = - 0.001 which is not significant at α = 0.05. Therefore, the null hypothesis is not accepted. In this study this shows that pupils' knowledge of agriculture does not affect their involvement in environmental practices.

This would be due to other factors other than the knowledge the pupils' get from school that is beyond the scope of this study. The other sources of knowledge for community shows that the pupils' are involved in the sources of knowledge at various levels, for instance, on matters related to control of environmental pollution (though not of any significance). However, Karembu and Kinyanjui (1994) found out that for school-community integration to exist successfully, the community must be convinced of the necessity for the integration, and the community must develop ownership of the school and its activities, while on the other hand the school must have a sense of belonging to the community. The results may be negative and not significant depending on how the school and the community view each other. The FAO (1996) expert consortium stated that most of the rural youth practice agriculture both directly and indirectly both in school and out of school as well as both practically and theoretically. Most of their practices involve their parents; guardians and teachers at interactive levels making them understand agriculture fully. Further, parents and guardians trust to learn from their sons and daughters. They are happy to adopt ideas brought home by their sons and daughter more than ideas brought by strangers and in many cases farmers see extension officers as strangers. Thus conservation agriculture can be promoted by rural youth. Parents and guardians see their sons and daughters as role models and especially when they are school going and they are much willing to share with them what they have learnt in school. Hence rural youth can be the best vehicles to promote conservation agriculture rural youth are therefore, better placed to promote conservation agriculture among themselves as well as to other farmers in Kenya FAO (1996).

4.7 Summary of the Findings and Discussions

The discussions show that pupils' gain knowledge on environmental conservation in the primary schools. The knowledge gained is related to environmental education and conservation as in waste management practices, soil erosion practices and structures and environmental pollution among others. Within the community around primary schools, there is environmental conservation taking place, such as in soil conservation structures, waste management practices and agro-forestry activities. The pupils' in the different

primary schools are involved in environmental conservation both at school and at the community level. The results indicate that there is a significant difference in knowledge gained on environmental conservation, levels of environmental conservation in the communities and in pupil involvement in environmental conservation in the communities. The results also indicate that there is no significant relationship between pupils' knowledge of agriculture related to environmental conservation and their involvement in environmental conservation practices and there is no significant relationship between the pupils' knowledge and the levels of environmental conservation in the community around the primary schools in Akithii division.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary and conclusions from the findings of the study. Secondly, the implication of the results and how environmental conservation is influenced in the community. Finally, recommendations are made on how the findings obtained can be used to improve on pupils' awareness, decision makers and community environmental conservation practices respectively.

5.2. Summary

This study sought to investigate the influence of pupils' knowledge of agriculture as it relates to environmental conservation and their influence on environmental conservation in Akithii division of Nyambene district. This was because primary school pupils' receive the knowledge on environmental conservation in school and there was need to find out whether the pupils' have any influence on environmental conservation in their communities.

Data was collected from standard seven pupils' from six primary schools and their households. The primary school pupils' involved in the study were those exposed to the new concepts on environmental conservation, while the household heads involved were those where the pupils' involved in the study come from. The household heads had more females than males because this depended on head of household who was available. The household sizes ranged from 1 to 20 members with an average of 6 members per household. This could have implications on environmental conservation although it is beyond the scope of this study. The farm sizes ranged from 0.25 acres to 7 acres with a mean of 1.9 acres. The farm size could have an implication on environmental conservation but this is beyond the scope of this study and could be studied later. The education level of the household head varied from primary school level to university

level. Majority of the household heads had attained primary school level of education (61.7%) and the lowest had education at all (7.0%). The study considered the pupils' knowledge of agriculture related to environmental conservation. The knowledge test results showed that the pupils' have knowledge of environmental conservation. The mean score from the knowledge test was (52.75%) from all the scores of the 120 respondents. Thinyaine had the highest mean score while Mwanika had the lowest. It can be concluded that the pupils' knowledge of environmental conservation has been passed to the communities as shown by the sources of knowledge for the community.

On levels of environmental conservation, the results of the study indicate that the communities are involved in various environmental conservation practices and structures. The results also indicate that most communities use the various soil conservation structures. General terraces for conserving soil and water were used more with a frequency of 58% while cut off drains were least with a frequency of 38%. The different communities engage in these practices at varying frequencies. These are mulching, trash lines, crop rotation, contour ploughing and tree planting. Tree planting had a frequency of 77.5% per year followed by contour ploughing at 60% while mulching had 8.3%. The results also indicated that different communities use chemical fertilizers and organic manures at frequencies. Farmyard manure, compost and artificial fertilizers were used. All the manures were used twice a year, however, artificial fertilizers were used at a higher rate (66.7%).

The analyzed data results indicate that the communities practice agro-forestry. Various agro-forestry practices like tree planting, trees/pasture, and hedgerows were investigated. All the communities practiced them but with different frequencies. The results indicated that boundary planting was highly practiced (90.6%) followed by the crop combination (27.5%) and the lowest was tree pasture combination with a frequency of (6.5%). The study revealed that pupils' were involved at various levels in environmental conservation in their schools and communities. The activities were sweeping, collection of litter, burning of litter and cutting of grass. All these led to improving the cleanliness in their communities and management of solid waste. The results indicated that the pupils' are

highly involved in these practices (99%). On solid waste management the results indicated that pupils' practiced these activities at various frequencies; collecting and dumping had (45.8%) while collecting and recycling had 50.5%. Pupils' showed to have been involved in manure and fertilizer application. The most common practice pupils' 'were involved in was measuring and application of farmyard manure (40.8%). The results showed that pupils' were involved in the measuring and spreading of manures and fertilizers in the field (55.8) while 53.3% were involved in mixing of manures and soil in the fields. On pupils' involvement in construction of soil conservation structures; the results indicated that pupils' were involved in both maintenance and construction. Pupils' involvement in other conservation activities such as cover cropping, contour ploughing, tree planting, use of trash lines and crop rotation was evident.

The study investigated the various sources of knowledge to the community. The sources under study were farmers' formal education, extension agents and other environmental education providers, NGOs, farmer-to-farmer interaction, indigenous traditional knowledge and pupils' knowledge. The results indicated that the communities not only gain knowledge from the pupils' but from other sources. Farmer's formal education on soil conservation (36.7%); extension agents give knowledge on soil and water conservation 25.4%; farmer-to-farmer interaction indicated 25.9% on knowledge on application of manures and fertilizers. Indigenous knowledge showed to give knowledge on types of pollution, its effects and control.

On hypotheses tests, the results indicated that hypotheses one, two and three were rejected while four and five were retained.

5.3 Conclusions

The study sought to find out the influence of pupils' knowledge of agriculture on environmental conservation in Akithii division of Nyambene district. The following are the conclusions drawn from the findings:

1. Primary school pupils' gain knowledge of agriculture on environmental conservation and that the knowledge gained is related to various aspects of environmental conservation.
2. The pupils' knowledge of agriculture on environmental conservation is passed on to the communities as shown by the sources of knowledge for the communities.
3. The community levels of environmental conservation indicate that various communities are involved in environmental conservation practices more than others.
4. Pupils' are involved in environmental conservation at various levels. Some pupils' from some schools are involved more than others in different practices. All pupils' are involved actively in practices that lead to cleanliness of the environment and solid waste management.
5. The results also indicate that there is no relationship between the pupils' awareness of environmental conservation and the level of environmental conservation and the practice in the community. However, according to sources of knowledge for the community, the pupils' contribute to the knowledge base that the community receives especially that which is related to tree planting and environmental pollution and its control.
6. The results showed that pupils' knowledge of environmental conservation has no relationship on their involvement in environmental conservation practices.

5.4 Recommendations

The following recommendations have been suggested from the findings and conclusions of the study:

1. There is need for interaction between the school and immediate community in relation to the teaching of environmental education and in the way learners are involved so that the two can be partners in learning and in conserving the environment.
2. There is need to strengthen the practical approach to environmental education in schools and establish networks for environmental conservation action between school and the community.

3. Schools should encourage co-curricula activities by means of which theoretical knowledge of the environment acquired in school can be put into practice for example managing garbage, greening of the school, forming environmental clubs, outreach/community activities and environmental research.
4. The communities around the school should be actively involved in the environmental activities that are taking place in the schools, so that integration of school and community could be meaningful.
5. There is need for schools to integrate school activities with the community around them in environmental conservation practices so that the learners are able to be effectively integrated and pass the knowledge they gain at school.

5.5 Recommendations for Further Research

The study identified areas for further research, these include:

1. Further research on the teaching methods the primary school teachers use in passing the knowledge on environmental education information to the learners.
2. Further research is required on the primary school curriculum and what aspects of agriculture are related to environmental conservation. How well are these topics stated in the syllabus taught and the weight given to them at each level.
3. There is need to study aspects of curriculum formulation and how environmental education can be introduced as a subject at various levels.
4. Environmental education is integrated in primary science and other subjects such as social studies; there is need to study how each is handled and what aspects need to be included where and why.
5. A study can be carried out on how the indigenous knowledge from the communities can be utilized to improve on environmental conservation practices.

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APPENDICES

APPENDIX A: Pupils' Knowledge Test on Agriculture/ Environmental Conservation

Instructions

This knowledge test will be used to collect data from the primary school pupils' concerning their knowledge of agriculture and environmental conservation. The respondent will tick (√) beside the selected response.All information supplied will be treated confidentially but will be used to improve the teaching of agriculture and environmental education in primary schools.

1. General information of the pupils'

1.1 Age:_____ Gender :_____

1.2 Name of the location._____

1.3 Name of the school

2.0 Pupils' knowledge on environmental conservation

Answer all questions.

1. Soil erosion is
    a) Removal of top soil
    b) Carrying away of top soil
    c) Removal and carrying away of topsoil by water.
    d) Removal of top fertile soil by wind and water
2. Soil conservation is
    a) Removal of top fertile soil
    b) Preparation of top layer of soil
    c) Preservation of natural top layer of the soil.
    d) Removal of natural top layer of soil.
3. Which of the following is a good soil conservation practice?
    a) Ploughing up and down the slope.
    b) Cutting all the trees
    c) Ploughing across the slope

d) overgrazing

4. The following are agents of soil erosion, except.
   a) Wind and water
   b) Wind
   c) Water
   d) Warmth
5. The main disadvantage of over-grazing in relation to soil conservation
   a) Does not encourage animals to uproot grass
   b) Leaves the soil bare and encourages erosion to take place.
   c) Makes the animals to lose weight.
   d) Encourages growth of grass.
6. Which one of the following practices will easily lead to water loss from a given area?
   a) Leaking water taps.
   b) Sprinkle irrigation.
   c) Digging trenches and dams to catch rainwater.
   d) Planting Napier grass along riverbanks.
7. Which one of the following has the lowest pollution effect on soil?
   a) Spraying of crops or insects with chemicals.
   b) Burning of vegetation
   c) Smoking cigarette.
   d) Dumping of chemicals from the factories.
8. The following will lead to air pollution, except-?
   a) People smoking in a room.
   b) A charcoal *jiko* burning outside the house.
   c) Motor car lights flashing
   d) Dusting a pair of shoes in the room.
9. The following are methods of water pollution, which one is not?
   a) Human and animal wastes.
   b) Wastes from industries.
   c) Farm chemicals
   d) Rain.

10. Which of the following soil conservation measure is commonly practiced in the farms in your community?

(a) Cut off drain

(b) Bench terraces

(c) *Fanya juu*

(d) *Fanya chini*

APPENDIX B: Pupils' Questionnaire on Environmental Conservation Practices

The questionnaire is to be used to collect information on environmental conservation practices carried out by pupils' in the communities. The pupils' will tick the appropriate item or write down the information required. All the information given will be confidential, but will be used for improving the teaching of agricultural education in primary schools.

1. Which of the following activities that make the environment clean are you involved in?

Activity	Tick
Sweeping	
Collecting rubbish	
Burning of rubbish	

2. Which of the following activities are you involved in while in school?

Activity	School (tick)
Sweeping	
Collecting rubbish	
Burning rubbish	

3. Which of the following activities for cleaning the environment do you carry out at home?

Activity	Home (Tick)
Sweeping	
Collecting rubbish	
Burning of rubbish	
Cutting grass	

4. Which of the following soil conservation structures are found in your farm?

Type of structure	Tick
Terraces	
Benches	
Fanya juu.	
Fanya chini.	
Cut off drains	

5. In which way(s) are you involved in the making of soil conservation structures? (**Tick where appropriate**)

Structure	Involvement			
	Construction	Maintenance	Construction &maintenance	Not involved
Benches				
Fanya juu				
Fanya chini				
Cut off drains				
Terraces				

6. How frequently do you practice the following soil conservation measures in a year?

Type of structure	Frequency (tick)				
	none	once	twice	3 times	More than 3 times
Establishing cover crops					
Contour ploughing					
Tree planting					
Making trash lines					
Crop rotation					
Mulching					

7. How frequently do you practice the following waste collection and disposal activities in your community in a week?

Practice	Frequency				
	None	once	Twice	Three times	More than 3 times
Burning litter					
Dumping in pits					
Recycling of waste products					

8. How frequently do you use the following manures in a year?

Manure	Frequency				
	none	once	twice	3 times	More than 3 times
Compost manure					
Commercial fertilizers					
FYM					

9. How many times are you involved in the following manure application activities in a year?

Involvement	Frequency				
	None	Once	2 times	3 times	More than 3 times
Measuring the amount					
Spreading in the field					
Mixing with the soil					

THANK YOU FOR YOUR COOPERATION

APPENDIX C: Household Questionnaire to be Administered On-Farm

This questionnaire will be used to collect information from the community on environmental conservation and ways in which they gain knowledge of environmental conservation. The researcher will fill needed information during the questionnaire administration with the respondents. All the information will be treated confidentially, but will be used to improve the teaching of agriculture and environmental education in primary schools in Kenya.

GENERAL INFORMATION

1.1 Age: _____ Gender: _____

1.2 Level of education: _____

1.3 Name of the Location: _____

1.4 Primary school: _____

1.5 Farm size: _____

1.6 Household size _____

Conservation structures and levels of environmental conservation

1. Which of the following soil conservation structures have you constructed in your farm?

Structure	Tick
Terraces	
Benches	
Fanya juu.	
Fanya chini.	
Cut off drains	

2.Are primary school pupils' involved in the construction of the following soil conservation structures?

Structure	Tick
Terraces	
Benches	
Fanya juu	
Fanya chini	
Cut off drains	

2. For the following soil conservation structures, how have the primary school pupils' in this community been involved?

Structure	Involvement			
	Construction	Maintenance	Construction &maintenance	Not involved
Terraces				
Fanya Juu				
Fanya chini				
Cut off drains				

3. In a year, how many times does your household practice the following soil conservation practices?

Structure	Frequency				
	None	Once	Twice	3 times	More than 3 times
Mulching					
Establish cover crops					
Contour ploughing					
Tree planting					
Trash lines					
Crop rotation					

4. Which of the following soil conservation practices are primary school pupils' practicing in your household?

Practice	Tick
Mulching	
Establishment of cover crops	
Contour ploughing	

Tree planting	
Trash lines	
Crop rotation	

6. How many times does your household carry out the following waste management practices per week?

Practices	**Frequency**				
	None	Once	twice	3 times	More than 3 times
Burning rubbish					
Dumping in pits					
Recycling of waste products/ using waste for other purposes					

7. Which of the following environmental conservation activities are the primary school pupils' involved in the household?

Activity	**Tick**
Burning of rubbish	
Dumping in pits	
Recycling of waste products/ using waste for other purposes	

8. How frequently do you apply the following manure and fertilizers in your farm?

Manure	**Frequency**				
	None	Once	2 times	3 times	More than 3 times
FYM					
Compost manure					
Commercial fertilizers					

9.How are primary school pupils' involved in application of the following types of manures?

Type of manure	**Involvement**			
	Spreading in the farm	Measuring the amount	Mixing with soil	Not involved
Farmyard manure (FYM)				
Compost manure				
Commercial fertilizers				

10. Which of the following tree nursery management practices are primary school pupils' involved in?

Nursery management practice	**Tick**
Planting tree seeds	
Nursery preparation	
Transporting of seedlings	
Watering of seedlings	

11. Which of the following agro-forestry practices are found in your farm?

AF Practice	Tick
Trees with crops	
Trees with pasture	
Crops/pasture	
Boundary planting	
Hedgerows	

12. In which of the following pollution control practices are primary school pupils' involved?

Involvement	Tick
a) Identification of various types of pollution in area and discussion with community members	
b) Collecting paper, metals and bottles and use them to make items like pots, flower toys and decoration	
c) Collecting rubbish from homestead and dispose it	

13. Community sources of knowledge on environmental conservation.

Knowledge statement	Farmers level of education	Primary pupils' knowledge	Extension agents	NGOS	Farmer to farmer interaction	Traditional indigenous knowledge
Soil conservation						
Application of fertilizers and manures						
Water conservation						
Afforestation						
Sources of tree seedlings						
Types of pollution						
Pollution control						

THANK YOU FOR YOUR COOPERATION.

APPENDIX D: List of Topics Related to Environmental Conservation Integrated in the Primary School Agriculture Syllabus

The following topics are studied in science in primary school:

1. Human body
2. Health Education
3. Plants
4. Animals
5. Weather
6. Water
7. Soil
8. Foods and Nutrition
9. Energy
10. Properties of matter
11. Making work easier
12. The solar system
13. Environment

Among the topics above the following are those that are directly related to environment:

1. Soil:

- Soil characteristics
- Types of soils
- Composition of soil
- Soil erosion and conservation
- Soil fertility

2. Water:

- Sources and uses of water
- Means of storing water
- Water born-diseases
- Water pollution
- Effects of water pollution

- Water conservation
- Soft and hard water

4. The Environment
    - Components of the environment

5. Pollution
    - Water pollution
    - Air pollution
    - Water conservation
    - Waste management