An Assessment of the Role of Environmental Education in Addressing Deforestation in Kaumba Area of Monze East, Southern Zambia

By

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Author's Declaration

I, Mwanamuchende Hespin, do hereby declare that this dissertation represents my own work and that it has not previously been submitted for the Master's degree at the University of Zambia or any other University.

Signature : ……

Date : ..…….

Certificate of Approval

This dissertation is approved as fulfilling the requirement for the award of the Master of Education degree in Environmental Education by the University of Zambia.

Examiners' Signatures	Date
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Dedication

To my mum, dad, brothers, sisters and my children Annie Mweemba Nkhoma, Vanessa Christine Nakazwe, Naomi Lulu Nakazwe and my granddaughter Jemimah Aboabea Odoi who joined us at the eleventh hour of this document. Above all, many thanks go to the Creator of the entire universe, Jehovah, the Lord God of the Sabbath whose boundless love is ever upon me.

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List of Acronyms

ADFRFRP	-	Arbor Day Foundation's Rain Forest Rescue Programme
AEO	-	Agriculture Extension Officer
CFI	-	Community Forestry International
CI	-	Conservation International
COFO	-	Committee on Forestry
COP	-	Conference of the Parties
DAPP	-	Development Aid from People to People
DEH	-	Department of the Environment and Heritage
EE	-	Environmental Education
EEASA	-	Environmental Education Association of Southern Africa
EETAP	-	Environmental Education and Training Partnership
ELF	-	Environmental Liaison Forum
EMA	-	Environmental Management Agency
EPI	-	Environmental Protection Index
EPPCA	-	Environmental Protection and Pollution Control Act
ERB	-	Energy Regulation Board
FAO	-	Food and Agriculture Organization
FGDs	-	Focus Group Discussions

FO	-	Forestry Officer
FRIS	-	Forest Retention Incentive Scheme
FTT	-	Forest Transition Theory
GRZ	-	Government of the Republic of Zambia
HFHD	-	High Forest cover – High Deforestation rate
HFLD	-	High Forest cover – Low Deforestation rate
IPCC	-	Inter-governmental Panel on Climate Change
IUCN	-	International Union for the Conservation of Nature
LFHD	-	Low Forest cover – High Deforestation rate
LFLD	-	Low Forest cover – Low Deforestation rate
MoE	-	Ministry of Education
MTENR	-	Ministry of Tourism, Environment and Natural Resources
NEAP	-	National Environmental Action Plan
NEEA	-	National Environmental Education Act
NEEN	-	Namibian Environmental Education Network
NPE	-	National Policy on Environment
NSW	-	New South Wales
NCS	-	National Conservation Strategy
PFAP	-	Provincial Forest Action Plan
REDD	-	Reducing Emissions from Deforestation and forest Degradation
SCAFE	-	Soil Conservation and Agricultural Forestry
UNCED	-	United Nations Conference on Environment and Development
UNCHE	-	United nations Conference on Human and Environment

UNDP - United Nations Development Programme

UNEP - United Nations Environmental Programme

UNESCO - United Nations Education, Scientific and Cultural Organization

UNFCCC - United Nations Framework Convention on Climate Change

UNZA - University of Zambia

US EPA - United States Environmental Protection Agency

WB - World Bank

WWF - World Wide Fund for Nature

ZANEEP - Zambia Network for Environmental Educators and Practitioners

ZEMA - Zambia Environmental Management Agency

ZEEN - Zambia Environmental Education Network

ZEEP - Zambia Environmental Education Programme

ZESCO - Zambia Electricity Supply Corporation

ZFAP - Zambia Forest Action Plan

ZNBC - Zambia National Broadcasting Corporation

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ABSTRACT

The noticeable increase in environmental degradation at global, regional and local levels is attributed to deforestation as one of the major causes (Pearce, 2001). The study aimed at assessing the role of Environmental Education in addressing deforestation in Kaumba area of Monze East, Southern Zambia after environmental educators visited the area in1992 and 2008. The study objectives were to: state all EE activities that took place in Kaumba area of Monze east, identify challenges that lead to deforestation in the study area, determine whether EE addressed the problem of deforestation in the area and lastly, to suggest alternative measures that could be employed to mitigate deforestation.

The study applied a case study research design and was purely qualitative in nature. Data were collected using semi-structured interviews, unstructured observation techniques and Focus Group Discussion schedules. The sample size of this study was 80 which comprised 10 teachers, 18 pupils selected from grade 7, 8 and 9 classes, 1 Forestry Department worker, 1 Agricultural Extension worker, and 50 farmers. Thematic analysis was used to analyze the collected data.

Research findings revealed many environmental activities that took place in Kaumba such as; tree-planting in woodlots, participation by residents in farming tillage, nursery-tree raising, cleaning surroundings, funding for EE activities and Conservation Agriculture Scaling-Up (CASU), greening school lawns and planting buffer zones. This showed the visibility of Environmental Education in the area. Challenges which led to deforestation in the area even after all the above EE activities took place include; limited sources of income, poor rainfall patterns and soils, poverty, high population rates, weak government policies, negligence, drying up of rivers, use of firewood for cooking, charcoal burning and many more. The role EE played in addressing deforestation which was taught and demonstrated by DAPP, SCAFE and Forestry Department include; nursery-tree raising, holding workshops to teach people about forest conservation,

planting woodlots, conservation tree-harvest, making heat-retaining clay stoves, fish-farming, bee-keeping and forest conservation rules. At the time of this research, only a few people were seen using woodlots to answer their daily forest needs.

Alternative measures to mitigate deforestation in Kaumba were; empowering people with soft loans, reforestation of the entire study area, emphasis on conservation tree-harvest, bee-keeping and fish-farming and allow EE to stand as a single subject in formal schools. The study recommended that the whole study area be reforested, that charcoal burning be stopped completely, EE stands as a single subject in the formal curriculum, bee-keeping projects be implemented in Kaumba so that forests could be saved in the process of reserving them for bee-keeping. Areas of future research were also tackled.

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.0 Overview

This chapter gives an outline of the background to the study, the statement of the research problem, the purpose of the study, research objectives and questions, the significance of the study, the operational definitions of terms used in the study and the theoretical framework that guided the study.

1.1 Background to the Study

Planet earth is endowed with a rich diversity of plant species which make up great forests of the world. According to Food and Agriculture Organization (FAO, 2001), it is estimated that there are over ten million plant species on earth. These species are under a serious threat of depletion (extinction) if sustainable measures are not promptly put in place. United Nations Education, Scientific and Cultural Organization (UNESCO, 2005), states that in 1990, total forest cover was 39, 755, 000ha which reduced to 31, 346, 000ha in 2000.

The noticeable increase in environmental degradation at global, regional and local levels is attributed to deforestation as one of the major causes (Pearce, 2001). Deforestation is shaping the global climatic conditions in an unfavorable way. Climate change and global warming have become the world's great environmental threats because forests which suck up carbon dioxide from the atmosphere are being destroyed at alarming rates. Carbon dioxide, therefore, freely rises to destroy the ozone layer which protects human life from the sun's intense heat, the heat which is not favorable to all forms of natural diversity. This heat brings about ailments such as eye diseases, skin cancers and other diseases. Rampant global deforestation trends have therefore, necessitated initiatives such as Environmental Education (EE) to help mitigate such problems. EE emphasizes tree-planting the world over so as to combat climate change as trees suck up carbon-dioxide from the atmosphere. Environmental Protection Index (EPI, 2012) asserts that

planet earth loses about 13.7 million hectares of forests through deforestation each year. These are huge forest cover losses that EE addresses through various strategies such as tree-planting programs. Africa as a continent loses about 927 400hectares of forests per year (UNEP, 2013), and out of Zambia's 50 million hectares of forest cover, 250 000 to 300 000 are lost each year (GRZ et al, 2010). Lindhe et al, (1992) assert that while countries in the sub-region like Kenya, Tanzania and others have mitigated deforestation by planting trees, Zambia is still lagging behind in this area. It is imperative, therefore, that EE strategies are implemented to help mitigate deforestation because forests are regarded as 'the lungs of the earth' (Frost, 1962).

In the People's Republic of China, where large scale destruction of forests has occurred, every able-bodied citizen between the ages of 11 and 60 has been mandated to plant three (3) to five (5) trees per year. So far 1 billion trees have been planted in China every year since 1982 (Owen, 2006).

1.2 Problem Statement

There is a noticeable increase in environmental degradation in Zambia. FAO (2010) states that, Zambia lost an average of three million, three hundred thirty-two thousand (3 332 000) hectares of forest cover between 1990 and 2010 which shows that little has been done to address deforestation trends in Zambia. Lindhe et al, (1992) asserts that while countries in the sub-region like Kenya, Tanzania, Malawi, South Africa, Namibia and many others have mitigated deforestation by implementing some EE strategies of tree-planting, Zambia is still lagging behind in this area.

Legislative environmental laws such as the Forests Act of 1973, Forest Policy of 1998 and the Environmental Management Act (EMA, 2011) are mandated to provide strategies for the conservation, protection and management of natural resources. Unfortunately, they have not done enough because natural resources, forests in particular, have continued to disappear at alarming rates in the presence of these laws, implying that the role of EE must be implemented both at national and local levels in order to save these forests.

Despite legislative environmental laws and public awareness campaigns on the role of EE in forest conservation by environmental educators in Kaumba area of Monze east, Southern Zambia, acceptance and participation in forest conservation has been limited. This constitutes a problem which has led to continued deforestation in the area. Before an individual switches from a degrading practice to a more sustainable behavior, an evaluation of his capacity to change needs to be undertaken. This, therefore, calls for an assessment of the role EE played in addressing deforestation which is still rampant in the study area after the visit of EE providers. Therefore, carrying out this study became imperative.

1.3 Purpose of the Study

The purpose of this study was to assess the role EE played in addressing deforestation in Kaumba area of Monze east.

1.4 Research Objectives

(a) To state all EE activities that took place in Kaumba area of Monze east.

(b) To identify challenges that led to deforestation in the study area.

(c) To determine whether EE addressed the problem of deforestation in the area.

(d) To suggest alternative measures that could be employed to mitigate deforestation.

1.5 Research Questions

(a) What environmental activities took place in Kaumba area of Monze East?

(b) What challenges lead to deforestation in the area?

(c) How did EE address deforestation in the study area?

(d) What alternative measures could be put in place to mitigate deforestation?

1.6 Significance of the Study

- The study may provide relevant EE knowledge to Kaumba residents and help to practically apply it towards addressing the issue of deforestation.
- It may bring about behavioral and social change to Kaumba residents towards deforestation and also add to the existing body of knowledge on EE and deforestation.
- It may help provoke further researches on how EE addresses deforestation in other parts of the country.
- The study may be beneficial to the Zambian government, EE policy-makers, church leaders, community leaders, Non-governmental Organizations (NGOs) and various stakeholders in mitigating deforestation by using EE strategies.

1.7 Operational Definition of Terms

Deforestation - in this study, it is the removal of stands of trees for different purposes which leading to untold loss of natural diversity.

Greenhouse gases - emissions of gases such as carbon-dioxide, methane nitrous oxide and fluorinated gases and other major contributors to global warming.

Global warming - the gradual increase in the temperature of the earth's atmosphere due to heat trapped by greenhouse gases.

Environmental Education - in this study, it is the study of our environment, that is, the atmosphere, biosphere, lithosphere and hydrosphere.

1.8 Theoretical Framework

The Forest Transition (FT) Theory

The Forest Transition (FT) theory was used in this study. Rudel (2005), asserts that in the early stages of development of a country, it is usually a trend that a country is characterized by High Forest cover and Low Deforestation rates (HFLD). Deforestation rates eventually, accelerate in the presence of High Forest cover – High Deforestation rates (HFHD) where forest cover is reduced due to human encroachment. This leads to Low Forest cover – High Deforestation rates (LFHD), meaning that forests will be scarce. This is the same scenario as that prevailing in the study area (Kaumba), where a lot of trees have recently disappeared due to deforestation which is now higher than the way it was about twenty years ago. The first people to settle in the study area found many animals, thick thickets and dense grooves of trees represented by the HFLD rates of the Forest Transition theory which is guiding this study. When they started increasing in numbers, a lot of trees were cut down to pave way to farming space and settlement leading to LFHD rates represented by the study theory.

The theory emphasizes that after environmental sensitizations through public awareness campaigns, deforestation rates are likely to decrease. Then there is Low Forest cover – Low Deforestation rates (LFLD) which is the time when forest cover stabilizes and eventually starts recovering. The FT theory, however, is not a law of nature because in this theory, pattern changes may be influenced by national context like human population density, stages of development, structure of the economy, global economic forces and government policies. A country may reach very low levels of forest cover before it stabilizes. This stabilization may happen through intensive awareness campaigns and good policies which may help halt the transition process.

This chapter dealt with the outline of the background to the study, the problem statement, purpose of the study, research objectives and questions, the significance of the study, the operational definitions of terms and the theoretical framework that guided the study. The next chapter reviews the literature related to the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter presents literature related to this study. It begins with a brief definition and history of EE, goals, objectives and principles of EE. It further defines and discusses deforestation. The chapter also presents EE activities and programmes worldwide so as to establish its visibility in different countries of the world. It brings out challenges that lead to deforestation, the effects of deforestation, the role of EE in addressing deforestation and the measures that could be used to mitigate deforestation. The literature concludes by pointing out the gaps that arose from the study and the summary of the chapter is provided.

The literature review was guided by the following four study objectives:

(1) To state all EE activities that took place in Kaumba area of Monze east.

(2) To identify challenges that lead to deforestation in the study area.

(3) To determine whether EE addressed the problem of deforestation in the area.

(4) To suggest alternative measures that could be employed to mitigate deforestation.

2.1 Environmental Education

Environmental Education is a combination of two important words, which usually stand alone in ordinary life and these are ‘Environment’ and ‘Education’. Environmental Education will be defined and its history, goals and principles will be given.

UNESCO (2005) defines Environmental Education as a process of identifying critical environmental issues and problems, observing them, monitoring them, acting and determining effective strategies of action in order to come up with solutions. This is what EE is doing to come up with crucial environmental problems so that best solutions for them could be found. The IUCN (1970) in Palmer (1998:7) defined EE as a “process

of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness between man, his culture, and his biophysical surroundings." This is also a very important definition of EE which encourages human beings to develop right values and attitudes towards issues of the environment for them to appreciate the relationships between man and his physical world. Le Roux (2001: 56) also defined EE as a "planned process which enables participants to explore the environment, to investigate recognized concerns and take action to make the world a better place for all living things."

EE aims to promote conservation tree-harvest, conservation farming, boosting our economy and dealing with garbage and all forms of pollution in different ways and is imparted formally, non-formally and informally for it to capture all sectors of society (Van, 2005). This means that no class of people will be left out in imparting EE because it involves all the three forms of education. EE has an open approach to issues of forest conservation, leaving room for additional knowledge at any time as opposed to formal education, which usually follows a prescribed curriculum. Developing durable solutions to complex environmental issues by everyone is what EE advocates for. All forms of knowledge about the environment whether traditional, modern, scientific, cultural or technological is important in Environmental Education.

The Department of Education (1993) pointed out that EE has direct experience at its core. It presents opportunities for experiences in a number of different environments. These experiences are sensory, aesthetic and practical and they are focused, progressive (each experience builds on the one before) and integrated with other learning activities both inside the classroom and beyond. By its very nature, EE is an on-going process in which members of the public, teachers and pupils have a role to play.

2.1.1 Brief History of Environmental Education

Originally Environmental Education was considered to simply be nature studies and it was only in the 1970s that environmental studies and conservation education first emerged (Mappin& Johnson, 2005). In the 1980s, the promotion of environmentally

responsible behavior became the primary goal of Environmental Education, so that the broad title of Environmental Education now included global education, politics and development (Hungerford & Volk, 1990).

Many conferences and meetings were held before the actual definition of Environmental Education was given. Wheeler (1985) in Palmer (1998) states that in 1948, the International Union for the Conservation of Nature (IUCN) conference took place in Paris where the term 'Environmental Education' first appeared in the book 'Commutas' written by Paul and Goodman in 1947.

In 1965, the term 'Environmental Education' was used for the first time in the United Kingdom (UK). It was finally defined at the IUCN and UNESCO International Working Meeting on Environmental Education in the school curriculum held at the Foresta Institute, Carson City in Nevada, United States of America in 1970. It was at this meeting that the landmark in trying to define the term 'Environmental Education' was struck (Palmer, 1998). Palmer & Birch (2005) state that approaches to Environmental Education have evolved dramatically from their natural science base of the 1960s to a social science oriented perspective in the 1990s.

The United Nations Conference on Human and Environment (UNCHE) which was held in Stockholm, 1972 attempted to look at global environmental problems, one of which was deforestation. EE that fosters meaningful community participation and learning has been considered a requisite to sustaining our human and natural environments in many of the global conferences, agreements, declarations and charters which took place since the1972 UN Conference on the Environment in Stockholm. The conference adopted a broader perspective of defining environment to include the natural and man-made aspects that were initially omitted during the Biosphere Conference. This conference gave birth to the United Nations Environmental Programme (UNEP) which acted as a catalyst, facilitator, educator and advocate in the promotion of wise use and sustainable development of the global environment and resources (United Nations Development Programme et al (UNDP, 2003). EE is now playing a major role in curbing wasteful

deforestation trends the world over. For example, in Southern, Central and East Africa, many countries have planted grooves of both indigenous and exotic forests so that the environment could be brought back to its normal state. The most unfortunate thing is that our country, Zambia, is lagging behind in terms of improving forest cover through reforestation.

Agenda 21, the main document which reflected the intentions of the United Nations Conference on Environment and Development (UNCED), dedicated a separate chapter (Chapter 36) to the role of education as a global response to world environmental crises (UNESCO-UNEP, 1992). There is a growing awareness of environmental problems in individual countries, which has led to calls for Environmental Education to be implemented formally, non-formally and informally the world over. The following were adopted as EE goals and objectives:

2.1.2 Main Goal of Environmental Education

The overall goal of EE is to develop an informed citizenry that is environmentally conscious and motivated to actively participate in managing and sustainably utilizing its environment (UNESCO, 1998).

2.1.3 Objectives of Environmental Education

According to Environmental Education and Training Partnership (EETAP) (2000), EE objectives are essential tools in successful implementation of environmental conservation because EE instills awareness, knowledge, skills, attitudes and participation in environmental care and protection in individuals. The objectives of EE go beyond curriculum and are outlined by UNESCO (1998) as follows:

(a) Awareness - to help social groups and individuals acquire an awareness of and sensitivity to the total environment and its allied problems.

(b) Knowledge - to help social groups and individuals gain a variety of experiences in, and acquire a basic understanding of the environment and its associated problems.

(c) Attitude - to help social groups and individuals acquire a set of values and feelings for the environment and the motivation for actively participating in environmental care and protection.

(d) Skills - to help social groups and individuals acquire the skills for identifying and solving environmental problems.

(e) Participation - to provide social groups and individuals with an opportunity to be actively involved at all levels in working towards resolution of environmental problems.

2.1.4 Principles of EE

To ensure the viability of EE the world over, the Intergovernmental Conference held at Tbilisi in 1977 adopted guiding principles for EE. According to these guiding principles EE should:

- Consider the environment in its totality-natural and built, technological and social economic, political, cultural-historical, moral and aesthetic environment.
- Be a continuous life-long process, beginning at the pre-school level and continuing through all formal and non-formal stages.
- Be interdisciplinary in its approach, drawing on the specific context of each discipline in making possible a holistic and balanced perspective.
- Examine major environmental issues from local, national, regional and international points of view so that students receive insights into environmental conditions in other geographical areas.
- Focus on current and potential environmental situation while taking into account the historical perspective.
- Promote the value and necessity of local, national and international cooperation in the prevention and solution of environmental problems.

- Explicitly consider environmental aspects in plans for development and growth;
- Enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences.
- Help learners discover the symptoms and real causes of environmental problems.
- Emphasize the complexity of environmental problems and thus need to develop critical thinking and problem-solving skills.
- Utilize diverse learning environments and a broad array of education approaches to teaching and learning about and from the environment with due stress on practical activities and first experience.

  Adopted from International NGO'S Forum (1992) Environmental Education for Sustainable Societies and Global Responsibilities, ICAE, Toronto.

2.2 Deforestation

To have a better understanding of the meaning of the word 'deforestation', Beer et al (2011: 25) defined it as "the permanent destruction of indigenous forests and woodlands". Despite the removal of exotic forests like *gmelina arborea* and pines, the situation cannot be referred to as deforestation because the term deforestation does not include the removal of industrial forests such as plantations of *gumsor* pines and *gmelina*. Conversely, the SAFEnet Dictionary of forests (2008) states that deforestation; clearance or clearing is the removal of a forest or stands of trees where the land is thereafter converted to a non-forest use. In this case, examples of deforestation may include conversion of forestland to farms, ranches, mines or urban use. This definition describes what is exactly obtaining on the ground in terms of loss of indigenous forest cover through non-forest projects like farming, mining and many more.

In 1990, world total forest cover was 39, 755, 000ha which reduced to 31, 346, 000ha in 2000 (FAO, 2001). EE however, identifies critical environmental problems such as deforestation, observing them, monitoring them and providing better strategies of action in order to come up with better solutions for them (UNESCO, 2005).

More than half of the animal and plant species in the world live in tropical forests. Deforestation has led to many serious environmental problems such as displacement of natural diversity from its natural habitats, climate change and global warming trends being experienced the world over.

Frost (1962) states that 'forests are the lungs of the earth' meaning trees act as breathers for the earth and without them, all forms of life on earth would become extinct. However, EE through Conservation International (CI) works towards protection of forests. Forests control the earth's climate as they make sure that the amount of carbon dioxide (CO_2) in the atmosphere is just right (balanced) as they suck CO_2 from the atmosphere.

Despite increasing deforestation trends noted the world over, some nations have boldly taken steps to mitigate deforestation by increasing the amount of trees on earth. The best example is that of China who in 1981, created a National Tree-planting Day and forest coverage reached 16.55% of China's land mass, against 12% two decades earlier (Gittings, 2001). This shows that reforestation is possible with concerted efforts even in developing countries like Zambia where deforestation is more rampant.

Deforestation poses negative effects on the environment and people's lives at large. Environmental protection, therefore, should not only focus on current trends, but that future generations should not fall under the same calamities which is one of the roles EE is tasked with. It is imperative that prompt action is taken, for example, more trees should be planted worldwide to replace the lost ones the way most of the countries like China and those in the African sub-region have done.

The Zambian forests are being threatened as all sectors of the economy need logs in their various construction ventures like wooden fence posts, wooden props in the mining industry, house constructions and even the railway line which uses wooden sleepers (National Conservation Strategy (NCS) (1985).

2.3 Environmental Education Activities and Programmes in Diverse Countries of the World

(a) Global View

This is the first objective whose purpose is to establish the visibility of different EE activities worldwide. The literature below shows a good number of different environmental activities and programmes that have so far taken place in different countries of the world. Environmental Education is multi-disciplinary in nature as it incorporates various fields of study, such as vocational studies, life sciences, physical science, earth science, mathematics, arts, humanities, geography, communications and social studies.

Gough and Lotz (1997) both accept that EE should be an integral part of the school curriculum and not simply a body of scientific facts to include in the learning areas for the physical and natural sciences. Similar forms of recognition had earlier on led UNESCO-UNEP (1992) to introduce Environmental Education in teacher education colleges as a 'priority of priorities' so that they can transmit the knowledge on the dangers of environmental degradation to the learners.

2.3.1 Funding for EE in New Zealand, Australia, New South Wales (NSW) and the United Nations (UN)

Environmental activities and programmes have and are still taking place in many different countries of the world. For example, funding for EE activities is consistent with previous researches by New Zealand MoE, (1998), Australian DEH, (2005) and Sanz, (2007) who respectively, argue that in New Zealand, an annual budget of 1.3 million dollars was dedicated to the promotion of Environmental Education in 1998. In Australia, 500,000 dollars' minimum annual budget was set aside for the purpose of Environmental Education while a UN Enabling Fund (Stabilization Fund) was formed to fund for preparation and support of developing countries to participate in Reducing Emissions from Deforestation and forest Degradation (REDD) mechanisms. Despite these projects seen in other countries, the Zambian government has not done any

tangible work in terms of funding for EE activities. For example, a tree-planting project was flagged-off in Eastern Province but no funding towards the project was seen.

In New South Wales, the Environmental Education Bill of 1998 provided the legislative backing for the direction of EE (Australian DEH, 2005). Literature further shows that in New Zealand, Environmental Education priorities and securing additional financial resources were established. These environmental activities are showing the visibility of EE activities in these countries as well as in organizations like the United Nations.

2.3.2 Formulation of a National Strategy in New Zealand and the National EE Act in the United States

To show more EE activities in the world, we see a lot of programmes taking place in different parts of the world. For example, New Zealand published its national strategy, *learning to Care for our Environment* in1998. This document is intended to serve as a framework to promote EE activities in rolling back deforestation (New Zealand MoE, 1998). EE activities are also seen in the United States which passed the National Environmental Education Act (NEEA) in 1990 with numerous targets and strategies to improve EE (US Environmental Protection Agency (US EPA), (1990). NEEA supports EE programmes such as developing EE curricula and training EE teachers. To show NEEA's dedication to implementing environmental activities in the United States, it created an Environmental Education Advisory Council and Task Force, whose mandate is to provide reports on the state of EE in the United States annually. These activities are showing the presence of EE in these countries.

2.3.3 Environmental Education Policy for Schools in New South Wales (NSW)

EE activities are also noted in the Ministry of Education and Training in New South Wales where *Environmental Education Policy for Schools* was implemented in 2001. NSW was actually regarded as an international leader in EE initiatives and opted for a formalized policy for EE (NSW Department of Education and Training, 2001). New South Wales is this far, combating deforestation through this policy.

(b) Regional View

McCay and Lobban (2012) assert that Hermannsburg school in KwaZulu-Natal is involved in recycling, litter control and water management signifying the visibility of EE in South Africa. In addition, the school participates in inter-school Mondi-WESSA National environmental quiz and the school won the national finals for nine years of the 24 years that the quiz has been running (ibid).

More EE activities were noted in Uganda by an environmental scholar Ojala (2006) who argued that most of the youths in Uganda were involved in practices related to energy conservation, recycling, 'green consumerism' and other environmental activities.

Lindhle et al (1992) talks of the formation of an environmental movement in Namibia called the Namibia Environmental Education Network (NEEN). This movement promotes many environmental activities like litter control through the use of three Rs which are 'Reduce', 'Re-use' and 'Recycle' in a quest to control garbage in the country.

Lindhe et al (1992) in Botswana observed negative attitudes by teachers towards EE as it was not timetabled and examinable. For this, teachers felt discouraged to teach EE because in the end it was not examinable. Therefore, EE was looked at as an additional burden and not a necessity in the curriculum. This shows the visibility of EE in Botswana although it was regarded as more theoretical than practical.

(c) Local View

2.3.4 Garbage Collection and Pollution Control

In Zambia, environmental activities have been running indicating the visibility of EE in the country especially in the area of garbage collection. A lot of Waste Management trucks are seen each week collecting garbage from homesteads thus, maintaining clean surroundings in the city of Lusaka and other towns as well. ECZ (2008) states that the Environmental Protection and Pollution Control Act (EPPCA) was enacted in 1990 and subsequently, ECZ currently ZEMA, was established in 1992 as a response to the

National Conservation Strategy's (NCS) recommendations. All this indicates the visibility of EE even here in Zambia although it is not very active.

2.3.5 Zambia Network for Environmental Educators and Practitioners (ZANEEP)

Zambia Network for Environmental Educators and Practitioners (ZANEEP) has been offering EE as regards environmental conservation and management in terms of pollution, recycling and other environmental issues. The Zambia Environmental Education Network (ZEEN) is tasked with the role of linking diverse environmental programmes in order to ensure that they are implemented countrywide.

2.3.6 Inclusion of EE in Zambian Tertiary Curriculum

In Zambia, EE was included in In-service Primary Diploma in Teachers' Training Colleges in 1990. Recently, EE was introduced as a pilot project by Zambia Environmental Education Programme (ZEEP). It is now offered in different colleges of education and at the University of Zambia both at Under-graduate and Post-graduate levels of education.

2.3.7 Zambia Environmental Conservation Policies

Like other countries of the world, Zambia has also put in place environmental policies and programmes to help put up strategies of action aimed at conservation of the total Environment (ECZ, 2008). For example, the first policy document, the National Conservation Strategy (NCS) was formulated in 1985 to act as a Policy Framework Document. It identified key environmental issues, status of environmental resources in Zambia and made recommendations for policies, programmes and actions to address these issues. All this shows the visibility of EE in Zambia.

2.3.8 The National Policy on Environment (NPE)

In 2007, the National Policy on Environment (NPE) which involved participation of various stakeholders was formed in Zambia as an umbrella policy for the nation's

environment. The aim of NPE was to develop socio-economic activities and see to it that they were effectively achieved without damaging the integrity of the environment. This is the sustainability that Zambia needs to take seriously in a practical way so that natural resources like animals, fish, water, trees and minerals are sustained.

2.4 Challenges that Lead to Deforestation

There are several challenges that lead to deforestation the world over. Deforestation has led to many serious environmental problems such as climate change and global warming trends being experienced the world over. More than half of the animal and plant species that are under the threat of extinction in the world are found in tropical forests.

The scene of environmental degradation at global level is very alarming. This led to many meetings and conventions being held to discuss how the environment could be saved from destruction. For example, UN (2003) states that FAO Committee on Forestry (COFO) in 2001 addressed illegal and corrupt forestry activities based on the research reported in the State of World forests. FAO Advisory Committee in Paper and Wood products also discussed the topic, "*Defining Illegal Logging: What is it and what is being done about it?"* This shows a great concern for the survival of forests the world over. It is estimated that at global level, planet earth loses about 13.7 million hectares of forests through deforestation each year (EPI, 2012).

2.4.1 Weakness of Environmental and Forest Policies on Firewood and Charcoal

Sahney et al (2010) states that disregard or ignorance of intrinsic value, lack of acceptable value; feeble forest management acts, frameworks, policies and deficient environmental laws are some of the factors that have led to deforestation on a large scale. This is true, for example, environmental laws tend to become soft when dealing with demand for firewood in rural areas taking it that there is nowhere people can turn to because rural electrification has not yet reached most of the remote parts of the country. This is further supported by UN (2003) which states that certain levels of illegal cutting are customarily tolerated when its use is for home heating and cooking in rural areas.

This is the toleration that has led to depletion of forests in rural areas that EE endeavours to address through one of its objectives of attitude change. Shokubutsu-gaku-zasshi (2009) asserts that wood fuel accounts for about 24% of the primary energy supply in rural areas. In urban areas, charcoal contributes to about 87% of household energy consumption. Charcoal burning is one of the biggest drivers of deforestation in Zambia and this needs serious checking before forests are completely depleted.

Although the Ministry of Tourism, Environment and Natural Resources (MTENR), under the Forestry Department, carries out forestation activities, these activities are minimal compared to the extent of deforestation. According to Forest Products (2011), almost three billion people rely on wood for heating and cooking in developing countries, a trend that may see massive destruction of forest cover.

2.4.2 Logging and Agriculture

According to Berkmuller (1992), one of the immediate underlying causes of deforestation is logging. This occurs because in many construction industries, logs are needed hence, the exploitation of forests. Some experts have further argued that industrial logging is the worst contributor to global deforestation (The New York Times, April 20, 2009). This scenario has led to massive forest cover loss and threatening desertification in countries like Zambia. According to the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, the overwhelming direct cause of deforestation is agriculture. Subsistence farming is responsible for 48% of deforestation, commercial agriculture is responsible for 32% of deforestation, logging is responsible for 14% of deforestation and wood fuel removals make up 5% of deforestation, (Kauppi et al, 2006). Such alarming rates of deforestation are likely to turn the world into a desert if nothing is put in place to save forests.

2.4.3 Poverty, Corruption, Population Growth and Urbanization

Poverty is one of the most serious causes of deforestation. Some scholars argue that poor people are more likely to clear forests because they have no alternatives (Kauppi et al,

2006). This is true because it has been noted even in Zambia that where poverty is high, trees tend to disappear at higher rates as people try to make ends meet using forest products. One study supports this by agreeing that population increase due to high fertility rates was a primary driver of tropical deforestation in 8% of cases (The New York Times, April 20, 2009). Deforestation may also be perpetuated by corruption of government institutions, the inequitable distribution of wealth and power, overpopulation, and urbanization (Arild and Kaimowitz, 1999).

2.4.4 Industrial Factors and Settlements

Stock and Rochen (2009) allude to the fact that by the 1990s much of deforestation was caused by industrial factors, including extractive industries, large-scale cattle ranching, and settlements. With the declining economic situation in Zambia, increasing population levels and other developments, the forest ecosystem has been greatly exploited. Such developments resulted in escalating rates of deforestation especially in developing countries like Zambia which had an inadequate Forest Policy up to 1998 (GRZ et al 2010). Zambia lost an average of three million, three hundred thirty-two thousand (3 332 000) hectares of forest cover between 1990 and 2010 (FAO, 2010). There is need to promptly plant trees countrywide to improve forest cover.

2.4.5 World Rainforest Deforestation Rates

Humankind needs to be proactive when it comes to issues of the environment because deforestation is occurring at very high rates. Scientists estimate that one fifth of the world's tropical rainforest was destroyed between 1960 and 1990. They claim that rainforests covered 14% of the world's land surface fifty (50) years ago, but by 2000, they only covered 5 - 7%. Mongillo et al. (2000) asserts that all tropical forests will be gone by the middle of the 21st century. This needs prompt action before the world turns into a desert.

2.4.6 Hiking of Electricity Tariffs in Zambia

In Zambia, the country's energy watchdog the Energy Regulation Board (ERB) allowed national electricity firm, the Zambia Electricity Supply Corporation (ZESCO) to hike electricity tariffs for domestic consumers by about 40 percent in 2010 and 30th May, 2014. This led to high and rampant deforestation for charcoal burning and wood fuel due to high demand for these commodities especially by high density (compound) dwellers. The rising cost of electricity tariffs could worsen the effects of climate change in Zambia through deforestation for charcoal if it goes unchecked.

Countries like Kenya, Tanzania, South Africa and many others in the sub-region have mitigated deforestation by planting trees while Zambia is still lagging behind in this area. This gap needs to be promptly addressed by rolling back deforestation through EE bodies and the powers that be.

2.4.7 The Threat

Beer et al (2011) allude to the fact that the rate at which deforestation is occurring is of great concern because currently, about 13 million hectares of global forests are cleared every year, an area about 3 times the size of KwaZulu-Natal. Almost all of this deforestation occurs in the moist forests and open woodlands of the tropics. Thus, the role of Environmental Education becomes critical in the quest to mitigate deforestation the world over. ZEMA, an EE policy maker also warned Zambia in 2012 that if no actions are taken in terms of reforestation, the environment would be degraded making availability of certain resources scarce (ZEMA, 2012). There is need, therefore, to find alternative measures of employing EE strategies so that forests are saved.

2.5 How EE is Addressing Deforestation

This section looks at the value or importance of EE and why its role is so crucial especially in addressing deforestation at global, regional and local levels. A number of scholars have stressed the importance of Environmental Education and the strategies it uses in rolling back deforestation. These arguments have been advanced both for the

formal, informal and non-formal settings. It is therefore, important to curb deforestation through the use of such EE strategies.

(a) Global View

Aggrawal et al (1996) state that professional organizations and individual countries in the 1970s advocated for EE as a way of dealing with environmental problems such as deforestation trends that have heavily contributed to global climate change. The global problems such as population growth, pollution, poverty, deforestation and extraction of resources for economic development led to the formulation of environmental movements globally, regionally and locally. EE addresses the problem of deforestation in many ways as follows:

2.5.1 Reforestation Trends: The Case of Japan

In Japan, tree-planting has been and is still taking place on a large scale. In 2003, Japan enacted the Law for Enhancing Motivation on Environmental Conservation and Promotion of Environmental Education (Government of Japan, 2003). Since then, grooves of trees have been witnessed in Japan. Despite environmental education activities manifested in countries like Japan, Zambia has not yet adopted such sustainable strategies in a quest to improve its forest cover and help curb climate change and global warming trends.

2.5.2 Reducing Emissions from Deforestation and forest Degradation (REDD)

EE is tasked with the role of curbing deforestation through tree-planting among many other roles. EE works together with Compensated Conservation mechanism to compensate developing countries for conserving and improving their forest cover. So far, some main international organizations including the United Nations (UN) and the World Bank (WB) have begun to develop programmes aimed at curbing deforestation. The term Reducing Emissions from Deforestation and Forest Degradation (REDD) describes these sorts of programmes, which use direct monetary or other incentives to

encourage developing countries to limit or roll back deforestation. In December 2009, the UN Framework Convention on Climate Change (UNFCCC) Conference of the Parties - 15 in Copenhagen sought for new and additional resources. These included forestry and investments through international institutions that would approach $US 30 billion project called UN REDD Enabling Fund (Forestry Stabilization Fund**)** for the period 2010–2012 (UNFCCC, 2009). It was meant to fund countries committed to rolling back deforestation worldwide. Zambia was among the top ten (10) countries of the world where deforestation was more rampant and was tasked with tree-planting after which it was to receive an award from REDD in monetary form and a green label to show that it had gone green. Unfortunately, Zambia did not adhere to this and deforestation has continued.

2.5.3 Avoided Deforestation Carbon Fund (ACDF)

To ensure the stability of forest cover and curb carbon stock losses through EE, Sanz (2007) asserts that ACDF provides resources for specific activities that directly reduce emissions from deforestation and activities that maintain forest cover and avoid Carbon stock losses.

(b) Regional View

In the SADC region, EE grips have been widened towards deforestation as the donor community supports EE directly or indirectly. Lindhe et al (1992) states that the School Maintenance programme has done a good job in the SADC region because many grooves of trees have been planted in schools for shade, windbreak, fruits and so on. Many SADC countries apart from Zambia are already rolling back deforestation through tree-planting. Although Zambia has projects with EE components like other countries in the sub-region, these projects are still dormant as they are more theoretical than practical.

2.5.4 Tree-Planting in Kenya

In East Africa, EE has reached greater heights in terms of sensitizations and participation in various environmental activities. Lindhe et al (1992) asserts that in Kenya, EE has gone beyond project centers to schools and that 80% of the pupils were already engaged in nursery-tree preparations and colliandra tree-planting. In Kenya, every school-going child is mandated to plant a tree at the fall of his/her birthday and for this, Kenya has witnessed a tremendous rise in forest cover. Zambia needs to adopt strategies such as this in order to improve its forest cover too.

2.5.5 Namibian Environmental Education Network (NEEN) in Namibia

This is an EE network which links tree-planting activities in Namibia. So far, the republic of Namibia is planting trees in line with NEEN targets, an example Zambia needs to emulate. This shows that Namibia is already rolling back deforestation through this EE network.

2.5.6 Environmental Education Association of Southern Africa (EEASA)

In Southern Africa, those who were involved in Environmental Education in the conservation agencies and organizations, schools and elsewhere came together to form the Environmental Education Association of Southern Africa (EEASA) (Van, 2005). Under this association, deforestation is getting curbed and a lot of indigenous and exotic forests are being planted in Southern Africa.

2.5.7 Tree-planting in South Africa

Planting indigenous trees in the school gardens and school grounds took place at Hermannsburg School through a 'Nature Club'. In KwaZulu-Natal, Highbury Preparatory School has also turned green due to a set target for its EE 'green' programme called 'Enviro - Stretch' which emphasizes going 'green' and has since seen to it that trees and grass are planted at the school (McCay and Lobban, 2012). This shows how deforestation is being addressed by EE. Le Roux (2001) also asserts that in

South Africa EE movements are working in collaboration with a number of organizations in combating deforestation through tree-planting programmes in schools.

2.5.8 Environmental Liaison Forum (ELF) in Zimbabwe

ELF is a Zimbabwean network responsible for mobilization of human resource towards massive tree-planting programmes (Lindhe et al., 1992). Unfortunately, ELF is somehow losing focus, probably one of the reasons why Zimbabwe is experiencing hunger trends of late.

2.5.9 Community Forestry International (CFI) in Tanzania

CFI is a Tanzanian based organization which was led by EE activists namely; Daimen Hardies, Zach Melanson and Estelle Drisdelle who founded a tree-planting movement where over 100 000 trees were planted in Pemba, Tanzania. This is no surprise as to why Tanzania has large grooves of exotic plantations across the country.

(c) Local View

2.5.10 Lobbying for EE Inclusion in the National School Curriculum

In Zambia, Environmental Educators came together in the Zambia Network for Environmental Educators and Practitioners (ZANEEP) to try and lobby for the inclusion and integration of EE in the national school curriculum. In supporting the notion that EE plays a pivotal role in environmental, economic, social and cultural development, Gupta (1998) notes that deforestation can only be curbed when backed by legislation, government machinery and public awareness as well as high participation in institutions like schools. Schools are further required to form environmental clubs such as ‘Think Green’, Chongololo, and so on where environmental issues like tree-planting could be discussed in detail. Saniya Investments in Zambia is producing exercise books with a ‘Think Green’ insignia which brings forth that passionate attachment to tree-planting thus, rolling back deforestation through EE.

2.5.11 Zambia Environmental Management Agency (ZEMA)

ZEMA became the law-making umbrella body in 2011 and is tasked with coordinating national environmental protection activities and programmes such as flagging off a tree-planting programme in Eastern Province. The environmental laws made by ZEMA act as guiding principles to proper environmental management like the Forestry Act No. 7 of 1999 which should be actively working towards combating deforestation in Zambia.

2.5.12 The National Environmental Action Plan (NEAP)

In 1994, an environmental body called the National Environmental Action Plan was formed with an overall objective of integrating environmental concerns such as deforestation into the social and economic development planning process. Kasutu (2001) asserts that a lot of reorientations and realignments of government policies and legislations were made in the 1990s with regards to natural resource management like air, forests, and many others.

2.5.13 The Zambia Forest Action Plan (ZFAP)

Deforestation which is still rampant in Zambia is supposed to have been fully addressed by now through environmental programs and policies that EE has put in place. For example, the Zambia Forest Action Plan (ZFAP) ushered in a number of coherent changes which included formulation of the Provincial Forest Action Plan (PFAP) and re-designing of the Forest Policy and Legislative frameworks in a bid to conserve forests (Lang, 2011). The PFAP undertook to facilitate the formulation of three participatory forest management plans for Central, Copperbelt and Luapula Provinces. We can say that at least Copperbelt province, reluctant though, has and is still planting exotic trees. This is an example that other provinces of Zambia need to emulate so as to improve forest cover nationwide.

2.5.14 The Forest Act of 1965

The role of EE in addressing deforestation is being noted in some environmental conservation strategies that have been undertaken by the Zambian government. For example, GRZ et al (2010) asserts that Forest Reserves were established by government to conserve forest resources for sustainable use. This is to be done by local people in the case of local forests and to protect major catchment areas and biodiversity in the case of national forests. This is one of the major roles of EE. Settlements and cultivation are normally not permitted in Forest Reserves while removal of any plant is only permissible under license. Botanical reserves were established by government to preserve some relic vegetation types. Plant species act as sources of germ-plasma for multiplication and plant breeding programmes and also to act as reference sites in determining human impacts on forest ecosystems outside the reserve. But such 'compare and contrast' tests should somehow be discouraged, instead, environmentalists should start addressing the apparent threatening desertification due to rampant deforestation trends even outside Forest Reserves.

2.5.15 The Forest Policy of 1998

The current Forest Policy is an EE body that was adopted in July 1998 after a review of the one developed in 1973 (GRZ, 1998). The policy aims at increasing the country's forest cover by collaborating with Government Agencies and the private sector in the quest to roll back deforestation in Zambia. This forest policy and some environmental laws could be of great help if every Zambian citizen can be equipped with this knowledge so that forests could be preserved.

2.6 Measures to Help Mitigate Deforestation

Deforestation is typically assessed by quantifying the amount of area deforested and measured at the present time. It is important that ways to bring deforestation to an end are sought so that the total environment could be saved from destruction. There are

many methods that are appropriate and reliable for reducing and monitoring deforestation as shown in the following sub-captions.

2.6.1 Reforestation

Reforestation helps in increasing forest cover and mitigating deforestation as alluded to by Foley et al (2005) that in many parts of the world, especially in East Asian countries, reforestation and afforestation are increasing the area of forested lands. The amount of woodland has increased in 22 of the world's 50 most forested nations. Asia as a whole gained 1 million hectares of forest cover between 2000 and 2005. So far, there is more reforestation than deforestation in oriental countries, an example Zambia needs to emulate.

2.6.2 Commemoration of Tree-planting Days

March 12 of every year in China is a Planting Holiday. China has also introduced the Green Wall of China project, which aims to halt the expansion of the Gobi desert through tree-planting. There has been a 47-million-hectare increase in forest area in China since the 1970s. The total number of trees amounted to about 35 billion and 4.55% of China's land mass increased in forest coverage (ibid). An ambitious proposal for China is the Aerially Delivered Re-forestation and Erosion Control System and the proposed Sahara Forest Project coupled with the Seawater Greenhouse. If these projects could seriously be emulated and implemented throughout the world, then the world will be moving towards greater heights in terms of curbing deforestation.

2.6.3 Monitoring Deforestation

EE is carrying out monitoring deforestation measures though it is very complicated especially with the increasing needs for plant resources. Defries et al (2007) state that deforestation rates and total area deforested, have been widely used for monitoring deforestation in many regions, including the Brazilian Amazon. Though complicated it may seem to be, it is quite helpful in establishing deforestation rates and determine

reforestation estimations so that environmental educators can best know the needed amounts of reforestation to be carried out.

2.6.4 Enriching the Soil

Making the soil rich is another important EE measure for curbing deforestation. Butler (2007) states that EE encourages cyclic agriculture which increases soil fertility through animal droppings. In cyclic agriculture, cattle are grazed on farmland that is resting and rejuvenating. Fertile soils enhance high crop yields which may help people forget about deforestation for income.

2.6.5 Use of Bamboo for Cleaner Burning

To mitigate deforestation, a brilliant clean measure was put in place by EE advocates to sustain forests which are usually cut for firewood. Rosenberg (2012) states that bamboo is advocated as a more sustainable alternative for fuel because fuel from bamboo rather than wood, results in cleaner burning. Conversely, bamboo matures much faster than other types of wood. Therefore, deforestation is reduced as fuel supply from bamboo can be replenished faster.

2.6.6 Forest Plantations

Stenstrup (2010) states that to mitigate deforestation and meet the world's demand for wood, forestry writers like Botkins and Sedjo points out that high-yielding forest plantations are suitable. It has been calculated that plantations yielding 10 cubic meters per hectare annually could supply all the timber required for international trade on 5% of the world's existing forestland. Conservation International (CI) (2011), states that in Senegal, on the western coast of Africa, an EE movement headed by youths has helped to plant over six (6) million mangrove trees. The trees will protect local villages from storm damages and provide a habitat for local wildlife. The project started in 2008, and already the Senegalese government has been asked to establish rules and regulations that would protect the new mangrove forests by Conservation International.

2.7 Areas of Concern (Gaps)

(a) Negligence - In Zambia, deforestation occurs largely without replacing felled trees. There are huge forest losses in the study area that need to be promptly addressed in form of reforestation projects. Extensive awareness campaigns on dangers of deforestation should seriously be carried out in Kaumba followed by extensive tree-planting.

(b) Lack of a Study on EE and Deforestation in Kaumba - While many scholars have written on EE and deforestation trends in various countries of the world, a study on the role EE played in addressing deforestation in Kaumba area of Monze east has not yet been done. This study, therefore, was carried out to bridge that gap.

(c) Weak Environmental Management Act of 2011 - While one of the functions of Environmental Management Act of 2011 is to provide for integrated environmental management and sustainable use of indigenous forests, it has not yet addressed countrywide reforestation so that deforestation could be mitigated. Without curbing deforestation, the issue of forest sustenance becomes null and void. Therefore, national tree-planting should be taken as a matter of urgency.

(d) Feeble Forest Action Plans- EPI (2012) asserts that the Zambia Forest Action Plan (ZFAP) was formulated and instituted in 1995 to provide a ministerial framework for the rational management and conservation of Zambia's forest resources. Unfortunately, the feebleness of these environmental action plans, frameworks and policies have led to perpetual deforestation. A roadmap towards action-based strategies of these policies should be drawn so that they become relevant in the quest to curb deforestation in Zambia.

2.8 Summary

This chapter discussed the literature review related to the study. The literature review started by defining EE, its history, goals and principles. It also defined and discussed deforestation. Deforestation is a big problem and EE is addressing this through various EE strategies, activities and programmes worldwide. Challenges that lead to

deforestation were tackled. The role of EE in addressing deforestation was also brought out and it included many environmental organizations which provide initiatives to roll back deforestation. Measures to mitigate deforestation were discussed and the literature pointed out the gaps that need to be addressed. The next chapter is the methodology that guided the study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Overview

Research methodology is the term used to describe the type of research one intends to carry out and the methods to be used. According to Kombo and Tromp (2013), research methodology can either be quantitative or qualitative pieces of work. They state that methodology describes the methods applied in carrying out the research study. The chapter discusses the research design, scope of the study, study population, sample size, sampling procedure, data collection instruments, data analysis methods and ethics that were considered when carrying out the research.

3.1 Research Design

This study was qualitative in nature. To capture the opinions of respondents, the researcher used a case study which Kombo and Tromp (2013) define as the study of a unit in detail, in context and holistically. Data were collected using semi-structured interviews, unstructured observation techniques and Focus Group Discussion schedules.

3.2 Target Population

The researcher collected data from two (2) villages out of eleven (11) in Kaumba where eighty (80) respondents out of an estimated population of six hundred seventy-five (675) were sampled. This population included forestry workers, farmers, teachers, agricultural workers and pupils.

3.3 Sampling Procedure

Gosh (2002) asserts that sampling is a process of selecting representative units of a population in order to obtain information regarding a phenomenon in such a way that it represents the entire population. A probability systematic random sampling was used to select respondents like farmers, teachers and pupils and every member of the population

had an equal chance of being selected. Kombo and Tromp (2013) state that purposive sampling under non-probability sampling can be carried out in addition to probability sampling. The use of purposive sampling was ideal in the selection of other important respondents like the agricultural extension officer and forestry worker because these had direct interactions with people who are involved in deforestation activities.

3.4 Sampling Design and Sample Size

The research applied systematic random and purposive sampling where homogeneous sampling was specifically chosen due to similarities in economic activities of the people of Kaumba. The sample size of this study was 80 which comprised 10 teachers, 18 pupils selected from grade 7, 8 and 9 classes, 1 Forestry Department worker, 1 Agricultural Extension worker, and 50 farmers.

3.5 Methods of Primary Data Collection

Data collection refers to the gathering of information to serve or prove some facts (Kombo and Tromp, 2013). Primary data were collected using the following methods; semi-structured interviews, unstructured observation techniques and Focus Group Discussion (FGD) schedules. The interviews and FGDs were ideal in the collection of rich data because the interviewer is free to probe where need be, and more functional questions may come in during the interview process. Observation helped the researcher to gather authentic data as obtained on the ground.

3.6 Methods of Secondary Data Collection

This is a method of data collection which involves putting together the data that someone else has already collected (Kombo and Tromp, 2013). It may involve the collection and analysis of published materials or information from internal sources. Information was collected from a diverse source of documents including electronically stored information. Secondary data may also be referred to as desk research. Secondary data were thus, collected from various books, dissertations, journals, newspapers, some

print and electronic media, environmental and forestry books from ZEMA library, Parliament library and University of Zambia library.

3.7 Data Analysis

Kombo and Tromp (2013) allude to the fact that data analysis is where research findings or results are clearly shown; areas or gaps for further research are pointed out. It can help the researcher to know the statistical methods used for analyzing data. Qualitative method was used for data analysis. After data were collected, they were analyzed thematically using research objectives where themes refer to topics or major subjects that came up in various discussions. In using this type of data analysis, major concepts or themes were identified.

3.8 Trustworthiness in the Study

Rolfe (2006) asserts that tests and measures used to establish validity and reliability cannot be applied to qualitative research. Merriam (1998) alludes to the fact that qualitative study provides the reader with a depiction in enough detail to show that the author's conclusion makes sense. To meet Merriam's expectations, the researcher ensured that enough details were brought out by respondents through probing during interviews and Focus Group Discussion schedules. The researcher, through the study questions saw to it that the verbatim descriptions pointed to the themes that were generated. Thus, through the verbatim descriptions, the themes would be made recognizable to a reader.

Guba and Lincoln (1985) assert that in qualitative research, researchers aim to design and incorporate methodological strategies to ensure 'trustworthiness' of the findings. To ensure trustworthiness in qualitative research, Sandelowski (1993) argues that the researcher must demonstrate clarity in terms of thought processes during data analysis and subsequent interpretation. To ensure clarity in this study, the researcher firstly ensured that the research questions were simple enough for respondents to understand and bring out data that corresponded to those questions. This enabled the researcher to

make clear and comprehensive data analyses which were responsive to the study objectives. This, subsequently, enhanced clear data interpretation which was thoughtfully interpreted according to the themes that emerged from the participants' responses. To ensure riguor in qualitative research, a researcher must include rich and thick verbatim descriptions of participants' accounts of findings (Slevin, 2002). Therefore, to ensure riguor and trustworthiness in the study, the researcher probed in order to get the data worth trusting. She (the researcher) also relied only on participants' responses without altering the responses to suit her expectations during data presentation and also thoughtfully analyzed the generated data.

3.9 Limitations

Data collection was not completed within the stipulated time frame mainly due to the fact that the sampled population was not available at the right time due to engagements in diverse in-and-out of season farming activities and other income-generating ventures. For example, the forestry officer in Monze was not readily available. The researcher had to miss him on a number of occasions because he rarely used his mobile phone which hindered the researcher from completing within the stipulated time frame. However, the researcher later met him and managed to collect the much needed data from him.

3.10 Delimitation

The study was limited to two out of eleven (11) villages of Kaumba area. The researcher was very familiar with the language of the area which made data collection easy. Rampant deforestation had continued in this area even after Environmental Education (EE) was introduced. This made it imperative that the role EE played in addressing deforestation be established. The following map shows the study area, Kaumba in Monze East:

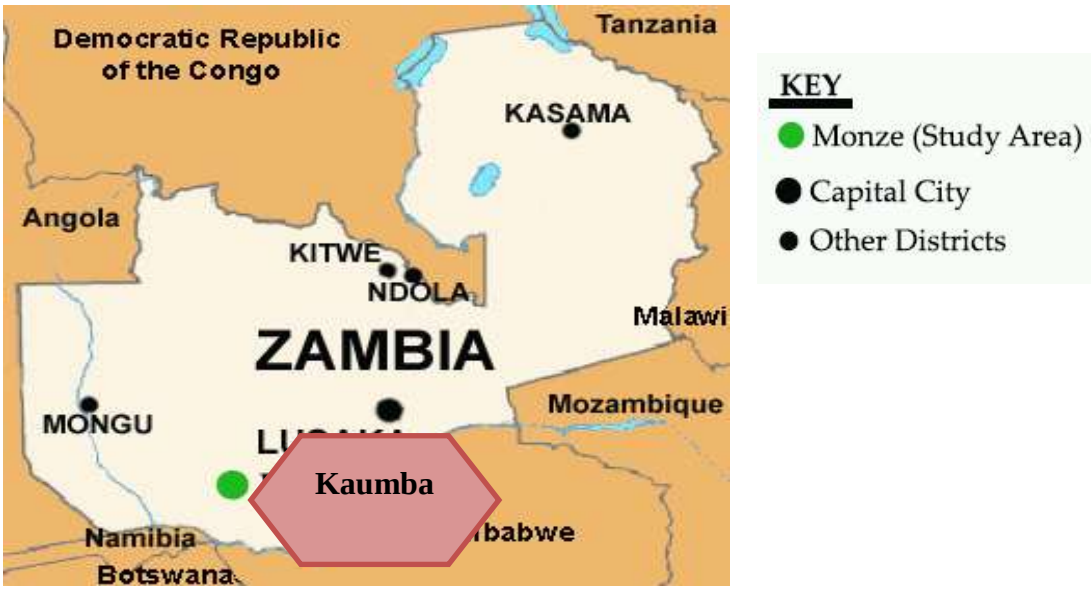

Figure 1: Map Showing Monze District (Study area)

Source: Courtesy of Basic Data of Zambia-Infoloso *www.infoloso.com*

3.11 Ethical Considerations

All the information pertaining to the respondents was treated with maximum confidentiality by ensuring that no one accessed their privacy. FGDs for teachers, farmers and pupils were completely isolated for free self-expression during the discussions. This actually helped the researcher to retrieve reliable data from these categories of respondents as they did not fear to bring out what exactly is obtaining on the ground.

This chapter discussed the introduction to research methodology, research design and target population, sampling procedure, sampling design and sample size, methods of primary data collection, methods of secondary data collection, data analysis and trustworthiness in the study, limitations, delimitation and ethical considerations. The next chapter discusses the presentation of findings.

CHAPTER FOUR

PRESENTATION OF RESEARCH FINDINGS

4.0 Overview

This chapter deals with presentation of findings. In this section, the researcher presented the findings obtained in the field using the objectives of the study. The following were the four objectives that guided the study:

(a) To state all EE activities that took place in Kaumba area of Monze east.

(b) To identify challenges that led to deforestation in the study area.

(c) To determine whether EE addressed the problem of deforestation in the area.

(d) To suggest alternative measures that could be employed to mitigate deforestation.

4.1 All Environmental Activities that Took Place in Kaumba

This is the first objective which sought to state all environmental activities that took place in Kaumba so as to confirm the visibility of EE in the area. The findings were presented according to the research questions of this first objective. These included: (1) What environmental activities took place in Kaumba? (2) What do you understand by the term 'Environmental Education? (3) What is your source of information on EE? Research findings revealed that the people of Kaumba were involved in many environmental activities since environmental educators like Development Aid Form People to People (DAPP), Soil Conservation and Agro-Forestry (SCAFE) and Forestry Department visited the study area.

4.1.1 All Environmental Activities in the Area

Farmers, teachers and pupils in Focus Group Discussions (FGDs) of eights (8s), tens (10s) and nines (9s) respectively, were asked to state all the environmental activities that took place in the study area, Kaumba. The following themes emerged through the responses from various respondents:

4.1.1.1 Conservation Farming

From all FGDs, farmers revealed some EE activities that took place in the study area. This is what they had to say:

> "*I was involved in conservation farming where organic manure-giving plants like acacia albida trees and others were planted in the fields*." (Farmer - 3)

> "*I planted jatropher around my home and fields to trap soil erosion*." (Farmer - 8)

> "*I was involved in planting sesbania sesban and cajanus cajana in my field for composite manure*." (Farmer - 8)

4.1.1.2 Building Non-Stinking Pit-latrines

Research findings revealed another important environmental activity which took place in Kaumba. Farmers, teachers and pupils all agreed that modern non-stinking pit-latrines were built in the study area. One farmer had this to say:

> "*Imebo ndakaiya lwiiyo lwakuyaka zimbuzi zitanunki. Aboobo toonse twakayaka zimbuzi eezyi zyitwakayiisyigwa kuyaka*." (I learnt about building non-stinking pit-latrines. Hence, we have all built these toilets). (Farmer - 6)

The following is a sensitization poster-message about cleanliness brought by environmental educators in Kaumba area of Chief Chona. It encouraged residents to build modern non-stinking pit-latrines in the entire chiefdom.

Figure 2: Sensitization Message towards the Building of Modern Non-stinking Pit-latrines

Source: Field Data, 2016

4.1.1.3 Woodlot Plantations and Conservation Agriculture Scaling-Up (CASU)

In different FGDs, farmers were asked to mention more EE activities that took place in the study area. The following were the responses:

> "*DAPP taught and demonstrated woodlot planting around my homestead where a lot of indigenous and exotic plant species were planted*." (Farmer - 1)

> "*I have taught Kaumba residents to plant vetiver grass across the fields to curb soil erosion and trap nutrient-laden matter for soil fertility.*" (Agriculture Extension Officer)

> "*I am currently involved in Conservation Agriculture Scaling-Up (CASU), where farmers get loans for various farming inputs. This helps them to improve their crop yields*." (Agriculture Camp Officer)

4.1.1.4 Funding for Environmental Education

Research findings showed that most of the farmers, teachers and pupils had similar responses towards funding for EE in the study area. The following were the responses:

> "*DAPP officers released about K67 000 to fund for the sinking of twelve boreholes for clean water*." (Farmer - 6)

> "*We built non-stinking pit-latrines through the money that DAPP gave each household*." (Pupil - 2)

> "*DAPP released funds for the expansion of nursery-tree raising projects here in Kaumba, Namakube, Sikabenga, Mujika, Tulonga, Nabukuyu, and Hachaanga*." (Teacher - 2)

4.1.1.5 Homestead Cleaning and Disease Control

Farmers revealed other EE activities that occurred in the study area and this is what they had to say:

> "*We were taught to cut long grass around our homes to avoid the breeding of mosquitoes*." (Farmer - 7)

> "*We were encouraged to clean our homes and every Friday DAPP officers inspected our homes and awarded the winners.*" (Farmer - 4)

> "*We received mosquito nets from DAPP officers especially pregnant women, the under-fives and the aged*." (Farmer - 6)

4.1.1.6 Making Heat-retaining Clay stoves and Grass Planting

Farmers, teachers and pupils brought out more EE activities that were taught in the area and the following were their responses:

> "*We were taught how to make clay-stoves which retained a lot of heat. These stoves use less firewood for cooking purposes*." (Farmer - 2)

> "*If the clay-stove making project that DAPP taught us was not abandoned, it would have saved many wild trees from exploitation for firewood*." (Teacher - 4)

> "*When DAPP officers came, they told us to plant 'kapinga' grass on the school lawns to keep the school environment green and attractive*." (Pupil - 3)

> "*DAPP officers said that grass planting is good because it helps to reduce soil erosion*." (Pupil - 2)

4.1.1.7 Farming Tillage and Erecting Waste-bins

An Agriculture Extension Officer and pupils brought out EE activities that took place in the study area in terms of litter control and farming tillage. The following were some of their responses:

> "*DAPP officers taught us how to erect waste bins for the school with green labels.*" (Pupil - 6)

> "*I have been involved in researches and workshops on tillage farming practices where organic manure is highly recommended*." (Agriculture Extension Officer)

From these findings, we can say that there is strong visibility of EE because a lot of different EE activities did take place in the study area.

4.1.2 Understanding of Environmental Education (EE) by Farmers, Teachers and Pupils

Farmers, teachers and pupils in their Focus Group Discussions (FGDs) of eights (8s), tens (10s) and nines (9s) respectively, were asked to state what they understood by the

term EE. They came up with different definitions of EE. The following were the themes that emerged from their responses.

4.1.2.1 EE is an Education about the Total Environment and Cleanliness

Farmers, teachers and pupils revealed what they understood by the term Environmental Education. From the knowledge they had, they brought out the following responses:

> "*EE is the education of the well-being of the total environment*." (Farmer - 3)
>
> "*EE is learning to clean our surroundings*." (Teacher - 3)
>
> "*EE is the education of things surrounding us*." (Farmer - 6)
>
> "*EE is learning about all forms of pollution*." (Pupil - 1)

4.1.2.2 EE is an Education about Greening the Environment and Erecting Waste Bins

Upon asking some farmers and pupils how they understood EE, they pointed out that:

> "*It is about keeping the environment clean and green*." (Farmer - 7)
>
> "*EE is learning about planting grass on school lawns*." (Pupil- 9)
>
> "*EE teaches about erecting waste bins to promote litter-control*." (Pupil - 7)

4.1.2.3 EE is about Cleanliness, Attitudes and Environmental Protection

Teachers and pupils were asked to mention what they understood by the term Environmental Education. The following were the responses:

> "*EE means educating people about cleanliness and people's understanding and attitudes towards the environment.*" (Teacher - 4)
>
> "*EE is learning about keeping the environment clean*." (Pupil- 2)

4.1.2.4 EE teaches about Global Warming, Climate Change and Drying-up of Rivers

In their different FGDs, teachers and pupils were asked to state what they understood by the term Environmental Education. Their responses were as follows:

> "*EE teaches about climate change, global warming, earthquakes, floods, deforestation, erosion, droughts and other natural disasters*." (Teacher - 8)
>
> "*EE is learning about drying up of rivers*." (Pupil - 5)

4.1.2.5 EE is Learning about Tree-planting and Behavioural Change

In an interview, a Forestry Officer was also asked to state what he understood by the term 'Environmental Education'. This is what he had to say:

> "*Environmental Education has to do with changing people's behaviour towards a better environment. It also has to do with learning about planting trees in the environment*." (Forestry Officer)

From the responses, we can say that farmers, teachers, Forestry Officer and pupils understood EE in different ways but almost all their responses were in line with the meaning of EE.

4.1.3 Farmers, Teachers and Pupils' Sources of Information on Environmental Education

From FGDs of eights (8s), tens (10s) and nines (9s) respectively, farmers, teachers and pupils were inquired to mention all their sources of information on Environmental

Education. They had almost similar responses as regards their sources of information on EE. The following themes emerged from the responses:

4.1.3.1 From Teachers, Fliers, Radio, Television, Books, Friends and Magazines

Farmers, Teachers and Pupils revealed their sources of information on EE as follows:

> "*I learnt about EE from my teachers in class*." (Pupil - 4)

> "*I read about EE from some fliers and books*." (Farmer - 7)

> "*I came to know about EE from my children who talk about conservation clubs they are involved in*." (Farmer - 2)

> "*I learnt about EE from magazines, radio, books, friends, newspapers, and TV programmes*." (Teacher - 1)

4.1.3.2 From DAPP Environmentalists and Forestry Officers

From the research findings, farmers, teachers and pupils were quick to point out their sources of information on EE as indicated in the following responses:

> "*I learnt about EE from DAPP officers who taught and demonstrated tree-planting around our school*." (Pupil - 3)

> "*The Denmark group (DAPP) has taught us a lot of activities which help to care for the environment like planting woodlots around our homesteads for various purposes.*" (Farmer - 5)

> "*I attended two seminars on environmental care and protection which was conducted by Forestry Officers. So far, there are active conservation groups in the area*." (Teacher - 6)

4.1.3.3 From Soil Conservation and Agro-Forestry (SCAFE) under Agriculture

From various FGDs, farmers explained their sources of information on EE as indicated in the following responses:

> "*Our Agriculture Extension Officers taught us conservation farming practices like planting acacia albida, sesbania sesban and cajanus cajana in the fields which add nutrients to the soil*." (Farmer - 3)

> "*I learnt about farming tillage from our Agriculture Extension Officers who taught us about good land use in terms of using organic manure*." (Farmer - 7)

From the above responses, it is clear that EE was brought to the area by DAPP, SCAFE, books, radios, televisions, fliers, newspapers and the Forestry Department.

4.2 Challenges that Led to Deforestation in the Study Area

This is the second objective which sought to identify the challenges that led to deforestation in Kaumba. The three research questions under this objective were: (1) What challenges lead to deforestation even after EE practical lessons in this area? (2) What is your source of income? (3) What problems do you think deforestation has brought to this area?

4.2.1 Deforestation Challenges as Perceived by Farmers, Agriculture Extension Officer, Forestry Officer, Teachers and Pupils

In separate (FGDs) of eight (8) farmers, ten (10) teachers and nine (9) pupils, findings revealed many challenges that made the residents of Kaumba to continue exploiting indigenous trees even after environmental educators taught them about the dangers of deforestation. The Agriculture Extension Officer and Forestry Officer in separate interviews also gave their responses. The following themes were brought out as major contributors to deforestation.

4.2.1.1 High Poverty Levels

Research findings showed that poverty was the most prominent challenge that led to deforestation and farmers had this to say:

> "*Poverty is on an increase here in Kaumba area which has made me turn to charcoal burning*." (Farmer - 5)

> "*I supply logs of wood for charcoal burning to Kaumba south due to poverty. Aaaaaah! We are really suffering my daughter* (referring to the researcher)." (Farmer - 2)

> "*I cannot afford to buy barbed and wire mesh to fence and protect young plants from damage by domestic animals like cows, goats and chickens due to poverty*." (Farmer - 3)

4.2.1.2 Poor Rainfall Patterns and Early Drying-up of Rivers

In their different FGDs, farmers were inquired to identify challenges that led to continued deforestation in the study area. The following were some of their responses:

> "*I have been a gardener all along, but rivers dry up fast due to poor rainfall patterns. So I have just started burning charcoal for selling.*" (Farmer - 5)

> "*Poor grazing pastures due to poor rainfall patterns have resulted in animal diseases and deaths. So we have no choice but to start burning charcoal for survival*." (Farmer - 5)

4.2.1.3 High population rates and High Demand for Settling and Farming Space

Some teachers and farmers were inquired as to why deforestation had continued in the area despite the fact that lessons from environmental educators were delivered in1992 and 2008. In response, they pointed out that:

> "*There are high population rates leading to high demand for settling and farming space which has led to clearing of vast portions of land.*" (Teacher - 2)

> "*We have become too many my daughter* (referring to the researcher). *As you can see, all these male children I have need land for farming and settlement when they grow up.*" (Farmer - 6)

4.2.1.4 High Demand for Wood Products

In their various FGDs farmers, teachers and pupils were asked why deforestation had continued in the area after all the lessons from Environmental Educators on tree-planting, care and protection for trees. Almost all of them had similar answers. One farmer had this to say:

> "*Deforestation has continued because we use wood in making hoes, picks, spades, sledges, scotch-carts, yokes and peg-stays, kraals, fencing gardens and constructing grain barns.*" (Farmer - 3)

4.2.1.5 Lack of Attitude Change and Negligence

In an interview and FGDs respectively, a forestry officer and pupils were asked if there were any challenges that led to deforestation in the area and the following were the responses:

> "*People have continued cutting down trees recklessly because they feel that trees belong to everyone. Ah! Some people are just arrogant madam* (referring to the researcher)." (Pupil- 3)

> "*It is not easy to change a person's attitude when it comes to the issue of deforestation. Madam* (referring to the researcher), *we need more forest sensitization programmes here.*" (Agriculture Extension Officer)

4.2.1.6 Corruption, Loss of Soil Fertility and Hostility

In an interview, a forestry officer revealed challenges that were faced by the residents of the study area and this is what he had to say:

> "*Soils are no longer fertile here due to constant use of inorganic fertilizers. This has led to increased deforestation for survival. Some people are too hostile when it comes to deforestation*." (Forestry Officer)

4.2.1.7 High Demand for Firewood and Charcoal Burning

Firewood and charcoal use was one other big challenge that people could not easily do away with in the study area because all the homes are not electrified apart from teachers' houses. (See Appendix V for scenes of indigenous tree exploitation for firewood in the study area). The following were some of their responses:

> "*Apart from teachers' compound at Kaumba Basic School where there is electricity, we all use firewood and charcoal for cooking. This becomes hard to maintain indigenous trees because we have no other alternatives for cooking purposes*." (Farmer - 8)

> "*I have resorted to charcoal burning because I realize good money from it even far more than gardening*." (Farmer - 2)

4.2.2 Sources of Income for Kaumba Residents

The researcher was also privileged to inquire the sources of income for Kaumba residents after discovering all those challenges that were brought out. Residents had limited sources of income. The following themes emerged from the responses:

4.2.2.1 From Livestock Farming and Maize Selling

Farmers in their different FGDs were asked to mention their sources of income and some farmers had this to say:

> "*I earn a living through rearing and selling livestock. These include chickens, guinea-fowls, turkeys, cattle and goats*." (Farmer - 2)

> "*I just sell few bags of maize to my friends in need rather than waiting for the government which pays us very late*." (Farmer - 1)

4.2.2.2 From Mat and Grass Selling

Research findings revealed that there were some industrious women who discovered different sources of income from the common ones. This is what they had to say:

> "*I make mats from sisal and plant fibers and sell them for income*." (Farmer - 6)

> "*I have no business to bring me income; all I do is cut grass and sell it to whoever needs it. I do not even know when and how this poverty will come to an end*." (Widowed Female Farmer)

4.2.2.3 From Wood Carving, Charcoal Burning and Fruit Sales

Majority of the farmers in their FGDs were privileged to reveal their main source of income and this is what they had to say:

> "*I carve and sell peg-stays, yokes, sledges, pestles and mortars so I can have money to send my children to school*." (Farmer - 7)

> "*I face a lot of challenges in terms of income but I started supplying logs of wood for the new profitable business of charcoal burning*." (Farmer - 2)

> "*I sell mangoes at the junction in rainy seasons and then buy some necessities for my children*." (Farmer - 5)

As seen from the preceding verbatims, the people of Kaumba had limited sources of income which made them turn to forests to answer their daily financial needs. This led to perpetual deforestation in the study area.

4.2.3 Farmers, AEO, Teachers, Forestry Officer and Pupils' Perceptions of Deforestation Problems

The researcher inquired if there were any problems that were brought by deforestation in the study area. The respondents in their different FGDs and interviews brought out the following themes through their responses:

4.2.3.1 Ozone Layer Depletion and Global Warming

The Forestry Officer in an interview mentioned some problems brought about by deforestation. The following was his response:

> "*Madam* (referring to the researcher), *serious changes are going on in the atmosphere and these changes have led to the damage of the ozone layer resulting in global warming. It is not just natural; we have caused it ourselves through merciless cutting down of indigenous forests*." (Forestry Officer)

4.2.3.2 Flash Floods, Droughts and Climate Change

In an interview and FGDs respectively, an Agriculture Extension Officer and some pupils revealed the problems that were brought by deforestation and these were their responses:

> "*Deforestation comes with so many problems such as climate change, droughts and flash floods. There is need for the government to launch an extensive tree-planting project in the area before we face serious hunger situations*." (Agriculture Extension Officer)

> "*Kapinga grass dry up fast because rainfall is only there for a short time and watering using buckets is a big problem for us*." (Pupil - 6)

4.2.3.3 Poor Rainfall Patterns and Soil Erosion

In their FGDs, teachers and pupils also revealed the problems that deforestation brings. This is what they had to say:

> "*We are experiencing poor rainfall in Kaumba because people are cutting down trees without realizing the serious consequences that go with deforestation*." (Teacher - 4)

> "*Deforestation leads to soil erosion because trees which trap wind and fast running water are cleared*." (Pupil - 7)

> "*The people of Kaumba were taught that deforestation leads to loss of soil fertility due to soil erosion, but they have continued cutting down trees without planting any for future use*." (Teacher - 3)

4.2.3.4 Poverty and Fluctuating Rainfall Patterns

An Agriculture Extension Officer (AEO) and farmers revealed problems that were brought by deforestation in Kaumba and were quick to point out that:

> "*Deforestation has led to many problems such as poverty due to little rains meant to support farming, so we cannot sell our farm produce but just eat the little we produce*." (Farmer - 2)

> "*There are serious fluctuating rainfall patterns in this area due to high deforestation rates*." (Agriculture Extension Officer)

4.2.3.5 Loss of Environmental Beauty and Natural Diversity

In their respective FGDs, farmers and pupils brought out the following responses as regards problems that were brought by deforestation in the study area:

> "*Plants beautify the environment, but deforestation has led to loss of diversity in natural beauty from plants*." (Pupil - 4)

> "*Many wild animals and bird species have disappeared due to loss of indigenous trees. We no longer enjoy the juicy wild fruits we used to eat*." (Farmer - 2)

Research findings revealed that there were many problems which were brought by deforestation as revealed by farmers, teachers, Agriculture Extension Officer, Forestry officer and pupils.

4.3 How EE addressed Deforestation in Kaumba

This objective sought for answers on how EE addressed deforestation in the study area. The objective had two questions and these were; (1) How did EE address the problem of deforestation in this area? (2) Have you continued planting trees in this area?

4.3.1 EE and Deforestation as Perceived by Farmers, AEO, Teachers and Pupils

Farmers, teachers and pupils in different FGDs of eights (8s), tens (10s) and nines (9s) respectively revealed how EE addressed deforestation in Kaumba. The following themes showed how EE addressed deforestation.

4.3.1.1 Teaching about Nursery Tree-raising in Polly Pots

The study revealed that people were taught how to raise nursery trees in polly-pots by DAPP officers. This was done to curb deforestation rates that were on an increase. One farmer had this to say:

> "*DAPP came and taught us how to raise nursery-trees using Polly-pots and plant them*." (Farmer - 3)

4.3.1.2 Planting Woodlots

Farmers, AEO, teachers and pupils revealed that DAPP environmentalists taught and demonstrated how to plant woodlots around the homesteads. The following were some of the responses:

> "*We were taught and planted woodlots around our homesteads so that they provide all our forest needs instead of exploiting indigenous forests*." (Farmer - 3)

> "*I was taught to plant trees in the woodlots where I get all types of medicines from plants like moringa, holy-thistle, neem-tree and others*." (Pupil - 8)

> "*Residents here no longer cut forest trees because woodlots provide long straight building poles.*" (Teacher - 2)

> "*We were taught that it is important to plant huge grooves of trees not just woodlots as it has been*." (AEO)

One farmer and widow to a late forestry officer who planted more than thirty (30) species of plants (both indigenous and exotic) narrated how her woodlot beautified her homestead and saved her home from a natural disaster that occurred in the area. The following was her narration:

> "*DAPP officers have really helped me beautify my homestead through planting all these different types of trees you are seeing* (pointing at her woodlot). *This same woodlot saved my homestead from destruction when a natural disaster, a black noisy smoke-like wind mightily erupted out of Munyumbwe Dam which is about 7km east of my home. It moved astonishingly and destroyed a lot of homes in the area in 2011.We thought it was the coming of the Lord. Zambia National Broadcasting Corporation (ZNBC) crew from Lusaka came and got pictures of destroyed houses and promised to come back and tell us what it was but up to now, they have not yet showed up*." (Farmer - 3)

The following figure shows a woodlot that was planted around a homestead by Farmer 3 in 1992. It was the same woodlot that saved her homestead from destruction as shown in the preceding narration.

Figure 3: Woodlot Plantation (indigenous and exotic) around a Homestead

Source: Field Data, 2016

The names of some of the indigenous and exotic plant species that were brought by DAPP are shown in the following Table:

Table 1: Indigenous and Exotic Plant Species that were Planted in Kaumba Woodlots

Local Name	Scientific Name	Purpose
Nchenje (apricots)	Mimusops Zeyheri	Nutrition
Mupulanga uutuba	Cassia Siamea	Building poles and windbreak
Kapulanga	Moringa	Food and medicinal purposes
Pawpaws	Papaya	Nutrition
Guavas	-	Nutrition
Mubombo	Brachystegia Boehmii	Shade, woodfuel and fibre
Mupondo	Bauhinia Petersiana	Woodfuel and shade
Musangu	Acacia Albida	Soil fertility
Masaansa	Boscia Angustifolia	Nutrition
Yemane	Gmelina Arborea	Firewood and windbreak
Masumpo	Bamboos	Building purposes
Flamboyant	-	Medicinal purposes and shade
Masau	-	Nutrition
Fan palm (Kahuma)	Borassus aethiopum	Nutrition and aesthetics
Sweet lemons	-	Nutrition
-	Jatropher	Traps soil erosion and for oil
Mukamba	Pterocarpus Antunesii	Relish, firewood and building
Cashew nuts	-	Nutrition
Yellow hedge	-	Buffer zone and medicine
-	Leucaena	Aesthetics, shade and medicine
Neem-tree	Cassia spectabilis	Shade and medicinal purposes
-	Sesbania sesban	Soil fertility
-	Cajanus Cajana	Soil fertility
Mupapa	Afzelia Quanzensis	Hunting charm and vegetable
-	Holy thistle	Medicine (blood purifier)
Masuku	-	Nutrition
Musikili	Trichilia Emetica	Boat-building, medicine, etc
Cassava	-	Food and nutrition
Mupani	Colophospermum Mopane	Carving andmedicinal purposes
Mulberry	-	Nutrition
Jacaranda	Mimosifolia	Shade

Source: Field Data, 2016

4.3.1.3 Holding Workshops on Forest Conservation

From the findings, farmers and teachers revealed how EE addressed deforestation through some workshops that were held by DAPP in the study area. The following were the responses:

> "*DAPP officers held workshops in Monze east where we were taught about forest conservation*." (Teacher - 4)

> "*I was involved in a workshop where I learnt how to protect trees from extinction by only cutting certain branches of trees for firewood and not the whole tree*." (Farmer - 8)

> "*Now that I came to know what EE is through some workshops held by DAPP, I will teach it seriously and will also start the 'Keep Clean and Green' club in the school*." (Teacher - 6)

4.3.1.4 Greening School and Home Environments

In different FGDs, farmers and pupils were asked to mention how EE addressed deforestation in the study area and this is what they had to say:

> "*The Department of Agriculture and DAPP officers have taught us to 'green' our school by planting indigenous 'kapinga' grass so as to beautify our school environment*." (Pupil - 4)

> "*DAPP officers taught us and have even demonstrated tree-planting around our school which act as windbreaks*." (Pupil - 2)

> "*We were taught to plant gmelina and cassia siamea and jatropher trees about 20m away from our homesteads to save our houses from gmelina's destructive meandering roots*." (Farmer - 6)

> "*Gmelina serves as firewood source. My mum has stopped cutting wild trees for firewood because gmelina provides firewood*." (Pupil - 5)

The following figure shows *gmelina arborea* and *cassia siamea* plants around a homestead about 20m away from the houses as instructed by DAPP officers.

Figure 3. *Gmelina Arborea* and *Cassia Siamea* around a Homestead in Kaumba

Source: Field Data, 2016

4.3.1.5 Bee-keeping

When asked how EE addressed deforestation in Kaumba, a Forestry Officer revealed that people were taught how to keep bees for honey as indicated in the following response:

> "*DAPP taught Kaumba residents about bee-keeping and how it can help to preserve forests for pollen and nectar. This would help curb deforestation*." (Forestry Officer)

4.3.1.6 Fish-Farming

In an FGD, a teacher revealed how fish-farming would help curb deforestation in the study area and this is what he had to say:

> "*DAPP officers taught us fish-rearing as a means of earning a living and divert people's attention from exploiting indigenous forests for income. This is because food items bring in quick money than non-food items*." (Teacher - 4)

4.3.1.7 Forest Conservation Rules

Farmers and teachers revealed that they were forbidden from cutting indigenous trees without permission and whoever was found breaking this law was punishable. The following were some of their responses:

> "*We are not allowed to cut trees without permission from our forest vigilantes or else we face punishment*." (Farmer - 4)

> "*We are told to plant a new tree each time we cut one*." (Teacher - 6)

> "*We were told to plant other people's woodlots if we cut indigenous trees without permission*." (Farmer - 8)

Findings showed that EE played an important role in addressing deforestation through a number of environmental activities that addressed the problem of deforestation in the area. These environmental activities were spearheaded by DAPP, SCAFE and the Forestry Department.

4.3.2 Current Tree-planting Activities in the Study area as Perceived by Farmers, Teachers and Pupils

It was cardinal to ask the residents if tree-planting had continued so as to establish the real cause of tree scarcity in the area. Farmers, teachers, an Agriculture Extension Officer, a Forestry Officer and pupils were inquired whether tree-planting had continued in the study area. The following were some of the responses:

> "*We have stopped planting woodlots because it is difficult to prepare nursery-plants*." (Farmer -3)

> "*Only less than twenty families have planted sound woodlots due to lack of change of attitude towards tree-planting. No one has continued planting trees.*" (Forestry Officer)

From these verbatims, it is clear that people in the study area abandoned tree-planting in the woodlots, no wonder they have continued exploiting indigenous forests.

4.4 Alternative Measures to Mitigate Deforestation

Farmers, teachers and pupils in FGDs of eights (8s), tens (10s) and nines (9s) respectively, were asked to suggest alternative measures to mitigate deforestation and the following themes emerged from the responses:

4.4.1 Empowering Residents

Farmers and teachers had similar suggestions on how empowering local people could help mitigate deforestation. The following were some of their responses:

> "*Empowering residents with small loans for small businesses may help divert their attention from charcoal burning.*" (Teacher - 7)

> "*Funding women's club-projects like goat-rearing and other fund-raising projects may help minimize deforestation because people will be more committed to fund-raising projects that exploiting wild trees for survival.*" (Farmer - 1)

4.4.2 Reforesting and Electrifying the Entire Study Area

Farmers, a forestry worker, teachers and pupils had similar responses on reforestation as an alternative measure to deforestation. This is what they had to say:

> "*We need electricity so that we can start using electric stoves instead of firewood.*" (Farmer - 3)

> "*Deforestation can be minimized if the whole area is reforested.*" (Teacher - 5)

> "*It is better to plant trees in the whole area not only woodlots as it has been*." (Farmer - 6)

> "*We need electricity in our homes so we can study properly*." (Pupil - 2)

4.4.3 Punishment through Paying Fines in Monetary Form and Planting Trees

A Forestry Officer and a farmer suggested some measures that could help curb deforestation trends in the study area and the following were their responses:

> "*Those who cut down trees without permission should be made to pay fines in monetary form*." (Farmer - 4)

> "*Whoever cuts a tree must plant one or two trees to replace the lost one*." (Forestry Officer)

4.4.4 World Environment Day Observation and Enriching the Soil

Farmers, the forestry worker, pupils and teachers had similar responses on world environment day observation and enriching the soil so as to mitigate deforestation. The following were some of the responses:

> "*I planted a lot of sesbania sesban and acacia albida trees in my fields to enrich the soil for good crop yields. Good crop yields will help me in income-generation and stop exploiting wild trees for income*." (Farmer - 3)

> "*DAPP encouraged us to plant trees on the 5th of June every year with our teachers*." (Pupil - 3)

> "*DAPP encouraged us to observe 5th June as a day for reflecting on environmental care and protection*." (Farmer - 1)

4.4.5 Bee-keeping, Attitude Change and Arresting Offenders

Some farmers, teachers and pupils in different FGDs were asked to suggest some measures that could help curb deforestation and this is what they had to say:

> "*People who cut trees without permission should be arrested and taken to the chief's palace for detention and questioning*." (Pupil - 2)
>
> "*Bee-keeping should be emphasized so that people can plant trees which are important for pollen and nectar*." (Teacher - 4)
>
> "*If peoples' attitudes towards deforestation changes, it can help to save indigenous trees from extinction*." (Farmer - 8)

4.4.6 Teaching Environmental Education as a Separate Subject

The Agriculture Extension Officer, Forestry Officer, farmers, teachers and pupils all suggested one important measure that could help bring deforestation to an end. Responses were given as follows:

> "*EE must be taught as a single subject so that we can fully understand it and help out in forest conservation and preservation*." (Pupil - 6)
>
> "*Pupils in schools are supposed to be taught EE but we do not see this subject in their books. This can help them to understand it well and fully help in forest conservation*." (Farmer - 7)
>
> "*As a teacher, I suggest we teach EE as a single subject without integrating it in other subjects because it confuses both teachers and pupils*." (Teacher - 6)

This chapter dealt with 'Presentation of Research Findings' as obtained in the field. The next chapter presents the 'Discussion of Research Findings'.

CHAPTER FIVE

DISCUSSION OF RESEARCH FINDINGS

5.0 Overview

This chapter discusses the research findings which were presented in Chapter Four on the role of EE in addressing deforestation in Kaumba area of Monze east, Southern Zambia. The chapter discusses the themes that emerged from the Presentation of Findings chapter, Chapter 4. The findings are discussed according to the following four objectives of the study:

(a) To state all EE activities that took place in Kaumba area of Monze east
(b) To identify challenges that led to deforestation in the area
(c) To determine whether EE addressed the problem of deforestation in the area.
(d) To suggest measures that could be employed to mitigate deforestation

5.1 Determining EE Activities in Kaumba area of Monze East

It was imperative to ask residents about all the environmental activities that took place in Kaumba so as to confirm the visibility of EE in the area. Although many EE activities were witnessed in the area, farmers did not really understand their importance because majority of the residents had already abandoned almost everything they were taught at the time of this research.

Conservation farming was among some EE activities that took place in the area. It was important to teach farmers about conservation farming which enriches the soil and improve crop yields. Conservation farming proved to be helpful only to those who accepted to plant *sesbania sesban, cajanus cajana* and *acacia albida* in their fields. *Acacia albida* fruits are favorite food for cattle so as they ate, they left their droppings and the soil was made rich for crops to grow well. Butler (2007) agrees that making the soil rich is an important measure for curbing deforestation in cyclic agriculture where

cattle are grazed on farm land that is resting and rejuvenating. Cyclic agriculture increases the fertility of the soil through cattle droppings.

EE also advocates for cleaning the environment through building modern non-stinking pit-latrines worldwide. Modern non-stinking pit-latrines were also built in the study area to improve environmental sanitation. Figure 2 of Section 4.1.1.2 shows a poster on sensitization message towards the building of modern non-stinking pit-latrines in Chief Chona's area.

Nursery-tree raising and woodlot plantations are very crucial in improving forest cover the world over. Kaumba residents also made a lot of nursery-trees in form of food for work and woodlots were planted in the homesteads. This helps to instill a sense of attachment to trees. A research by NSW Department of Education and Training (2001) argues that New South Wales' approach to Environmental Education seeks not only to provide students with a sense of attachment to the environment, but also to foster a sense of care for the environment through tree-planting. It was somehow discouraging to find that woodlots were only planted by a few dedicated individuals while others did not see it as profitable. This is because woodlot plantations take long to mature hence, did not bring benefits right there and then. *Vetiver* grass planting was done across the fields to reduce soil erosion and trap nutrient-laden matter so that organic nutrients can be retained in the field without being washed away. An Agriculture Camp Officer was involved in an environmental programme called Conservation Agriculture Scaling-Up (CASU). This is a loan-giving programme which aims higher in terms of assisting farmers through purchase of farming equipment such as ploughs, tractors, scotch-carts and many other farming implements. Farmers then returned the money in bits till the whole loan is paid back. This helped farmers to stop cutting down trees for sledges thus, saving trees from depletion.

5.1.1 Funding for EE Projects

Funding for EE projects was among the many environmental activities that took place in Kaumba. Funding for environmental projects is consistent with New Zealand MoE

(1998), Australian DEH (2005) and UNFCCC, (2009). These are environmental bodies that funded for Environmental Education activities in their respective countries.

EE activities like cleaning of homes and disease control took place in Kaumba. Residents were taught to maintain cleanliness in and around their homesteads. This was important because cleanliness in terms of cutting grass around homesteads helps to combat diseases like malaria although it was not completely eradicated. DAPP also gave out mosquito nets to farmers especially to the aged, under-fives and pregnant women because these were more vulnerable to diseases than others. Farmers further added that home-cleanliness was taught and homes were inspected every Friday. The 'Cleanest Home of the Month' was awarded with nursery-plants which were planted in woodlots.

Farmers made clay-stoves which retained a lot of heat so that they used less firewood for cooking purposes. This would have saved a lot of trees from firewood exploitation in Kaumba if it was not abandoned by residents. Indigenous kapinga grass was planted in the school lawns to maintain the green colour. Greening school lawns through *kapinga* grass and tree-planting is line with other researchers like Jutvik & Liepine (2008) and Le Roux (2001) who assert that EE is an essential tool in environmental greening programmes in schools. Grass also helps to reduce soil erosion as topsoil cannot easily be swept away by fast running water or blown away by wind.

Farming tillage is very useful in enriching the soil because it teaches how organic manure can be made and used to make the soil fertile. Farming tillage was among some EE activities that occurred in Kaumba where farmers learnt about good land use. Farmers were taught and encouraged to use farmyard manure as well as composite in order to rejuvenate the deteriorating soil in the area. DAPP officers in 2008 encouraged pupils to erect waste-bins. This helped the pupils to pick litter and dispose of it in order to keep the environment clean all the time.

These research findings showed that Kaumba residents were involved in many EE activities which signified the visibility of Environmental Education in the area.

5.1.2 Understanding of Environmental Education by Farmers, Teachers and Pupils

Findings revealed that farmers, teachers and pupils understood EE as an education about the total environment and its cleanliness. They added that it was learning how to clean their surroundings, the well-being of the environment, pollution control and the education of things in the surrounding. Findings brought out the values and attachment that exists between the residents and the total environment. This helped residents to understand and appreciate the relationship that exists between them and their surroundings. This is a very important definition of EE because it encourages human beings to develop right values and attitudes towards issues of the environment.

Some farmers and pupils stated that EE was about keeping the environment clean, educating people about cleanliness and environmental care and protection. Environmental care and protection conforms to a previous research by NSW Department of Education and Training, (2001). The research advocates for an EE policy for schools which fosters a sense of environmental care and protection.EE involves learning about tree-planting and how trees help to reduce soil erosion. Tree-planting is actually one of the objectives EE advocates for. Some teachers attached EE to behaviour change and greening the environment while pupils said EE was learning about planting grass on school lawns. There was much association of EE to global warming, earthquakes, floods, deforestation, tornadoes, hurricanes, soil erosion, droughts and other natural disasters. Pupils also said it was an education about the drying up of rivers.

Other respondents defined EE as the education of things surrounding them and people's attitudes towards the environment. This definition agrees with one of the objectives of EE which deals with attitude and acquiring a set of values and feelings for the environment (UNESCO, 1998). People need to develop right attitudes towards the environment and protect it from degradation and this can be achieved by identifying serious issues of the environment and finding better solutions for them. If this is not achieved, then environmental degradation will be the result.

The responses from the respondents indicate that they had an idea of the meaning of EE because all the answers that were given had an attachment to EE.

5.1.3 Farmers, Teachers and Pupils' Sources of Information on EE

From the FGDs, farmers, teachers and pupils gave out almost similar responses as regards sources of information on EE. Findings revealed that people learnt about Environmental Education mainly through the Development Aid from People to People (DAPP). This is a combined team of Environmental Educators who came from Norway, Sweden and Denmark. They visited the study area in 1992 and 2008 and delivered a diversity of environmental activities. Other environmental educators that taught the people of Kaumba about EE include Soil Conservation and Agro-Forestry (SCAFE) under the Ministry of Agriculture as well as Forestry Department. Teachers were enlightened that EE was a subject that deals with cross-cutting issues of the environment such as climate change and global warming; highlighting the negative impacts they had on the environment. Many teachers appreciated this because that far, they were not aware of how to handle the EE component which was integrated in many subjects. This was contrary to Jekanyifa and Yusuf's (2005) study which discovered that there was heightened awareness of the incorporation of EE in the primary school curriculum in Nigeria. However, the same finding was similar to Lindhe (1999) who also found that primary and secondary school teachers in Tanzania were not aware of EE topics in diverse subjects.

The presence of EE in Kaumba saw the formation of environmental conservation clubs in the area as well as in schools such as 'Think Green', 'Keep Clean and Green' and re-starting the Chongololo Club. Other respondents learnt about EE from teachers, friends, books, magazines, newspapers, Environmental Conservation Clubs, fliers, radio and television programmes. This shows that the people in the study area had an idea of EE because they were taught and fully participated in the environmental activities that took place.

5.2 Challenges that Led to Deforestation in the Study Area

This is the second objective which sought to establish challenges that led to deforestation in Kaumba. It is here that the themes which were generated from the research findings of this objective were discussed.

5.2.1 Challenges that Led to Deforestation as Perceived by Farmers, Teachers and Pupils

Findings revealed that several challenges made farmers to continue exploiting indigenous trees even after environmental educators taught them about the dangers of deforestation. Challenges under this objective are those things that force people to cut down trees for survival. High poverty levels were cited as the main challenges that led to perpetual deforestation in the area by farmers. This conforms to Kauppi et al, (2006) who argued that poor people are more likely to clear forests because they have no other alternatives. This is true and has been noted even in Zambia that where poverty is high, trees tend to disappear at alarming rates as people use forest products to make ends meet. More challenges on poverty included lack of money to buy fencing wire to protect young trees from being trampled upon by domestic animals in Kaumba. Those were small nursery-trees planted in homestead woodlots which could not survive due to damage by cows, goats and other domestic animals. One respondent who could not afford to buy barbed or wire mesh in order to protect his young plants from damage used wooden fencing poles from indigenous forests to save his young trees. This led to more deforestation in the study area as it were.

Poor rainfall patterns resulted into poor grazing pastures for domestic animals leading to diseases which killed a lot of domestic animals every year. Since people in the study area depend on animals for farming and income generation, hunger trends were recorded which left people with no choice but start burning charcoal for survival. Early drying-up of rivers was one of the challenges where rivers dried up as early as July due to poor rainfall patterns. This made it hard for farmers to engage in gardening activities which had sustained them for many years hence, turned to charcoal burning in order to make

ends meet. People in the study area shunned woodlot planting projects which provide firewood to households and save indigenous forest trees from destruction (Appendix V shows exploitation of indigenous trees for firewood in the study area). Despite DAPP, SCAFE and the Forestry Department, carrying out woodlot plantation activities, these activities were too minimal compared to the extent of deforestation in Kaumba.

High population rates was among the challenges and is consistent with one study in New York which discovered that population increase was a primary driver of tropical deforestation (The New York Times, April 20, 2009). More studies by Arild and Kaimowitz (1999) and Nielsen (2006) confirm that population growth and overpopulation were among the worst causes of deforestation. High population rates as contributors to deforestation also conform to the theory which supports this study, the Forest Transition theory by Rudel (2005). The theory states that when settlements begin to occur, deforestation rates increase and there is reduction in forest cover. Such developments result in escalating rates of deforestation especially in developing countries like Zambia. Thus, overpopulation was cited as one of the major contributing factors to the degradation of the forest ecosystem in the study area.

Great need for agriculture (farming) space was another cause of deforestation in the study area. This is backed by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, which states that the overwhelming direct cause of deforestation is agriculture where subsistence farming is responsible for 48% of deforestation while commercial agriculture is responsible for 32% of deforestation. In the study area, each farmer owns several big fields which are cleared in a way that no stump or root would be left as this would inconvenience free movements of ox-drawn ploughs. This perpetuated deforestation in the study area.

From the researcher's observation, it was noted that a lot of retirees from Ministry of General Education, Agriculture, Health and Forestry chose to settle in Kaumba rather than going back to their homelands after retirement. This too contributed to population increase in Kaumba leading to clearing of vast portions of land resulting in high

deforestation rates. More people use more forest products like firewood, charcoal, building poles and many other areas that need wood.

Some pupils confirmed that there was high demand for wood used in making hoes, picks, kraals, grain-barns, sledges, peg-stays and yokes yet no reforestation of the entire study area had taken place. (Appendix IV shows deforestation trends in Kaumba along Chivuna Road). Butler (2009) confirms that forest ecosystems are more destroyed for income generation than people putting in efforts to conserving them. It was the duty of EE to see to it that felled trees were replaced in order to save the environment from degradation in the study area.

Lack of attitude change towards reckless cutting down of trees and negligence were among the cited challenges. Attitudes were supposed to change after EE providers taught the residents about EE but this is contrary to EETAP's (2000) study which states that EE has the potential of making citizens develop right attitudes in environmental care and protection. In an interview, a forestry officer emphasized that more sensitization programmes were needed in the area. He lamented that it was not easy to change a person's attitude when it came to issues of deforestation. One pupil who became somehow emotional added that some people were too reckless and arrogant because they felt that trees belonged to everyone.

Corruption was seen through paying incentives to forest vigilantes by some unscrupulous residents for them to be allowed to cut trees even without permission from Forestry Department where they were required to pay more money. Other corrupt individuals paid little amounts of money to Forestry officers outside working hours for them to be allowed to cut indigenous trees. Arild and Kaimowitz (1999) agree that deforestation may also be perpetuated by corruption of individuals or government institutions who want to fatten their pockets alone. Loss of soil fertility in Kaumba also led to poor crop yields which forced residents to turn to deforestation for charcoal burning. Hostility from residents who felt intimidated by forest agents also led to continued deforestation in the area.

Charcoal burning led to massive deforestation in the study area. Kaumba Central residents had partnered up with charcoal burners in Kaumba South by supplying them with logs of wood to be used for charcoal burning. Diminishing of trees due to logging conforms to Berkmuller's (1992) study which asserts that one of the immediate underlying causes of deforestation is logging. It was actually sad to see a Tonga farmer who owns several big farming fields turning to charcoal burning which is an additional destruction to forests. It became so serious because in Tongaland, a field is completely cleared such that no tree is allowed to stand in the way of the plough. Hence, a combination of complete clearance of farming fields and charcoal burning worsened the situation. Forest Products (2011) state that almost three billion people rely on wood for heating and cooking in developing countries, a scenario which is posing a threat to forest cover in developing countries like Zambia. However, UN (2003) and Shokubutsu-gaku-zasshi's (2009) studies argue that there is some lenience exercised when it comes to cutting down of trees for firewood in rural areas. This may be the toleration that has led to depletion of forests in Kaumba. If this toleration recklessly continues, forests will diminish in few years to come.

From these findings, it is clear that there were many challenges that the people of Kaumba faced which made them turn to forests for survival. Conversely, negligence was found to have greatly contributed to the diminishing of trees because people neglected nursery-tree preparations and woodlot plantations which they were taught.

5.2.2 Sources of Income for Kaumba Residents

Findings revealed that some industrious women made mats from plant fibers and sisal for selling while others resorted to grass cutting and selling in a quest to make ends meet. Some farmers got their income from livestock farming, maize selling, and charcoal sales and from wood carving sales. Others just sold their little farm products to their friends in need rather than waiting for the government because it paid them very late. They lamented that poor rainfall patterns in the area led to poor crop yields. It was discovered that in rainy seasons, Kaumba residents also sold mangoes at the roadside for

income. They used to do a lot of gardening activities in the preceding years and sold vegetables to businesswomen from Monze town. But due to poor rains and early drying up of rivers and streams, they no longer did gardening. This left them with no option but start supplying logs of wood to charcoal burners for them to survive.

5.2.3 Problems of Deforestation in the Study Area

A forestry officer revealed critical issues that come with deforestation and cited global warming as one of the main problems. These findings conform to a research by Pearce (2001) who asserts that deforestation is a contributor to global warming and is often cited as one of the major causes of enhanced greenhouse effects. Global warming comes about due to damage of the ozone layer below the sun by carbon dioxide and other gases hence, bringing intense heat on the planet. Plants protect nature from this heat because they absorb carbon dioxide from the atmosphere which is used in the process of photosynthesis. This carbon dioxide, if not utilized by forests, rises to damage the ozone layer that protects us from the sun's heat. Broeker (2006) argues that tropical deforestation releases about 1.5 billion tons of carbon each year into the atmosphere which rises to destroy the ozone layer. This was noted in Kaumba where cutting down of indigenous forests occurred on a large scale. The area is very hot and receives fluctuating flash floods and droughts which leave the crops semi-ripe most of the recent years.

Butler (2009) asserts that deforestation is ongoing and is shaping climate and geography in the entire world. Tropical deforestation is responsible for approximately 20% of the world's greenhouse gas emissions. It is, therefore, cardinal to note that forests play a very critical role in mitigating climate change by planting a lot of trees. In Southern Africa, for example, Zambia has one of the highest pools of carbon in its forests or woodlands. Menno (2014) further asserts that Africa and America are due to experience increased malaria cases in the next few years due to global warming necessitated by high deforestation rates.

Poverty and poor rainfall patterns like droughts, soil erosion, flash floods, late onset and early subsiding of rains were revealed as products of deforestation in the area. This is consistent with two previous researches by Drevensk (2004) and Flannery (1994) who assert that deforestation causes increased natural disasters like soil erosion and that deforested regions typically incur significant adverse flash floods and soil erosion. Maycock (2008) states that the clearance of forests on China's Loess Plateau some years ago created dramatic incised valleys which caused the flooding of the Yellow River with a lot of mud giving it its sad nickname of 'China's sorrow'.

An Agriculture Extension Officer revealed that clearance of forest cover brought a lot of fluctuating rainfall patterns in Kaumba. He pointed out that too many trees were cut down which resulted into flash floods and droughts. These findings are in line with Erwin et al's (2010) study which asserts that in deforested areas, land heats up faster and enhances flash floods. This is the scenario that has been noted in the study area where most of the land is now almost bare (See Appendix IV). Some pupils lamented the drying up of *kapinga* grass due to droughts. They added that they no longer enjoyed the green beauty (aesthetics) from indigenous *kapinga* grass in school lawns as well as from flowers. Natural diversity such as wild animals, fruits and bird species were displaced due to high deforestation rates in the area. Teachers revealed that Kaumba residents always expected to be given incentives even when planting trees was for their own benefit.

5.3 How EE Addressed Deforestation in the study area

This is the third study objective which mainly discussed how EE addressed the problem of deforestation and current tree-planting activities in the study area. It is imperative that where EE has been introduced, positive changes in forest cover must be seen. This is supported by Rudel (2005), an advocate of the Forest Transition Theory which supports this study. The theory states that in the early stages of development of a country, it is a trend that a country is characterized by High Forest cover and Low Deforestation rates (HFLD). The deforestation rates eventually, accelerate in the presence of High Forest

cover – High Deforestation rates (HFHD) where forest cover is reduced due to human encroachment seen in high deforestation rates. This will lead to Low Forest cover – High Deforestation rates (LFHD), meaning that forests will become scarce. This is the scenario obtaining in the study area, Kaumba. A lot of trees have disappeared due to human encroachment leading to high deforestation rates.

5.3.1 EE and Deforestation as Perceived by Farmers, Agriculture Extension Officer, Forestry Officer, Teachers and Pupils

Findings revealed that farmers, Agriculture Extension Officer, Forestry Officer, teachers and pupils gave out different environmental activities that particularly addressed the problem of deforestation in the study area. Farmers had varied understanding of the way EE addressed the problem of deforestation. They mentioned that they were taught how to raise nursery trees in polly-pots. Nursery plants were raised in Kaumba which were then distributed amongst the residents and everyone was encouraged to plant them in woodlots around their homesteads. This conforms to a previous research by Lindhe et al (1992) who assert that in Kenya; EE had gone beyond project centers to schools where farmers and formal employees were raising nursery-trees while pupils were engaged in EE activities of nursery-tree preparations and colliandra tree-planting. In the study area, nursery-trees from seeds in polly-pots were raised and nursery-tree projects were extended to nearby areas like Sikabenga, Namakube, Kasaka, Nkaba, Mujika and Haachaanga.

Farmers further revealed that demonstration of tree-planting was done in Kaumba by DAPP environmental educators who visited the study area in 1992 and 2008. These brought with them over thirty (30) different species of nursery trees shown in Table 1 of Section 4.3.1.2 in the Presentation of Findings. The Table shows both exotic and indigenous trees that were planted in the woodlots in a quest to improve windbreaks, firewood sources, medicine, fruits, building poles and many other forest uses. Those trees in the woodlots were meant to provide anything one would need from forests and stop people from exploiting indigenous forests. Improvement of forest cover is very

important and is supported by the current Forest Policy of 1998 whose aim is to increase the country's forest cover.

As noted in section 4.3.1.2 of the Presentation of Findings, farmer 3 planted a sound woodlot which saved her homestead from a natural disaster which destroyed a lot of houses in the study area in 2011. If other people had not been negligent enough at planting woodlots around their homesteads, their homes would have been spared just like that of Farmer 3. In fact, after this disaster, a meeting was convened by environmental agents (residents who were voluntarily trained by DAPP to continue monitoring woodlot plantation projects in the area) to remind the people of the importance of planting woodlots around their homesteads as buffer zones.

Holding of workshops on forest conservation revealed how EE addressed the problem of deforestation in Kaumba. Farmers learnt how to care and protect trees from extinction by only cutting certain branches of trees for firewood and not the whole tree. This is very important because tree-trunks produce healthy new shoots after trimming them. This means that forest cover could improve much better than cutting the whole tree. EE also played an important role in addressing deforestation because teachers' mental horizons were widened concerning the teaching of EE in the area of rolling back deforestation. One teacher, after knowing that EE is a cross-cutting issue from DAPP environmentalists in 2008, promised to teach it with the seriousness it deserves and promised to restart the 'Keep Clean and Green' club and Chongololo club so that learners would develop a positive attitude towards combating deforestation. This conforms to one previous research by the Australian DEST, (1999) which asserts that the State and Territory Environment ministers in Australia proposed their commitment to furthering EE in schools. This was to be achieved through teaching learners how EE could help combat deforestation by the signing of the Adelaide Declaration in 1999 in Australia. This is one of the roles EE played in Kaumba where DAPP encouraged teachers to teach EE that has been integrated in diverse subjects. Jickling (1994) argues that it is imperative that teachers who transmit knowledge to pupils be well vested with the knowledge of EE if it was to create an impact in the learners and achieve EE goals.

Greening of school and home environments were done by planting indigenous *kapinga* grass and trees so as to beautify the school environment. Flamboyant, *leucaena,* yellow hedge, yellow *leander, gmelina arborea,* cassia *siamea, mimospholia* and many other trees shown in Table 1 of Section 4.3.1.2 were planted around Kaumba Basic School and some residents' homesteads so as to green and beautify the respective environments. Planting various trees in school gardens by Kaumba Primary School pupils is one of the requirements of EE. It is encouraging to note that even at Hermannsburg and Highbury Preparatory Schools in KwaZulu-Natal, South Africa, pupils also planted indigenous trees in the school gardens to beautify the school environment (McCay and Lobban, 2012).

Committed farmers also greened their homesteads through planting sound woodlots like the one shown in Figure 4 of Section 4.3.1.4. One pupil boasted that her mother had even stopped cutting down wild trees for firewood because *gmelina arborea* provided logs for firewood. An AEO further revealed that at least each and every home has a tree to point at which signifies that DAPP played its just role of teaching and demonstrating tree-planting in the area. This means that people in the study area were aware of the positive effects of reforestation, what is needed is reforesting the entire area so as to improve forest cover.

Findings from the Forestry Officer were diverse from most of the findings from other respondents on the role EE played in addressing deforestation in the study area. He explained that they were encouraged to keep bees. Bee-keeping is a good project because it requires planting grooves of trees which produce flowers with sweet scent from nectar. This attracts bees and in the process gathers pollen used in honey-making. Unfortunately, no one had gone into bee-keeping business in the area at the time of this research. They said that trees were too scanty leading to scarcity in pollen and nectar. Bee-keeping may help in income generation for residents and may divert charcoal burners' attention from deforestation to bee-keeping. Fish-farming was also taught to Kaumba residents with a hope of diverting peoples' attention from deforestation. The only problem was water scarcity because rivers dried up as early as July.

Conservation tree-harvest which was taught in the study area could help save a lot of trees from extinction and roll back deforestation. Conservation tree-harvest was taught in a way that when cutting a tree for firewood, a good number of trees were to be left standing before cutting another one. If this method was followed, it would have saved a lot of trees from destruction. Environmental Education's response to addressing deforestation conforms to Zambia's Forest Act, Cap 199 of 1973 which ensures conservation and sustainable use of forests and management of forest ecosystems and biological diversity. This shows how EE is devoted to rolling back deforestation in the entire nation.

EE played an important role of addressing deforestation challenges in that forest conservation rules were put in place by DAPP officers. People became aware of the negative effects of deforestation. The problem was that people always disobeyed and waited till the worst was experienced. This was seen to be a very bad approach because forests could be depleted before people realize the bad side of such negligence.

Inter-governmental Panel on Climate Change (IPCC) (2000) shows the formation of various forestry environmental organizations which uses EE to roll back deforestation worldwide. These include; Greenpeace, Earth Nature, World Wide Fund for Nature (WWF), Forest Retention Incentive Scheme (FRIS), Community Forestry International, Avoided Deforestation Carbon Fund (ACDF) and the Arbor Day Foundation's Rain Forest Rescue Programme (ADFRFRP).

In a nutshell, research findings showed that EE played a big role in addressing the problem of deforestation as shown in the preceding EE activities. Residents were made aware that woodlots could provide anything they needed from forests and conversely, indigenous forests would be saved from extinction. However, it should be pointed out that though a lot of EE activities addressed deforestation in the study area, deforestation was not curbed because these EE activities were just on a small-scale. No large-scale reforestation activities have so far taken place in the study area hence, there is need to carry out large-scale reforestation projects and not woodlots only as it were.

5.3.2 Current Tree-planting Activities in the Study Area

Farmers, teachers, Agriculture Extension Officer, Forestry Officer and pupils had abandoned the woodlot planting project at the time of the research. Research findings showed that all the above categories of respondents had one and similar response regarding continuation of tree-planting in the area. They all revealed that tree-planting was no longer taking place due to scarcity of nursery-trees for planting because it was difficult to raise nursery trees on their own. The researcher, however, concluded that people in the study area were just too negligent towards tree-planting because the same residents revealed that they were taught how to raise nursery-trees for planting. The researcher actually found dried up nursery-trees in polly-pots at one of the Forest Agent's house and attributed it to utter negligence. The Agriculture Extension Officer and Forestry Officer agreed that people never went to collect nursery-trees even when they were prepared for them, only a few did that. The study further revealed that since EE was introduced, less than twenty families had planted sound woodlots around their homesteads with many different plant species both indigenous and exotic. This showed lack of attitude change towards tree-planting.

5.4 Alternative Measures to Mitigate Deforestation

This is the fourth and last objective of the study which sought to suggest alternative measures to help curb deforestation. Farmers, Agriculture Extension Officer, Forestry Officer, teachers and pupils suggested various alternative measures to help mitigate deforestation. These may help increase forest cover and save the environment from degradation through deforestation.

Farmers and teachers suggested that empowering residents through funding women's club-projects like goat-rearing and other fund-raising projects may help sustain indigenous forests. This may help generate income for residents and divert their attention from deforestation for charcoal-burning. The empowerment of citizens is in line with researchers like Le Roux (2001) who points out that EE should empower all

peoples in knowledge and monetary form in a quest to roll back deforestation. Thus, deforestation can only be brought to an end when every citizen gets involved.

Reforesting the whole study area instead of concentrating on woodlots alone is in line with Foley et al (2005) who argued that reforestation of expanse areas of land helped a lot in increasing forest cover and mitigating deforestation in many parts of the world, especially in East Asian countries. Stenstrup (2010) asserts that forestry writers like Botkins and Sedjo suggested that high-yielding forest plantations are suitable in meeting the world's demand for wood. Thus, it has been calculated that plantations yielding 10 cubic meters per hectare annually could supply all the timber required for international trade on 5% of the world's existing forestland. This may help save indigenous forests from depletion if such measures were to be employed worldwide. It is imperative that the role of Environmental Education becomes action-based in the area of reforestation in order to mitigate deforestation in developing countries like Zambia. FAO (2010) asserts that Zambia lost an average of three million, three hundred thirty-two thousand (3 332 000) hectares of forest cover between 1990 and 2010 due to increasing deforestation rates. These are the losses that EE needs to take into serious consideration through massive tree-planting projects so as to improve forest cover.

Electrifying all the homes in Kaumba was another suggested measure. Electricity is the best alternative to firewood and would help curb deforestation habits seen through firewood and charcoal demands in Kaumba. But the problem still remains that local people were economically incapacitated such that there is a big likelihood of them not managing to pay for electricity bills even if power was to be installed in all the homes in the study area unless government heavily subsidizes.

Punishment through paying fines in monetary form and planting trees may help instill a sense of responsibility and care for the environment. This would help foster a sense of care and responsibility that will lead to concrete actions towards forest sustenance. Sustenance measures are good in that they help in maintaining resources such as forests so that future generations may also benefit from them. Soil enrichment through planting

acacia albida, cajanus cajana and *sesbania sesban* in the fields was cardinal as it supports abundant crop yields. That way, people may be turned away from forest exploitation for income because the sale of crop yields enhances financial stability.

Observation of World Environment days like tree-planting days is important as it instills levels of awareness on the need to reduce deforestation through tree-planting. Owen (2006) asserts that China observes 12th March of every year as a Planting Holiday and has also introduced the Green Wall of China project which halted the expansion of the Gobi desert through tree-planting. The total number of trees planted amounted to about 35 billion on China's land mass.

Changing peoples' attitudes towards deforestation ensures safety of indigenous forests. Bee-keeping and fish-farming were among the suggested measures. Residents also suggested arresting offenders to help reduce deforestation. Stiffening rules and regulations was another suggested measure for mitigating deforestation. Government of the Republic of Zambia (GRZ) (1998) puts in rules, regulations and policies for sustainable management and use of forest resources. This Forest Policy could be of great help if every Zambian citizen is equipped with this knowledge so that forests are preserved.

Teaching EE as a single subject was also suggested so that learners could fully understand the importance of tree-planting. This is in line with Kimaryo's (2011) study where she found that teachers opted for the incorporation of EE in the curriculum as a separate subject in Tanzania. Other environmentalists like Ballantyne (1996) and Palmer (1998) also argue that the aim of EE was to aid citizens in becoming environmentally knowledgeable and skilled, dedicated and willing to work individually and collectively towards solving and maintaining a balance between quality of life and quality of the environment. This notion could help save the environment from degradation if applied in places like Kaumba.

This chapter dealt with 'Discussion of Research Findings'. The next chapter presents the 'Conclusion and Recommendations 'that were made to the study

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.0 Overview

The research set out to assess the role EE played in addressing deforestation in Kaumba area of Monze east, Southern Zambia. This chapter dealt with the conclusion of the study and also made recommendations based on the major findings of the study. It also presented areas of future research. The conclusion was laid down according to the research objectives.

6.1 Conclusion

The study revealed that in Kaumba area of Monze east, deforestation rates were on an increase despite Environmental Education lessons that were imparted in the area.

The first objective sought to establish EE activities that took place in the study area so as to show its visibility. EE activities that took place in Kaumba include conservation farming where *acacia albida, sesbania sesban, cajanus cajana* and *vetiver* grass were planted in the fields to retain soil nutrients. Woodlot plantations, funding for EE projects like sinking of twelve boreholes for clean drinking water and building non-stinking pit-latrines were also done. Homestead cleaning, disease control, making heat-retaining clay stoves were done by farmers. Others include; erecting waste-bins, grass-planting and planting buffer zones around Kaumba Basic School by pupils. An Agriculture Extension Officer was involved in farming tillage while an Agriculture Camp Officer was involved in a loan-giving programme to farmers called Conservation Agriculture Scaling-Up (CASU) at the time of the research. This signified the visibility of EE in the study area.

Findings further revealed that people had some knowledge of EE which they learnt from environmental educators like DAPP, SCAFE and Forestry Department, teachers, friends, books, magazines, newspapers, Environmental Conservation Clubs, fliers, radio and television programmes. Residents defined EE as the changing of people's attitudes

towards the environment, the planting of woodlots in the surroundings, cleaning the surroundings, planting manure-retaining plants like *acacia albida* and *sesbania sesban*, greening the environment, learning about climate change, consuming clean water and building better toilets. Research findings showed that the people of Kaumba had limited sources of income which made them exploit indigenous forests to make ends meet.

Findings further showed that people faced many challenges that led to deforestation in the area. These were; poor rainfall patterns, poverty, high population rates, weak government policies, negligence, farming and settling space, early drying up of rivers, early subsiding of rains and lack of attitude change. Others challenges brought forth include use of firewood and charcoal for cooking, high demand for wood used in making hoes, picks, kraals, grain-barns and in construction of modern pit-latrines as well as other wood products for sale such as sledges, peg-stays and yokes. Another challenge is that most woodlots were destroyed at a tender age by domesticated animals like cows, goats, pigs and some bird species like chickens, guinea fowls and turkeys. Charcoal burning which started in Kaumba South was one of the worst challenges that led to deforestation.

Deforestation also brought problems such as climate change, loss of nutritious wild fruits, and displacement of natural diversity from its natural habitats, poverty, droughts and flash floods, poor rainfall patterns, global warming, tree scarcity and early drying up of rivers. Findings further revealed that people of Kaumba had negligently stopped planting trees in the area at the time of this research.

EE played a good role in addressing deforestation through some practical lessons that were done by DAPP, SCAFE and the Forestry Department. EE activities that were done include; nursery-tree raising, holding workshops to teach people about forest conservation, planting woodlots which provided anything one would need from a forest, conservation tree-harvest, making heat-retaining clay stoves, fish-farming, bee-keeping and conservation rules. So far, a few people are using woodlots to answer their daily needs instead of turning to indigenous forests.

Alternative measures that were suggested by Kaumba residents to help solve the problem of rampant deforestation in the area included; punishing the offenders, empowering the people with soft loans, introducing fish-farming and bee-keeping projects, electrification of Kaumba homesteads, conservation tree-harvest, early burning of bushes, implementing stiff rules and regulations, extensive awareness campaigns and reforestation of the whole area.

This study may help EE policy makers, EE bodies, EE desks in different government departments, NGOs, the government itself, Church bodies, general public and other stakeholders to become aware of how EE could help in addressing problems of deforestation in Zambia. It may also help them find better and swift strategies of action to help curb rampant deforestation in various parts of the country including Kaumba.

6.2 Recommendations

Recommendations based on the major findings of the study were made. These recommendations were based on policy, practice and further research. Thus, the following recommendations were made to the study:

6.2.1 Recommendations Towards Policy - Based on research findings, it was recommended that the government flags off a tree-planting (reforestation) programme in Kaumba. Respondents suggested that it be implemented as promptly as possible because many indigenous plant species were depleted in the area leading to threatening desertification and poor rainfall patterns. It was also recommended that charcoal burning be quickly stopped in Kaumba so as to help save trees because destructive farming methods of the Tonga people had already caused severe deforestation in the area.

6.2.2 Recommendations Towards Practice - Bee-keeping projects need to be emphasized and implemented in Kaumba so that forests could be saved in the process of reserving them for pollen and nectar needed in honey-making. It was also recommended that intensive awareness campaigns on the goodness of

reforestation are carried out before reforestation of the entire study area is conducted so as to help change the mindsets of Kaumba residents.

6.2.3 Recommendations Towards Future Research - It would be necessary to use a comparative approach when carrying out a future study on a similar topic. Comparisons could be made on the effectiveness of EE methods in addressing deforestation in other areas of Zambia. This may help identify areas that still need attention in terms of rampant deforestation. This may be helpful because Zambia is still among the top ten (10) countries of the world identified by EE REDD Desk of the UN as the worst at rampant deforestation.

Future research should also endeavor to compare the response to EE methods in areas where deforestation is high and those where deforestation is mild. This may help to assess how effective ZANEEP has been at offering EE programmes as regards forest conservation in Zambia and ascertain the necessary support to be rendered to such areas.

This chapter dealt with the conclusion of the entire study and recommendations that were made to the study. What follows, heretofore, are references of the study and the appendices.

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APPENDIX I: Semi-structured Interview

Semi-structured Interview Schedule for Kaumba Residents (Farmers, Agriculture Extension officers, Forestry Officers and Teachers).

Instructions: This interview schedule aims at assessing the role Environmental Education played in addressing deforestation in Kaumba area of Monze east, Southern Zambia. You are therefore, requested to be as objective and as precise as possible on the role EE played in addressing deforestation in this area.

SECTION A - Personal Information

1. Age: 15 – 30 [ ] 31 – 40 [ ] 41 – 50 [ ] 51 and above [ ]
2. Gender : M [ ] F [ ]
3. Educational Level: None [ ] Primary [ ] Secondary [ ] Tertiary [ ]
4. Occupation: …….....
5. Length of stay in Kaumba area: Less than one year [ ] 1 – 5 years [ ]

   6 – 10 years [ ] 11 years and above [ ]

SECTION B – All EE activities that took place in Kaumba area of Monze east

6. What environmental activities took place in Kaumba?

   ……

   ……

   ……

7. What do you understand by the term 'Environmental Education?

   ……

   ……

   ……

   ……

8. What is your source of information on EE?

……

……

……

SECTION C - Challenges that Lead to Deforestation in Kaumba

9. What challenges lead to deforestation after EE practical lessons in this area?

……

……

……

……

10. What is your source of income?

……

11. What problems do you think deforestation has brought to this area?

……

……

……

……

SECTION D – How EE Addressed Deforestation Problems in Kaumba

12. How has EE addressed the problem of deforestation in this area?

……

……

……

……

……

……

13. Have you continued planting trees in this area?

Yes [ ] No [ ]

If 'No', why not?

……

……

……

14. If 'Yes' to Question 13, what type of trees have you continued planting?

……

……

……

SECTION E - Measures that Could be Employed to Mitigate Deforestation

15. Suggest any measures you think can help mitigate deforestation.

……

……

……

……

If there is any information you would like to add, you are free to do so.

……

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……

*******THANK YOU FOR YOUR PARTICIPATION*******

APPENDIX II: Focus Group Discussion Schedule

Focus Group Discussion Schedule for Farmers, Teachers, Forestry Officer, Agriculture Extension Officer and Pupils

1. What is your understanding of Environmental Education?

2. Which EE activities took place in Kaumba?

3. What is your source of information on EE in this area?

4. What challenges do you think still lead to deforestation after EE practical lessons in this area?

5. What is your source of income?

6. What problems do you think deforestation has brought?

7. How did EE address the problem of deforestation in this area?

8. Have you continued planting trees in this area?

9. Suggest any other measures you think can help mitigate deforestation

APPENDIX III: Unstructured Observation Strategy

1. Gestures
2. Environmental observations in relation to trees

Type of Environment	**Aspects to be Observed**
Economic Environment	- business in forest products - turnover in forest products - values - attitudes
Natural Environment	- land degradation - soil erosion - felled trees - charcoal burning scenes
Political Environment	- civic and traditional leaders' authoritative traits - leaders' behaviours - leaders' values and attitudes - pricing of wood products - equality and equity in the sharing of benefits from wood products
Personal Environment	- self-esteem - values - attitudes - behavior
Social Environment	- attitudes - values - social trends - behavior

APPENDIX IV: Deforestation Trends

Deforestation Trends in Kaumba along Chivuna Road

Source: Field Data, 2016

APPENDIX V: Deforestation for Firewood

Exploitation of Indigenous Forests for Firewood in Kaumba

Source: Field Data, 2016