AN ASSESSMENT OF ENCHROACHMENT AND RESOURCE MANAGEMENT OF LUANO NATIONAL FOREST, CHINGOLA.

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GEO 474

NOVEMBER 2003.
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A project report submitted to the Department of Geography at the University of Zambia in partial fulfillment of the degree of B.Sc. Natural Resources.

NOVEMBER 2003.
DECLARATION

"I Mwila M. Roselyne declare that this report has been composed and compiled by me and that the work recorded has been done by me, that the sources of all material referred to have been specifically acknowledged, and that the project report has not been accepted in any previous application for academic award."

Signature: ___________________________ Date: 21 - 11 - 03
DEDICATION

This report is dedicated to my family and all my friends for their support and inspiration throughout my academic life.
ACKNOWLEDGEMENTS

This research is the product of all my efforts, different institutions and individuals whose contributions helped to shape the final report.

To begin with, I would like to thank my supervisor Mr. Gear M. Kajoba for his advice and assistance throughout the project. Without his supervision and critical comments, the report could not have been produced to this standard.

On the institution front, I would like to thank officials from Zambia Electricity Supply Co-operation Limited, Zambia Railways, Zambia Forestry and Forestry Industries Co-operation Limited, Copperbelt Energy Co-operation plc, The Ministry of Tourism, Environment and Natural Resources and the Ministry of Agriculture Food and Fisheries, for their assistance in giving information on their organisation’s involvement with Luano national forest.

I am so grateful to Mr. Able Siampale, GIS department at the Forest Department headquarters for providing me with up to date information in form of the satellite image. My other gratitude goes to the forest technician at the Forest Department headquarters for updating me on the changes in terminologies in the field of forestry and the forest extension assistant, Forest Department, Chingola, for the in-depth data on Luano National forest. The other person I would like to extend my gratitude to, is Mr. J Chalila, Chief Cartographer Geography Department, University of Zambia, for providing me with the analogue maps used to produce the maps in the report. My other gratitude goes to Mr. T. Saisha and Samuel Twasa for their help in printing and typing of the final report. My biggest appreciation goes to Ms. R. Mweendo for typing the whole document. I am also greatfull for all the help and encouragement that was rendered to me by my good friends Mendai Imasiku and Tembo E nock.

I am also grateful to the hundreds of individuals for their contribution to this research. These are people who assisted me in one way or the other, too numerous to mention one
by one. I thank them all for their time and patience. I would like to take this opportunity to thank my daddy, Mr. Enock M. Mwila and mummy, Mrs Mable K. Mwila for their financial and moral support during data collection. Special gratitude goes to my young sister, Cecilia Mwila who generously gave me her time and accompanied me to the study area when I was doing field observations and interviews for the local people.
ABSTRACT

Luano national forest has come under a lot of pressure from people venturing into agriculture, charcoal production over exploitation of timber and encroachment after retrenchment from the mines. Lack of forest management has led to environmental degradation and hinders socio-economic development.

The questionnaire interview method was employed in obtaining information from stakeholders and the local people. The information helped in evaluating the management strategies employed in Luano national forest. Personal interviews and direct observation were conducted to get the qualitative information that could not be captured through other means of data collection. To determine the extent of encroachment, a satellite image for August, 2000 and digitized analogue maps for 1994 and 1995 were overlayed to get the land cover map.

The study findings revealed that Luano national forest is heavily encroached with a high level of anthropogenic activities. The local people do not view the area as the forest but they consider it as an agricultural area. Of the 50 people interviewed, 90 percent were males and 10 percent were females. 64 percent of the respondents live in Luano area while 30 percent and 6 percent of the respondents live in Chingola and Kitwe, respectively. Poverty was cited as the main reason for the people to go and settle in the forest as it accounted for 72 percent of the answers obtained. Fertile soils and a place to settle accounted for 22 percent and 6 percent, respectively. The factors depleting resources in Luano forest were identified as charcoal production, conversion of the forest to agriculture land, encroachment, settlement, fire, and poverty.

Lack of monitoring processes from the understaffed forest department contributed to encroachment of the forest. The forest officials concentrate on the management of local forests where Joint Forest Management strategies are employed. Even though the companies utilizing resources from the forest are ready to contribute to the sustainable management of the forest, there are no management strategies being employed in the
forest. Luano forest should be degazetted so that it becomes a joint management entity for sustainable utilization of natural resources.
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ACRONYMS

CEC  Copperbelt Energy Cooperation plc
ECZ  Environmental Council of Zambia
JFM  Joint Forest Management
WCED World Commission on Environment and Development
ZAFFICO Zambia Forestry and Forestry Industries Cooperation
ZESCO Zambia Electricity Supply Cooperation Limited
CHAPTER ONE

INTRODUCTION
Forests are ecosystems that are tree dominated with under wood associated vegetation (Shukla, 2000). Their development is influenced by atmospheric conditions, edaphic and anthropogenic factors. Zambia has 44.6 million hectares of indigenous forests that cover 60 percent of the total land area, (Shakacite, 2000). There are 481 protected forests, of which 181 are national forest reserves and 300 are local forests. 9.6 percent of these forests are gazetted forests. Luano national forest reserve is one of the open forests found in Chingola district of Zambia, (figure 1).

This report is divided into seven chapters each giving a description of different issues. Chapter one, gives the forest concepts and a brief background to forest resources in Zambia. The functions, uses, threats and resource management have been described to give the general picture on forestry. Other aspects of the research such as the statement of the problem, purpose of the study, objectives, research questions, rationale and the scope of the study are also described in this chapter. Chapter two outlines the literature that was consulted on forestry from different parts of the world. The forest management strategies used in Zambia had been cited. This included the benefits, uses, functions and factors that have led to encroachment. The description of the study area is given in chapter three. The location, climatic factors, edaphic factors and vegetation of the area are described in detail. Chapter four outlines the methods employed in data collection. Questionnaires for companies utilizing resources in Luano national forest, major stakeholders and local people were administered to collect information on resource management strategies used in the area. Direct observation and personal interviews were also used as the methods of data collection to obtain qualitative information not captured by other means. To determine the extent of encroachment, a satellite image layer for August, 2000 and digitized analogue map layers for 1994 and 1995 were overlayed to produce the land cover map. Data processing and presentation as well as limitations and problems encountered during the study are given in this chapter. Chapter five gives the study findings in form of tables, maps and figures. Other analyses of the study findings
are also incorporated in the chapter. The percentages of different factors have been evaluated and included in the study findings. A run-down of the results of the study is given in chapter six. It discusses the status of Luano national forest, factors threatening the resources, the resource management strategies and the benefits of resource management. The implications of the results and study constraints have been discussed in this chapter. The summaries of the study findings are given as concluding remarks in chapter seven. Recommendations based on interpretation of the study findings have been suggested. The possible topics for further research are outlined at the end of the chapter.

1.1.1 FUNCTIONS OF THE FOREST
Shukla (2000), highlighted the significance of the forest resources because they store biological diversity which comprises a large number of flora and fauna. They maintain ecological balance and act as catchment for soil and water. Furthermore, forests support industrial and commercial activities, contributing substantially to income, employment and subsistence in most parts of the country.

The forest plants are producers in food chains in the forest ecosystem, which trap solar energy. They transform carbon dioxide from the air along with water and nutrients from soil into food substances such as starch, sugar and protein through the process of photosynthesis. Food materials are stored in plant parts such as fruits, nuts, legumes and seeds. This keeps the balance between oxygen and carbon dioxide. In turn they maintain soil fertility, regulate temperatures, prevent soil erosion, landslide and improve the environment. Rainfall water is retained in the form of humus or in plant tissue. Thus, forests play a major role in the hydrological cycle, (Shukla, 2000).

1.1.2 USES OF THE FOREST
Segreiya (1967), stated that forest resources are distinguished from other resources because they are renewable. In developing countries, forests are cleared to offer the ever
increasing population a place to settle as well as provide them with land on which they can grow crops to alleviate poverty. World Commission on Environment and Development, (WCED, 1987) estimated that 70 percent of the world’s population depend on wood as a source of energy. The use of wood fuel in the world, vary within and across geographical regions ranging from 0 percent in highly developed countries to over 95% in the poorest regions.

Furley (1994) and Tietenburg (1996) identified other localized uses of the forest as provision of edible plant parts in form of vegetables, nuts and medicines. The forests also provide materials for crafts work, fibre, place for worship and burial sites. They are best sites for recreation as they provide a sanctuary for peace, meditation and give an aesthetic sense to the users.

1.1.3 THREATS TO FORESTS
Although, the rich genetic pool contained in the forests provide a vast potential, the varied nature of this resource pose unique problems in human development. There are a lot of threats that if not checked could result in the destruction of the resource base on which livelihood of human population depends. These threats include deforestation through disease causing pathogens, fire and a wide range of anthropogenic activities (WCED, 1987). The demographic data for Luano forest was not readily available. The total population that depend on resources from the forest cannot accurately be determined because people from all the towns on the Copperbelt and areas beyond, have access to all forms of resources found in Luano forest. However, in 1998, the population of Copperbelt province was estimated to be 1, 837, 000 people giving the density of 58.2 people per square Kilometre, Environmental Council of Zambia (ECZ, 2001).

Natural causes of deforestation in Luano national forest due to insects or natural fires have not been documented if at all the problems have been investigated. Their occurrence have not extensively destroyed the forest stocks. However, the biggest threats in this forest are anthropogenic in nature. Fire started accidentally especially late fires have a significant effect on the reduction of forest resources.
Encroachment in the form of settlement and cultivation is the major threat to reduction in forest stocks. To distinguish different states of the forests, the forest Act, 1998, described four types of forest states; intact, threatened, encroached and depleted forest. An intact forest is the forest reserve that is isolated, well stocked and it is without any anthropogenic activities. A threatened forest is one that has human population around and could be encroached anytime due to population pressure. An encroached forest is one that have physical and visible anthropogenic activities such as foot paths, cultivation, animal hunting and honey collection. A depleted forest is one, which have massive anthropogenic activities up to 80 percent depletion of tree species.

Underlining causes such as population growth, redundancies and poverty are other factors that drive people into encroaching forest land. These determine the rates at which the resources are used and regenerated. They also determine the way the resources will be managed or conserved.

1.1.4 RESOURCE MANAGEMENT

The protection of forests from the natural as well as the anthropogenic threats, lead to forest management. Shukla (2000), describes forest management as the practical application of the scientific, technical and economical principles of forestry for continuous provision of recreation, products and services in the long-run.

In Chingola, forest exploitation has become pronounced. There is a lot of demand for agricultural land and the need to conserve natural forests. The conflicts between these land use types have put a lot of pressure on Luano forest as it is situated in an area with plenty of water from the Kafue river through the numerous streams that can be used for irrigation in dry months. On the other hand the forest department would insist on the conservation of this Miombo forest. Therefore, management strategies should take into account these conflicting demands.
The Environmental Council of Zambia, (2001), highlighted the new approach to forest management that is fashioned to suit local conditions. It include Joint Forestry Management (JFM) based on the principle that local communities become involved in the management of public forests and get direct benefits from the use of the forests. The JFM is the partnership between the local community and all stakeholders for the protection and long-term survival of both man and the forest resources.

1.1.5 STATEMENT OF THE PROBLEM
Luano national forest is one of the major open forests in Chingola. This forest has come under a lot of pressure as a lot of people venture into agriculture and charcoal production after retrenchment from the mines. Over exploitation of timber and encroachment are other activities that have mounted pressure on this forest.

Lack of resource management has led to environmental degradation and hinders socio-economic development.

1.1.6 PURPOSE OF THE STUDY
The purpose of the study was to assess the extent of encroachment and determine the factors threatening the resources in Luano national forest. The practical application of the scientific and economic principles in the sustainable management of the forest has been suggested.

1.1.7 OBJECTIVES
The main objective of the study was to establish the resource management strategies in Luano national forest by:
1. Assessing the extent of encroachment and determining the factors threatening forest stocks.
2. Verifying if there is resource management in Luano national forest.
3. Determining the benefits of forest resource management to all stakeholders.
1.1.8 RESEARCH QUESTIONS

1. How much of the forest is encroached and what factors are threatening Luano national forest?
2. What strategies of resource management have been implemented in Luano national forest?
3. What are the benefits of resource management to the local people and the country at large?

1.1.9 RATIONALE

With the privatization of the mines and subsequent retrenchment of miners, people in Chingola have ventured into other sectors for livelihood. Agriculture and charcoal production are the immediate options. Luano is preferred because of its proximity to Kafue river, the roads and residential areas. The invasion of the forest has created problems, which have either short-term effects or will have long term repercussions on both man and the environment.

It is hoped that the findings of this study will help the forest department to re-evaluate their strategies in order to sustainably manage the forests and meet the ever increasing needs of the local community. It will also help to add current knowledge on the state of the forest.

1.1.10 SCOPE OF THE STUDY

The study was focused on determining the extent of encroachment into Luano national forest reserve. In addition, the study focused on finding the factors threatening resource stocks, the benefits of resource management and the kinds of management strategies employed in Luano national forest.
2 CHAPTER TWO

LITERATURE REVIEW

Forest resource conservation and management in developing countries in the past has ignored the socio-economic situation of the farmers and encroachers. These strategies concentrated on threats against protected areas by the local society whereas most threats, are caused by people from other places. Most governments these days are adopting strategies that promote reaping maximum benefits of income, subsistence products and environmental services that the forest has to provide, especially for the local community. In other instances, the strategies include conflict resolution between forest conservation and encroachment to convert forests into agricultural land brought about by population growth and landlessness of the local community.

In Nepal, landlessness and near landlessness (0. 0 to 0.5 hectares) is prevalent, with national average being estimated at 51 percent, making products from community forestry an essential complementary and supplementary component of livelihood strategies. Farming is based on an interactive system where crop production, animal husbandry techniques and forest products are combined. Badyi (2000), in his report indicated that sensitization of the local people through Forest radio Programmes makes people aware of what forestry policy and regulation are adopted by the Nepalese government. The knowledge of scientific management practices ensures maximum utilisation of valuable resources that are under-utilised. The formation of community forestry user groups in Nepal has increased awareness and strengthened the role of actual forest users in policy making and resource-related activities. The government has renewed emphasis on decentralisation in forest management being achieved through
forest user groups. Operational management plans are being negotiated and the community forests are being handed over to local users with all associated rights and responsibilities (Shrestha et al. 1997). Community forestry policy in Nepal combines an environmental objective, that is, to protect against land degradation and deforestation, with a socio-economic objective that encourages participation in resource management to meet people's basic needs for fuel wood, timber, fodder and other forest products on a sustainable basis. This encourages farm-forest links and increases food production as well as sustainability of the forest stock.

Wenxia (1999) in his report on community forestry assessment in Lian-chi village, China, stressed the point of empowering the villages with the management of the forestry resources. Villages in Lian-chi plant multi-purpose trees around their homesteads. These trees are used for water and soil catchment, provide fruits, medicine, firewood and vegetables for consumption and for sale. The user rights of these trees belong to those that planted them.

In Kenya, East Africa, Omosa, (1998) brings out the dilemma that comes with forest management policy. This dilemma is brought about as most forested lands in Kenya are situated in areas that have high potential for agriculture. With increasing rural population, pressure to convert forest land to farms is mounting and Omosa argues that for agriculture to co-exist with forestry, there is need to harmonize land use practices. This will include, taking into account the opinions and needs of the local people and resolving the question of ownership and security of tenure.
In her concluding remarks Omosa (1998) suggested that forestry be taken back to the people as there is a close link between forestry and agriculture, trees and the people. She also suggested that women and other household members should be involved in the design and implementation of forestry activities. This will ensure that all members of the local community are equipped with the necessary knowledge and skill to sustain the resources. In the long run, greater success will be achieved if local people are involved and enjoy a secure livelihood from the sustainable use of forest and agricultural resources.

According to Ochieng-Odhiambo (1997), the Kenyan government's commitment towards improving forest management is reflected in the Kenya forestry master plan and the new policy. The new policy and the forestry master plan emphasizes the importance of creating opportunities for community participation and institutions that contribute to the sustainable management of natural resources for the improvement of people's livelihood. He strongly stated that the top-down approach in forest management dis-empowered and alienated resource users from the decision-making process. The new approach of Joint Forestry Management is also taking place in Tanzania. In the past, forests had suffered rapid degradation through cultivation, charcoal burning, timber and pole extraction. These events promoted the local people to take over the management of what was an open resource. Under the Joint Forestry Management tree planting has been intensified and villagers have been issued with permits to use the forest resources. The interaction
between the forest department officials, local administration and the local community minimizes the conflicts between the different stakeholders, (Ssembajjwe, 1997).

Gakou and Force (1996), in their report stated that the government of Mali and all stakeholders, especially the local people must be involved in the drawing of management plans. Thus since 1995, the new forest policy has emphasized the participation of rural people. They suggested the inclusion of Non-Timber Forest products (NTFP) in the policies to determine a sustainable use of these products identified by the local people. They went on to say that involvement of women in forestry planning should be imperative because they are significant users of the forest and their activities differ considerably from those of men.

In Zimbabwe efforts to empower the local communities through participatory Joint Forestry Management are also under-way. McNamara (1993) suggests the introduction of policy reforms that create legal, land tenure and local institutional framework that will be conducive to the local people to ensure woodland management. To be assured of local community involvement, such policies should include incentives to invest in woodland management and tree cultivation and long term inheritable leases.

Fortmann and Bruce (1993) emphasised on the need to define gender issues in land and tree tenure. The forest policy should empower women to have the rights to control the use of trees they planted. This is because women in Zimbabwe are responsible for
harvesting wood fuel and other tree products which contribute to the welfare of all the members of the family.

In the past, the Zambian government formulated a set of legal instruments to protect the environment. These laws gave full control to the central government over ownership, planning and management. The amended forest Act number 7 of 1998 will lead to the establishment of the Forestry Commission, which is mandated to do all things necessary for resource and maintenance of sustainable forest management, (ECZ, 2001).

The Zambia Environmental Action Plan has a strategic plan in forestry which should raise awareness to update the forest policy, preparing specific action programmes or projects. This will stimulate financial and political support to implement these initiatives. In some provinces, the Provincial Forestry Action Plans have been prepared to predict the enhanced forest sector interventions. These plans are designed to have better agriculture practices, local community involvement in the management of forest resources and involvement of all stakeholders such as the private sector, research institutions and the business community. These Provincial Forest Action Plans have been going on in three provinces namely Luapula, Central and Copperbelt, in local forests. (Alarjani, 1996 and GRZ, 1994).

The new approach to forest management is the JFM based on the principle that local communities become directly involved in the management of public forests and get direct benefits from the use of the forests. Some strategies include establishing and supporting
the development of the cost and benefit sharing mechanisms through the JFM arrangement. The JFM is the partnership between the local community and all stakeholders for the protection and long term survival of both man and the forest resources. Land ownership is still under government and local communities become co-managers of the forests, (ECZ, 2001, GRZ, 1999 and Kajoba, 1999).

Kajoba and Chidumayo (1999) estimated the levels of encroached reserves due to settlement, uncontrolled harvesting of timber and wood fuel to be 16 percent of the reserves in Zambia, though the trends show that the increase is at an unprecedented rate. Depletion due to deforestation was estimated at 3.2 percent while 39.4 percent of the forests are surrounded by areas with high population density, which are classified as threatened. 36 percent of the reserves were intact and 0.5 percent was established exotic plantations in some depleted forest reserves. Given the threat to human encroachment which forest reserves in Zambia and elsewhere face, there is an emerging perspective, which can resolve the conflicts between conservation and encroachment. This should involve individuals, local communities and the government managing the resources jointly through the JFM programmes. Kapungwe (1997) considered the most popular approach to conflict management with community-based natural resource management as being the consensus approach. This involves, among other things, the empowering of local institutions, such as traditional leaders, or creating new ones to address new challenges.
In related research conducted in Chibombo District, Kajoba (1999), showed that Muyama forest reserve squatters have full and occupation of the reserve and that there is a gradual but effective transformation of land use, from forest to agricultural land through settlement in homestead. This has led to pressures from settlers to have the forest degazetted as a way of resolving the conflict through JFM policy for sustainable use of the resources.
3 CHAPTER THREE

STUDY AREA
This chapter focuses on the description of the study area. The climatic conditions, edaphic factors and the vegetation types found in the area are also discussed.

3.1.1 LOCATION
The study area is Luano national forest reserve number 12. It is located approximately 14 kilometres from Chingola town, (figure 2). It’s eastern boundary borders with Mufulira district boundary and has a small portion in the northern part of Kalulushi district. Luano forest is situated between latitude 12° 30’S and 12° 35’S; and longitude 27°50’ E and 28° 30’E. The area has an average altitude of 1300m above sea level. There are 6 water catchments in the area. (Maxwell, 1972).

Luano national forest was originally established as a forest reserve when it was surveyed and gazetted on 25th March 1946, (Forest Department, 1986). It had an initial area of 18,000 hectares and the main purpose of its establishment was to provide timber to the mining industry as well as conserving the valuable Miombo tree species. In 1957 and 1962, there was a review and the area was increased to 35,471 hectares and 35,471 hectares, respectively. This was prompted by the increased demand for timber. In 1979 the total area was reduced to 13,944 hectares to pave way for other developmental programmes such as Agriculture and mining and currently the total area is 13,132 hectares, (Forest department, 1986).

3.1.2 CLIMATE
Luano national forest is found in the sub-tropics. The climate in the area has a marked summer rainfall between November and April; a cool and dry season between April and August; and a dry hot season between August and November. The annual rainfall is approximately 1194mm and mean daily temperatures range between 17 and 23 degrees
LOCATION OF LUANO FOREST IN CHINGOLA

LEGEND
- Main farmac roads
- Power line 220kV
- District boundary
- Streams
- Built areas
- Forest boundary

SCALE 1:250,000

Source: Map sheet SD 35-3

N  Nsato forest reserve
C  Chingola local forest
L  Lushishi forest reserve
Celsius. This weather pattern and climatic conditions make Luano area ideally suited for Miombo woodland vegetation growth (Kay, 1967 and American Geological Survey, 1956).

3.1.3 VEGETATION

Fanshawe (1965), described Luano national forest as a “top quality Miombo woodland” dominated by Brachystegia, Julbernardia and Isorberlinia tree species. Marquesia, Uapeca, Syzygium tree species occur as associated vegetation. In depression areas called “sour dambos”, grass species of Adropogon, Hyparrhenia and Loudetia are dominant.

The Miombo woodland is maintained by early fires but destroyed by late fires. The tree species are deciduous in nature and burning the forests when the trees have defoliated give rise to a well maintained forest. The trees are well adapted to the environmental conditions found in the area.

Apart from the Miombo tree species, Luano national forest has a portion of exotic tree species. There are 80 percent Pine and 20 percent Eucalyptus species. The plantation is owned and maintained by Zambia Forestry and Forestry Industries Co-operation Limited (ZAFFICO) which was established in 1962. ZAFFICO has a capacity of producing 500,000m³ sawn timber per annum which forms 50 percent of the country’s timber production. The company could be 30 percent more productive if certain measures such as boundary maintenance and effective monitoring strategies are put in place, (Komex Ltd, 1995).

3.1.4 EDAPHIC CONDITIONS

The soils in Luano national forest are devised from a micaceous granite gneiss which contains many quartz and saprolite underlies most areas, (Fanshawe, 1965). The slopes in the area are generally between 1 and 6 percent. Weathering rates are very high and there are very few native materials. The soil types are sandy to sandy loams with good drainage but poor water holding capacity. They are highly leached, acidic, have very low fertility and nutrient levels.
The soils found in the water catchment areas have poor drainage and are more acidic than
the other places, thus, known as sour dambos, (Fanshawe, 1965). The area surrounding
the water catchments lies on deep well drained soil that forms the bulk of the woodland.
These are the areas extensively used for agricultural purpose and are heavily
enchroached. It is feared that enchroachment of the catchment areas will disturb the
hydrological cycle, (Maxwell, 1972).
CHAPTER FOUR

RESEARCH METHODS
The aim of this chapter is to outline all the methods employed in collecting data during the study. Both primary and secondary sources of data were used. The following methods were utilized to collect data: Questionnaire survey; personal interviews; Direct observation; maps and a satellite image and literature review. Data processing, analysis methods and presentation of data are outlined. Limitations of the study and problems encountered during the study are also given in this chapter.

4.1.1 PRIMARY SOURCES OF DATA

4.1.1.1 QUESTIONNAIRE

Three questionnaires were used to get information from the local people, companies utilizing resources from Luano national forest and other stakeholders, such as forestry Department officials.

A non-structured questionnaire (appendix (i) ) was used to collect data from the local people. This non-structured questionnaire was administered to the people found living or working in Luano forest to determine the benefits the local community, obtain from the forest and how they are involved in the management of the forest reserve.

STUDY SAMPLE AND SAMPLE SIZE
The study sample was the head of the household. In cases were the interviewee was not living in Luano forest, only people who work in the area were interviewed.
Judgmental sampling in which was considered appropriate because of the nature of the study sample, was employed in this study. Sample size was difficult to determine though 50 people were picked for the questionnaire interview.

The rationale for the selection of the local people was based on the fact that the area is not surveyed and enumerated, thus, the data on the total number of people living in Luano national forest was not available. Furthermore a substantial number of people live in Chingola and Kitwe or other towns. They only go to the forest to do agricultural activities. 50 people as a sample size was considered statistically sound.

A questionnaire (appendix (ii) ) was used to determine the resources used by companies utilizing resources from Luano national forest. This questionnaire was also used to assess how the companies help in the sustainable management of the forest. The companies interviewed were Zambia Forestry and Forestry Industries Cooperation limited (ZAFFICO), Zambia Electricity supply Cooperation limited (ZESCO). Zambia Railways and Copperbelt Energy Cooperation plc (CEC).

Another questionnaire for stakeholders (appendix (iii) ) was used to determine the resource management strategies that are employed in Luano national forest. It was also used to determine the factors threatening forest resources, stakeholder involvement with Luano forest and benefits of managing forest resources to the country as a whole. The stakeholders interviewed were officials from the Ministry of Agriculture Food and Fisheries, the Ministry of Tourism, Environment and Natural Resources and the Forest Department in Chingola.

4.1.1.2 PERSONAL INTERVIEWS

These interviews took place with the officials from the stakeholder institutions. They were mainly to enquire about some information that could not be captured through the questionnaire such as the history of Luano forest as a reserve.
4.1.3 DIRECT OBSERVATION

Direct observation on the ground was also utilized as a means of collecting data. This method assisted in the qualitative information that could not be captured through the questionnaire survey. It also helped in capturing the state of the forest and its structures such as huts and path ways that could not be captured by the satellite image or that were not yet updated on the analogue maps.

4.1.2 SECONDARY SOURCES OF DATA

4.1.2.1 DIGITIZED ANALQUE MAPS AND SATELLITE IMAGE

A satellite image, Landsat TM for August 2000 and digitized analogue maps for 1994 and 1995 were used to estimate the extent of encroachment (figure 3).

Digital image processing as described in Lillesand and Kiefer, 1987, were employed by the GIS department at the Ministry of Tourism, Environment and Natural Resources, Forest Department to come up with the satellite image layer. The digitized maps provided the other two layers used in the analysis. These three layers were overlayed to produce the land cover map to show the extent of encroachment into Luano national forest reserve. (figure 3)

Landsat TM band 7 was used in interpretation because of its high spatial resolution, 30m x 30m. The date for the satellite image was chosen because by August all the agricultural crops could have been harvested and a clear distinction between vegetated areas and bare land could be obtained. The satellite image was used as opposed to the aerial photographs suggested in the project proposal because the latest photos that were obtained were for 1984 and the maps were for 1973. Analysing of the data from these sets of materials was not going to give the true picture of what is on the ground. Enchroachment into Luano forest began way after 1991 when the forest was licenced to harvest because trees had matured and had reached ecological climax. Licenses were issued to people to harvest
timber, mainly foreigners, and the remaining trees were sold to the charcoal manufacturers. Therefore, it was only imperative to source current or real time data to get the situation on the ground.

4.1.2.2 LITERATURE REVIEW

Available literature on forestry and forest resource management were consulted and is presented in Chapter 2. The sources of this literature are outlined in the reference section.

4.1.3 DATA PROCESSING, ANALYSIS AND PRESENTATION

The data collected was processed using the coding system. Manual analysis of the data and tabulation was done in this study. This helped to work out the percentages of the responses. The analysed data is presented in form of maps, charts, tables and graphs to give visual representation of the data collected.

4.1.4 LIMITATIONS OF THE STUDY AND PROBLEMS ENCOUNTERED

The research findings presented in the next chapter of this report are subject to certain limitations. Some limitations are as listed:

- It was not possible to pre-test the research instruments due to limited time amidst pressure to meet the deadline for research proposals.
- There was no enumeration of the total population of the local people living in Luano national forest thus determination of the study sample size was difficult to come up with using statistical methods.
- The non-structured questionnaire was administered to respondents while they were in the midst of other activities such as farming and charcoal production. Therefore, the responses could have been affected by impatience by some respondents.

The problems encountered in the study were that of access to the local people. Apart from the gravel road used by ZESCO and CEC, there were no other roads, thus long
distances were covered on foot to interview a few people, making the study costly in the long-run.
5 CHAPTER FIVE

RESEARCH FINDING AND DATA ANALYSIS
The results of the data collected using the methods described in the methodology section (Chapter four) are as illustrated in paragraphs, tables, a map and figures below.

5.1.1 STATE OF LUANO NATIONAL FOREST
From the satellite image, Landsat TM7 and digitized maps for Luano national forest reserve in Chingola, six land cover types were obtained as shown in figure 3.

The areas represented by attribute code 111 had less than 9 percent canopy cover and covered 1041 hectares. These are used for cultivation and were classified as agricultural fields. The areas represented by attribute code 112 had between 10 percent and 39 percent canopy cover. They were classified as heavily enroached land covering 4036 hectares of land in total. The areas represented by attribute code 113 had canopy cover between 40 percent and 59 percent with a total hectarage of 1025. The areas were classified as low to open forest areas. The land cover with attribute code 114 represents areas with 60 percent up to 79 percent canopy cover. They were classified as medium dense forests with a total hectarage of 3053. The areas represented by attribute code 115 had canopy cover above 80 percent. They were classified as high dense forests covering 3097 hectares. The other land cover, represented by attribute code 116, is the portion of land with exotic trees referred to as an upgraded area. It was classified as exotic plantation area covering 880 hectares only. The plantation comprises of Pines and Eucalyptus tree species owned and managed by ZAFFICO. The details of how the total areas were obtained are given in (appendix iv).

5.1.2 LOCAL PEOPLE’S RESPONSES
From the study, 10 percent of the interviewed local people were women and 90 percent were men. 64 percent of the respondents, live in Luano national forest while 30 percent and 6 percent of the respondents live in Chingola and Kitwe respectively. Table 1 shows the number years the respondents have been living in Luano national forest.
Table 1: Number of years people have been living in Luano national forests

<table>
<thead>
<tr>
<th>No. of Respondents</th>
<th>Percentage (%)</th>
<th>No. of years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>Between 7 and 3 years</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>Less than 3 years</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Not sure</td>
</tr>
<tr>
<td>18</td>
<td>36</td>
<td>Kitwe or Chingola</td>
</tr>
</tbody>
</table>

Source: Data collected in the field

When asked why they chose to live or work in Luano forest 22 percent of the respondents said the place has fertile soil good for agriculture. 6 percent of the respondents said it was the only place they could find for settlement and 72 percent of the respondents cited poverty as the many reason for them to choose Luano forest.

Apart from the 70 percent respondents who were engaged fully in agricultural activities, 20 percent of the respondents were miners, 6 percent respondents were teachers and 4 percent of the respondents were charcoal manufacturers.

5.1.2.1 Forest Benefits the Local People Get

From the study findings, a number of benefits people get from the forest were as illustrated in figure 4. 80 percent of the respondents said agriculture land or good harvest while 8 percent said firewood. However, 8 percent of the respondents were yet to get benefits because it was their first year of farming. 2 percent of the respondents said there are no benefits from the forest because there is no "Mushitu" (forest) as the area is now an agricultural area.
Figure 4: Benefits obtained from Luano national forest

Source: Data collected in the field.

The study revealed that people do not get any help such as extension services from the forest department. 98 percent of the respondents had not seen any forest official since they started living or working in Luano national forest. 2 percent of the respondents, had only worked with the forest officials in the past and do not get to see them nowadays. When asked what they wanted the forest department to do for them, the responses were, farming inputs, title deeds, and social amenities in form of schools, clinics, a market and
a road that link the area to the townships in Chingola. The responses are summarized in figure 5.

Figure 5: Shows the things Luano settlers want the forest department to do for them

Source: Data collected in field

The study further revealed that 90 percent of the respondents have never been harassed since they settled or started working in the area. 6 percent of the respondents have experienced border disputes with neighbouring farms and 4 percent of the respondents have been harassed by charcoal manufacturers who bought trees from the forest department and have come back to claim the land.

5.1.2.2 FOREST CONSERVATION BY THE COMMUNITY

The responses to how individuals and Luano community can contribute to the conservation or sustainable management of Luano forest are presented in figure 6. Close to half the people said they will produce a lot of food to alleviate poverty. 28 percent of the respondents were for the idea of working in co-operatives and only 8 percent said they would plant trees to avoid desertification.
Figure 6: Shows the percentage of people and what they can do to conserve or manage Luano forest.

Source: Data collected in the field.

5.1.3 STAKEHOLDER INSTITUTION

The stakeholder institutions that were interviewed in this study, were, the Ministry of Agriculture Food and Fisheries (MAFF), the Ministry of Tourism, Environment and Natural Resources and the Forest Department in Chingola. These institutions have been involved with Luano national forest for over 20 years. The Ministry of Tourism, Environment and Natural Resources have been protecting, managing and conserving biodiversity of the forest. The MAFF have been providing agricultural extension services and inputs to the local people in the area. The forest Department in Chingola have been protecting the forest by controlling charcoal manufacturing, sand pit mining, boundary maintenance and early burning for sustainable utility of the natural resources.
5.1.3.1 FOREST RESOURCE MANAGEMENT

From the study finding, the stakeholder institutions cited the control of illegal charcoal manufacturing as the most common forest management practiced in Luano national forest. The details of the responses are presented in figure 7. There are no soil conservation practices being done in the area.

Figure 7: Forest management in Luano

Source: Data collected in the field

5.1.3.2 FACTORS DEPLETING RESOURCES IN LUANO FOREST

The factors threatening the depletion of forest resources in Luano national forest are shown in table 2. Illegal charcoal manufacturing and conversion of forest land
to agricultural land are the most common factors depleting Luano forest resources. Settlement and enchroachment are other factors identified.

Table 2: The factors depleting forest resources and percent of respondents

<table>
<thead>
<tr>
<th>Factor</th>
<th>Contribution %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illegal charcoal production</td>
<td>33.3</td>
</tr>
<tr>
<td>Conversion of forest land to Agric. Land</td>
<td>33.3</td>
</tr>
<tr>
<td>Grazing</td>
<td>0</td>
</tr>
<tr>
<td>Enchroachment</td>
<td>11.1</td>
</tr>
<tr>
<td>Others (settlement and poverty, Fire)</td>
<td>22.2</td>
</tr>
</tbody>
</table>

*Source: Data collected in the field.*

The benefits obtained from the forest as a result of good forest management were as illustrated in the table 3 below.

Table 3: The benefits of forest resource management

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribute to the growth of the economy</td>
<td>18</td>
</tr>
<tr>
<td>It stores biodiversity</td>
<td>30</td>
</tr>
<tr>
<td>Catchment for soil and water</td>
<td>15</td>
</tr>
<tr>
<td>Support industrial and commercial activities</td>
<td>10</td>
</tr>
<tr>
<td>Provides employment</td>
<td>7</td>
</tr>
<tr>
<td>Provides food through Agriculture</td>
<td>20</td>
</tr>
</tbody>
</table>

*Source: Data collection in the field*
When asked about what should be done to Luano national forest in order to manage its resources sustainably, the MAFF suggested the incorporation of agro forestry principles in the farming practices in the area. The Ministry of Tourism, Environment and Natural Resources suggested participatory forest resources management and the Forest Department in Chingola suggested the degazettement of the forest so that it becomes a Joint Forest Management entity for its sustainable management.

5.1.4 COMPANIES UTILIZING RESOURCES FROM LUANO NATIONAL FOREST
The companies utilizing resources from Luano national forest were Zambia Electricity supply Co-operation limited (ZESCO), Copperbelt Energy Co-operation (CEC), ZAFFICO and Zambia Railways. The types of resources they use are presented in figure 8.

Figure 8: Shows resources utilized by companies from Luano national forest.

Source; Data collected in the field.

ZESCO and CEC use the forest land as an economically feasible route to extend power supply to other provinces and consequently, to the Democratic Republic of Congo.
Zambia Railways have passed a railway line near the forest and used the timber from the forest to make the rail sleepers. ZAFFICO found the area a good site quality for their plantations of exotic pine and Eucalyptus tree species.

5.1.4.1 COMPANY INVOLVEMENT IN RESOURCE UTILISATION

To ensure sustainable use of resources from Luano national forest, CEC was ready to work with all stakeholders to support community conservation activities. Zambia Railways will ensure community participation in conservation and afforestation programmes. ZESCO and ZAFFICO had community education through the community consultation programme. The programme has been identified as the best tool to manage, conserve and utilize resources that Luano national forest has to offer in the long-run. ZESCO provided a vehicle used in the community consultation programme.
CHAPTER SIX

DISCUSSION
This chapter will focus on the understanding of the results and provide a critical appraisal in relation to the points made in the literature review. It also focuses on what points can be refuted and what can be inferred. The demonstration of the constraints as well as the strengths of this study will also be done in this chapter.

6.1.1 STATUS OF LUANO FOREST RESERVE
The status of forests is often very difficult to assess as there is no clear cut definition of encroachment. According to the Forest Act, 1998, the forest reserve should be without any anthropogenic activities, not even a pathway. Therefore, encroachment can only be described in qualitative terms and by the year 2000, over 46.5 percent of the forest (figure 3) was extensively encroached, almost depleted. By the time of the study, more and more forest land was converted to agricultural land. Large areas were devoid of the natural Miombo woodland tree species, though, stumps of trees gave evidence of overexploitation. The forest had numerous pathways across and within the forest. The plantations also had stumps of trees from the illegal cutting by the local people or others to meet their building material needs.

The improvement of the access road to Luano substation by ZESCO in the mid 1990s led to the influx of people into the forest and in a way contributed to the encroachment. 30 hectares of the forest is to be cleared to pave way for the development of the Luano-Kansanshi 330kV power line project. ZESCO officials justify the clearance saying it will have minimal impact on the local environment because the forest is heavily encroached and the trees will be stumped instead of being uprooted, therefore, there will be soil conservation.

6.1.2 FACTORS THREATENING RESOURCE DEPLETION
The direct causes of resource depletion identified in the study were illegal charcoal production, conversion of forest land into agricultural land and encroachment. The other anthropogenic factor responsible was late fires usually from the preparation of
agricultural fields. These factors interact to cause damage to vegetation cover, reduce soil fertility levels and cause environmental degradation. Demographic trends in terms of growth, migration and density combined with social and economic factors are among the root causes of resource depletion.

Information on land use is not readily available to everyone. Thus, the question of ownership and land tenure are not well defined. This resulted in the local people taking advantage of what they thought was an open resource. From (www.biodiv.org), “It is widely believed that poor populations in places where natural resources are abundant and where health facilities, schools and basic infrastructure are absent the people have no option but to exploit their local environment to meet subsistence needs”.

There are other resource users who are only interested in timber harvesting which is one of the major threats to resource depletion. These people come from Chingola, Kitwe, Kalulushi other towns in Zambia, and beyond the national boundaries.

6.1.3 FOREST RESOURCE MANAGEMENT STRATEGIES

Within the confines of the study, there are no resource management strategies for managing Luano national forest. Ochieng-Odhiambo (1997) argues that a broader approach to forest management should integrate the social, economic and ecological aspects of forestry. At national level, there is lack of comprehensive forest resources assessment contributing to poor planning and policy formulation because these activities are based on inconsistent estimates. ECZ (2001), acknowledged the lack of up to date information of forest resources and encroachment of forest reserve boundaries in the country as a whole. There is also lack of coordination between conservation programmes and forestry policy.

Land use planning is an important process of coordination and zoning to ensure separate compatible and incompatible land uses. Land uses should be clear but the functional linkages between these uses should be maintained. Omosa, (1998) identified land tenure as a key factor in natural resources conservation and management in Kenya. The rights
of the local people in natural resource management and harvesting are still often very rudimentary. People are insecure and have little control over the land they are occupying. The flaws in legal instruments make it easy for people to encroach and at the same time cannot protect the forest reserve once encroached.

The Forest Department in Chingola have a shortage of human resources. A few workers (3) at the department who are supposed to protect the forests by controlling charcoal production, sand pit mining, late burning, boundary maintenance and general forest management for sustainable utility of natural resources cannot do these duties effectively. Lack of adequate funding coupled with lack of transport makes it extremely difficult for the department to patrol the forests and to perform their duties. Basically, they have concentrated on working in the local forests where JFM programmes have been implemented. The absence of any monitoring activities from the forest department left the forest reserves vulnerable to encroachment and resource depletion.

### 6.1.4 BENEFITS

The benefits the local people get from the forest are measured in terms of the agricultural outputs. Their priority is household food security. This implies that they view the place as an agricultural area and not as a forest. They could not even acknowledge the non-timber products such as mushrooms as benefits. The ecological role of the forest such as acting as catchment for soil and water is being adversely affected as encroachers have no information about the catchments areas.

The possible benefits the local people and the whole country could get from the forests in form of employment opportunities have been hampered by massive redundancies from the Forest Department and retrenchment of people from other forms of forest related occupations. This has contributed to the low levels of economic growth, even, when the forestry sector has potential for growth, (ECZ 2001).
6.1.5 IMPLICATIONS OF RESULTS
The results of the study imply that Luano forest reserve is no longer an intact, Miombo woodland it used to be in the 1960s and 1970s. The forest with the scant natural trees is almost certain to disappear completely unless drastic measures to conserve and manage this forest are implemented because the current trends show a “downward spiral” or depletion of stocks of resources in the forest.

6.1.6 STUDY CONSTRAINTS
There were no non-governmental organizations (NGOs) identified to have any involvement in the conservation and management of Luano forest. Ssembajjwe (1997), emphasised the vital role NGOs play in decision making and implementation of actions concerning forests in Tanzania. They also play an important role in focusing public attention on threats and opportunities related to forests. Even though the participation of all stakeholders is recognised in the 1998 Forest Policy (ECZ, 2001), NGOs participation is far from making an impact in the forest sector especially in forest reserves such as Luano where no management strategies are employed.
7 CHAPTER SEVEN

CONCLUSION

Luano national forest is heavily encroached with a few trees, which are a remnant of the once intact Miombo woodland. Mismanagement of this productive forest through encroachment, cultivation, fire and over exploitation for various uses directly contributed to the depletion of the forest resources. Poverty as a result of redundancies and poor micro economic policies with no favourable terms of forest harvesting, indirectly affected the trends in resource consumption by the local people. (WCED) 1987, stated that the essential needs of the world’s poor must be met or they will be pushed into abusing and overexploiting the forest resources.

Government policies should include forest management programmes that will help reforest the deforested areas, control fires, shifting cultivation and give more attention to forestry research. Personnel recruitment and establishment of up-to-date data base so that the management of the Forest Department will be enhanced, should be a major priority. Forest policies should be revised for stakeholders to resolve areas of common interests or conflicts. The forest resources with its numerous functions should be conserved, regenerated and harvested in a way that they are not depleted or destroyed. Land use planning information must be communicated to everyone and boundaries clearly demarcated to avoid encroachment and promote sustainable resource utilisation.

The interests and responsibilities of forest land managers must be expanded to include, management of trees in any production system. They should not just focus on forest products of wood, fruits or other industrial raw materials but the prime functions of the trees to provide agricultural crops, protect water catchments and soil erosion. Forest enchoachers should be viewed as protectors of forests and consider integration of agro forestry in (JFM) programmes that should be designed specifically for the encroached forest reserves. This will ensure food security for the impoverished settlers and provision of forest products that can restore the dwindling forest sector growth. Massive afforestation programmes by communities, NGOs and the government should be part of
the harvesting terms so that consumption of forest resources and their regeneration does not have a major imbalance.

7.1.1 RECOMMENDATIONS

- Luano National forest reserve should be degazetted so that it becomes a Joint Forest Management entity to allow full participation of the local people, NGO's and the government for sustainable management and development.
- The government should formulate policies that will effectively reduce poverty. These policies should provide knowledge to the poor so that they utilise the natural resources in a sustainable manner. The other policies should have comprehensive planning, effective implementation and control of harvesting operations to avoid encroachment into protected areas.
- There should be a wider platform on which forestry information should be made available to the people. Radio and Television programmes, drama performances in local communities and introduction of natural resources conservation in school curriculum could increase people's perception of the value of forests.
- There should be an improvement in methodologies used to collect forestry information in order to incorporate social, economic and ecological values of trees, forests and forest land into national accounting systems.

7.1.2 FURTHER RESEARCH

Inventory making of all forests in Zambia should be undertaken so as to know the levels of deforestation and extent of encroachment in order to come up with management strategies that will sustain the forest resources. These inventories should focus on forest reserves were JFM programmes have not yet been implemented.

Research to establish the threats against protected areas caused by outsiders rather than the encroachers should be conducted to have an overview of the impact of their activities on the local community and the environment.
The effects of tree depletion on the hydrological cycle in Luano forest should be investigated to determine the impacts of changes on the micro climate.
REFERENCES


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APPENDICES

7.2.1 Appendix (i)

INTERVIEW SCHEDULE FOR THE LOCAL PEOPLE IN AND NEAR LUANO NATIONAL FOREST.

1. Sex:

2. Do you live in or work in this area?

3. How long have you lived in this area?

4. What is your occupation?

5. Why did you choose to live or work in this area?

6. What benefits does the forest offer you and the community?

7. What help do you get from the forestry department?

8. What would you want the forestry department to do for you?

9. Do you get harassed by forest workers or people from other areas?
10. How can you and your community contribute to the conservation/sustainable management of the Luano forest reserve?
7.2.2 Appendix (ii)

THE UNIVERSITY OF ZAMBIA

SCHOOL OF NATURAL SCIENCES

DEPARTMENT OF GEOGRAPHY

A QUESTIONNAIRE ON ASSESSING FOREST RESOURCE MANAGEMENT

IN LUANO NATIONAL FOREST

Dear Respondent

I am a student from the University of Zambia conducting research to assess forest resource management in Luano National Forest, the Benefits of Resource Management and factors that are threatening these resources. Your company was chosen on purpose to participate in the study. The information you give is purely for academic purposes and will be kept in strict confidence.

You will be directed on how you are supposed to answer the questions. Please answer them as honestly as possible.

NAME OF ORGANISATION

POSITION OF RESPONDENT

1. What forest resources/products do you use as inputs in your factory? (Tick as many as applicable).

☐ Timber

☐ Mushroom

☐ Honey

☐ Others (specify)
2. How do you use the forest resources? (Specify products)

3. Who are your source of these forest resources? (Tick as many as applicable).

- [ ] Luano national forest.
- [ ] Forests outside Chingola.
- [ ] Forests outside the country.

4. Does your factory have any programmes with Luano national forest? (Tick one).

- [ ] Yes
- [ ] No

5. If the answer is yes to Q4, specify the programme's activities and if the answer is no to Q4 state why you do not.

6. In your opinion, how is your factory involved or should be involved in ensuring sustainable use of the forest resources from Luano national forest? (Please explain).
7.2.3 Appendix (iii)

THE UNIVERSITY OF ZAMBIA

SCHOOL OF NATURAL SCIENCES

DEPARTMENT OF GEOGRAPHY

A QUESTIONNAIRE ON ASSESSING FOREST RESOURCE MANAGEMENT
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You will be directed on how you are supposed to answer the questions. Please answer them as honestly as possible.

NAME OF ORGANISATION

POSITION OF RESPONDENT

SECTION A

1. How long has your organisation been involved with Luano national forest?

   (Tick one)
more than 20 years

Between 5 and 20 years.

Less than 5 years.

2. Is your institution aware of the forest management practiced in Luano national forest? (Tick one)
   
   Yes
   
   No

3. If your answer to question 2 was yes, what practices do you know? (Tick as many as applicable)

   Agroforestry
   
   Soil conservation
   
   Control of illegal charcoal burners and Agricultural plots.
   
   Other (Specify) ________________________________

   Not applicable

4. How involved is your organisation in the management of Luano national forest? (Please explain)

   __________________________________________________________

   __________________________________________________________
SECTION B

5. What factors threaten the depletion of forest resources in Luano national forest?
   - Illegal charcoal manufacturing.
   - Conversion of forest land into Agricultural land use.
   - Grazing
   - Enchroachment
   - Others (Specify) __________________________

6. What are the benefits of forest resource management?
   - Contribute to the growth of the economy.
   - It stores ecological biodiversity.
   - Catchment, for soil and water.
   - Support industrial and commercial activities.
   - Provide employment.
   - Produce food through agriculture.
   - Others specify.

7. In your opinion, what should be done to Luano national forest so that its resources are sustainably managed (Please explain).
### 7.2.4 Appendix (iv)

**TABLE SHOWING THE AREAS MAKING UP EACH LAND CLASS FROM THE LAND COVER MAP (Figure 3 )**

<table>
<thead>
<tr>
<th>LUCODE</th>
<th>COUNT</th>
<th>DENSITY</th>
<th>ID</th>
<th>AREA_HA</th>
</tr>
</thead>
<tbody>
<tr>
<td>111</td>
<td>1</td>
<td>Fields</td>
<td>3</td>
<td>345</td>
</tr>
<tr>
<td>111</td>
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<td>Fields</td>
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<td>Fields</td>
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<td>111</td>
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<td>Fields</td>
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