ASSESSING THE IMPACT OF AGRICULTURE ON PROTECTED AREAS, A CASE STUDY OF ARUSHA NATONAL PARK- ARUSHA- TANZANIA

BY

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A DISSERTATION SUBMITTED TO FACULTY OF SOCIAL SCIENCES IN PARTIAL FULFILMENT FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN ENVIRONMENTAL MANAGEMENT

NOVEMBER 2008

DECLARATION

I, Nyangusi Mathias, Registration Number BEM/10370/52/DF declare that the work presented in this report is my own and has never been presented in any University or Institution.

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SIGNED ----------

DATE. 28/12/2008

APPROVAL FOR SUBMISSION

This work has been under my supervision as a University supervisor and submitted with my approval.

SUPERVISOR: NAOMI OBBO

SIGNED ----------

DATE 28/12/2008 ----------

DEDICATION

This research is dedicated to my parents Mathias and Flora Lowassari, Mr. and Mrs. Noel Lowassari and my brothers and sisters Gipson; Philipo, Samwel, Saraphine, Evaline and Thabea. Your are a great aspirators to my life.

ACKONOWLEGEMENT

I wish to express my thanks to Almighty God for granted me good health, all those who assisted me materially and morally to be able to complete this research successfully. Special thanks goes to my supervisor Ms.Naomi Obbo whose guidance, advice and effort made this research paper a success.

I would like also to express my words of gratitude to Mr. and Mrs. Noël lowassari for their encouragements, Caroline Onyonja. Julius Edward, Meshack Elphas, Denis Paul, Neema Mwakisambwe for their suggestions, ideas and enthusiasms.

I highly indebted to the various persons of Arusha National Parks authority, and the local community who responded my research questionnaires and interviews, their valuable information helped me to accomplish the requirements for research objectives.

Finally special thanks goes to my family for their financial support their offered me through out the three years that finally made this research success

TABLE OF CONTENTS

Declaration.....ii
Aproval for submission.....iii
Dedication.....iv
Acknoledgment.....v
Abstract.....xiii

CHAPTER ONE: INTRODUCTION.....1

1.1. Back ground to the study.....1
1.2.Statement of the Problem.....3
1.3.General objective.....4
1.3.1.Specific objectives.....4
1.4.Significance of the study.....4
1.5 .Research questions.....5

CHAPTER TWO: LITERATURE REVIEW.....6

2.1 Introduction 6
2.2 Definition of Key concepts.....6
2.3 Reasons for practicing agriculture around PAs 9
2.4. The impacts of agriculture on protected areas 10
2.5. Efforts carried out so far to reduce the adverse impacts of agriculture on PAs.....13

CHAPTER THREE: METHODOLOGY.....15

3.1. Introduction.....15
3.3. Area and Study Population.....15
3.3.1. Location.....15
3.3.2. Climate.....16
3.3.3 Social economic situation.....16
3.3.5.Geology and soils.....16
3.3.6.Wildlife.....17
3.4. Sample selection and size.....17
3.5. Data Collection Methods and Research Instrument.....17
3.5.2. Oral interview.....17
3.5.2. Observation and photography.....18
3.5.3. Secondary Data 18
3.5. Procedure of collecting data.....18
3. 6 Data Processing and Presentation analysis 18

TABLE OF CONTENTS

Declaration.....ii
Aproval for submission.....iii
Dedication.....iv
Acknoledgment.....v
Abstract.....xiii

CHAPTER ONE: INTRODUCTION.....1

1.1. Back ground to the study.....1
1.2.Statement of the Problem.....3
1.3.General objective.....4
1.3.1.Specific objectives.....4
1.4.Significance of the study.....4
1.5 .Research questions.....5

CHAPTER TWO: LITERATURE REVIEW.....6

2.1 Introduction 6
2.2 Definition of Key concepts.....6
2.3 Reasons for practicing agriculture around PAs 9
2.4. The impacts of agriculture on protected areas 10
2.5. Efforts carried out so far to reduce the adverse impacts of agriculture on PAs.....13

CHAPTER THREE: METHODOLOGY.....15

3.1. Introduction.....15
3.3. Area and Study Population.....15
3.3.1. Location.....15
3.3.2. Climate.....16
3.3.3 Social economic situation.....16
3.3.5.Geology and soils.....16
3.3.6.Wildlife.....17
3.4. Sample selection and size.....17
3.5. Data Collection Methods and Research Instrument.....17
3.5.2. Oral interview.....17
3.5.2. Observation and photography.....18
3.5.3. Secondary Data 18
3.5. Procedure of collecting data.....18
3. 6 Data Processing and Presentation analysis 18

LIST OF TABLES

(I) Factors influencing agriculture around ANAPA.....21

(II) Main type agriculture activities carried out around ANAPA.....22

LIST OF PLATES

Plate 1-showing restraining and administration of Rabies vaccine to control transmission zoonotic diseases.....25

Plate 2. Big Momella lake in ANAPA.....26

LIST OF FIGURES

Figure 1: Showing the reason of practicing agriculture around ANAPA 21

Figure 2: Showing main type of agriculture carried out around ANAPA 22

LIST OF APPENDICES

Appendix i: Letter of Introductory from the faculty..... 31

Appendix ii. Research questionnaires..... 32

Appendix iii. Arusha National Park map..... 36

Appendix iv. Map of Tanzania showing Arusha National Park.....37

Appendix v. Bibliography..... 38

LIST OF ABBREVIATIONS

ANAPA	-	Arusha National Park
Pas	-	Protected Areas
IUCN	-	International Union Organization
NGOs	-	Non Governmental Organization
CCS	-	Community conservation services
SCIP	-	Support for the community initiated project
NP	-	National Park
COMPACT	-	Community Management of Protected Areas Conservation of Tanzania
WCST	-	Wildlife conservation society of Tanzania
WRI	-	World resource institute
TANAPA	-	Tanzania National Park

ABSTRACT

A study on assessing the impacts of agriculture on protected areas was carried out in Arusha National Park in Tanzania.

The variables considered include identifying the factors influencing agriculture around Arusha National Park (ANAPA) and major type of agriculture activities carried out, examining the impacts of these activities on ANAPA and identify the effort of local community and NGOs and National Park Authority to address these effects of agricultural activities on ANAPA and also suggestion for further measures minimize the impacts.

To investigate the above variables a general survey research design was used, the data collection tools used includes the interview; observation, questionnaires and literature review.

The study further more identify the major reasons for practicing agricultural activities around Arusha National Park such as livestock keeping such as goats ,cattle, sheep's and rearing pigs, cultivation of food crops such maize, beans, tomato, onions and banana and coffee to small extent.

The study revealed the effects of agricultural activities around ANAPA in the general wild biodiversity in the Park and around the Park. The major impacts on the area of study identified ware transmissions of diseases from domestic's animals to wild animals, loss of wild diversity habitats through clearing land to get more land for cultivation, distraction of migratory route of wild animals and disappearing of indigenous plant species. The researchers established what has been done to protect the wild biodiversity in and around the park through community participation, setting the policies and laws.

The study comes up with recommendation that must be put in place in order to minimize the effects of agriculture on ANAPA and these include arising awareness of the public and decision makers, community participation and defining clear roles of relevant agencies.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Agriculture and protected areas are some time seen as opposite ends of spectrum, but in fact they can play important complementary roles especially when the protected areas are managed in ways explicitly designed to support agriculture development.

The direct ecosystem services provided by agriculture, namely food and fiber, have been enhanced significantly over the past century via improved farming techniques and technology. Most notably, the "green revolution" of the 1960s and 1970s grew global grain yields by 60%. As a result, today's per capita food supply is approximately 25% larger than it was in 1961, and the real price of food fell 40% during this period (FAO, 2007)

Although the world's population is projected to increase by 50% between 2000 and 2050, most experts currently believe that agriculture will be able to grow space. The Food and Agriculture Organization (FAO) predicts that 80% of the needed increase in food production will come from greater input use and improved technology on existing land. The remaining 20% will come from expansion onto new land, predominantly in South America and sub-Saharan Africa.

However the greatest losses in biodiversity worldwide have been attributed to the expansion and intensification of agriculture and land use, these are often characterized by transforming of complex ecosystem and land scopes into simple ones resulting into reducing of biodiversity.

Agriculture occupies more than one third of the world land and it is the leading causes of habitat distraction on global basis. In the face of an expending world population and rapid economic growth, global agriculture has kept space via there double growth in scale and intensity.

It has provided increasing quantities of crops, livestock and fish every decade, but often at the cost of other under value of ecosystem services such as climate regulation, water provision and biodiversity.

Increasing of intensity of agriculture will place more strain on already stressed ecosystems and wildlife in protected areas. Agriculture currently consumes more land and water than any other human activity with crops and pasture occupying of the world total land area and accounting for total water use in 2005, the appraised the state of 24 key ecosystem services and 15 were being degraded or used unsustainably Swaziland(Anderson 1993)

As a consequence, agriculture is a leading driver of soil erosion, water production, biodiversity loss in and out of Protected Areas, Green gas emission from land use change. Agriculture is the primary driver of land use change and deforestation.

Degradation and distraction of forest have a severe impact on wild life habitant and biodiversity with potentially irreversible loss of animals and plant life. The World Conservation Union (IUCN) and the World Resources Institute (WRI) estimate that 64 percent of original wildlife habitant in sub Sahara Africa has already been lost. The main causes are deforestation conversion of wetland to agriculture uses and other human activity.

Protected area as biodiversity bench mark allow separation of direct effects of human impact on biodiversity loss from those of other environmental changes, however urbanization and agriculture are the two most important threat to biodiversity world wide, the intensities of these land use phenomena however as the level of biodiversity itself differ widely amongst regions.

Rural poverty and hunger, prohibitive costs of wildlife law enforcement and human wildlife conflicts a rising from land use practices severely limit wild life conservation outside African's national parks. Developing conservation approaches that are culturally accepted as well as financially and ecologically sustainable in responses to these challenges would have enormous implications for maintaining viable larger mammal populations in Africa. In eastern and southern Africa conservation efforts have placed much emphasis on tourism to link tourism revenues to conservation outside protected areas on community land. Except where human population are small or revenues exceptionally high, tourism income on a per capital basis is generally to little to modify local land use practices on a scale needed to protect large mammal species and their habitant (Lambin 2001).

1.2 Statement of the Problem

The agricultural activities (livestock keeping and crops growing) protected areas has the negative impacts or the ecosystem within the protected areas, Arusha National Park which is a protected area lack the buffer zone which delineate human activities such as grazing non extractive agro forestry, and cropping. This allow this interaction of domestic animal and wild animals hence they interception of domestic animals and wild animas end up with transmission of diseases from domestic animals to wild animal and also from wild animals to domestic animals, many emerging of infections disease of wild animal life are associated with the spill over of pathogens from domestic animals to wild life population with the translocation of host or parasite by lumen, for example zoon tic viral disease after much in put both domestic and wild animals .

The exploitation of the Anana forest for subsistence utilization result into degradation of the National Park ecosystem due to distraction of habitats for wild animals as well as destruction of migratory route of wild animals, the use of agrochemicals also around ANAPA cause the eutrophication in water bodies in ANAPA hence during the rain season agrochemicals run in water bodies through water run off into water bodies in the Park and interferers with the favorable habitat of aquatic organism such as fish species and some aquatic birds.

The subsistence farming around the park result into introduction of exotic plant interferes with indigenous plants which is a favorable habitat for wild animals. As the population increases around ANAPA result into increase the demand of the resources available in the park as far as the ANAPA is the major source of water for irrigation and for domestics purposes, the demand of water will increase to suit the need of the growing population hence this result into over extraction of water from the park for irrigating and for domestic use.

However due to effects associated with agricultural activities around ANAPA, there are some effort from non governmental organization (NGOs) and local community which are trying to minimize the impacts of agricultural activities on ANAPA such as Community Conservation Initiated Support (SCIP) for conservation of wild animals and providing environmental education through workshops services and meetings.

1.3. General Objective

The purpose of this study is to examine the impacts of agriculture on the biodiversity in the Protected areas, and how to minimize the negatives effects caused by agriculture.

1.3.1. Specific objectives

(i) To discuss the major reasons why agriculture is carried out around Arusha National Park
(ii) To examine the impacts of agriculture on Arusha Nationa Park
(iii) To identify the local and NGO's efforts to address the effects of agriculture on Arusha National Park
(iv) . To suggest the possible solutions to address the problem of agriculture on Arusha National Park.

1.4 Significance of the study

By studying the impacts of agriculture on protected areas, the research information will be availed to environmentalists as well as non governmental organizations (NGO's) concerning with conservation of wildlife such as worldwide life fund (WWF), community conservation service(CCS), Support for Community Initiated project (SCIP) which concern with creation of awareness to local community on conservation of the environment through workshops services and meetings, Community Management of Protected Area Conservation of Tanzania (COMPACT) which concern on the conservation of wildlife.

The research study will also create awareness among the local community living around ANAPA on the effects of agriculture on PAs can have on their daily agriculture activities and the effects on wildlife in the Park and they must do in order to minimize the effects caused by agricultural activities to PAs.

The study will help other students of the same field in the future to carry out a similar research during their academic study in the University hence some copy will retained in the faculty where others student will use it as a sample

1.5 Research questions

1. Why is agriculture carried out around Arusha National Park?
2. What are the major effects of agriculture on Arusha National Park?
3. What are the local efforts and NGOs to address these effects of agriculture on Arusha National Park?
4. What are the measures that can be put in place to control the problem of agriculture on ANAPA?

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Agriculture and protected are as some time seen as opposite ends of a spectrum, but in fact they can play important complimentary roles especially when the protected areas managed in ways explicitly designed to support agriculture development. Protected areas provide water for agriculture systems. However protected areas also out line possible conflicts between the agriculturalist and protected areas management (Jeffrey and Needy 1993)

Agriculture, grazing, forestry, and other managed ecosystem cover at least two thirds of the terrestrials surface of the planet where as protected areas cover only 6 percentage and the remaining percentage is wilderness urban lands e.c.t. Technological solutions to agricultural problem have left a legacy of concentrated land ownership, marginalized indigenous people and small farmer, rural impoverishment and other social problems. In current agricultural varieties and food plants there are often far more suited that, the modern verities and local condition and dietary preference (Neely and Norgard 1992).

Human population growth, agricultural expansion, deforestation, hunting and the ramifications of economic development have had profound cumulative impacts on the environment, natural habitats and wildlife populations all over the world. East Africa is no exception. The number of people in Kenya, Tanzania and Uganda has doubled over the past 20 years, and is set to double again in the next 30-40 years.

2.2 Definition of Key concepts

Agriculture refers that and science of crop and livestock production, in this broadest sense, agriculture comprises the entire range of technologies associated with production of useful products from plants and animals including soil cultivation, crop and livestock management and the activities of processing and marketing. Agriculture encompasses the whole range of economic activities involved in manufacturing and distributing the industrial inputs used in farming (Diamond 1988).

Biodiversity is the short term of biological diversity. It refers to the variety of living things on the earth and their interaction with the environment. Scientists often categorize them into three component i.e. species, genes and ecosystem diversity (Fallmeir 1993)

Buffer zones, buffer zones link protected areas to one another through the preservation of habitat. By definition, these areas are intended to remain under wild cover or be managed in such a way to ensure that human land use is compatible with the maintenance of a high degree of biological connectivity. Buffer zones are used in protected areas to delineate areas where human activities such as grazing, non extractives agro forestry, cropping, hunting and gathering may occur.

The definition of a protected area adopted by International Union Conservation of Natural resource (IUCN) is An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.(IUCN1994)

Protected Area Management Categories

IUCN has defined a series of six protected area management categories, based on primary management objective. In summary, these are:

Box 1	Protected areas management categories
CATEGORY Ia:	**Strict Nature Reserve: protected area managed mainly for science**
Definition	Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.
CATEGORY Ib	**Wilderness Area: protected area managed mainly for wilderness protection**
Definition	Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.
CATEGORY II	**National Park: protected area managed mainly for ecosystem protection and recreation**
Definition	Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.
CATEGORY III	**Natural Monument: protected area managed mainly for conservation of specific natural features**
Definition	Area containing one, or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.
CATEGORY IV	**Habitat/Species Management Area: protected area managed mainly for conservation through management intervention**
Definition	Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.
CATEGORY V	**Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation**
Definition	Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.
CATEGORY VI	**Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems**
Definition	Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

Source. (IUCN 1994)

2.3 Reasons for Practicing Agriculture Around PAs

There are many different factors which influence the kind of agriculture practiced at a particular area such as climate, soil, water availability and topography vary widely throughout the world and this variation brings about the wide range in agricultural outputs. (D.T. Msabila 2002)

Protected areas provide valuable services to the local communities which include soil regeneration, nutrient cycling, pollination, recreation, provision of pure water which influence entire practices of agriculture. One of the most important services provided by protected areas especially in view of the major investments in water and agriculture in much of the developing world is the stabilizing of hydrological functions. Natural vegetation covers on the watersheds regulates and stabilize water runoff. Deep penetration by tree roots or other vegetation makes the soil more permeable to rainwater so that is slower more uniform than on cleared land. It has been shown that in Malaysia the peak runoff per unit area of forested watersheds is about half than that of rubber or oil palm plantations, whereas the low flows are roughly double. (Daniel and Kulangham 1974)

Protected areas support agriculture especially through the protection of watersheds, providing protection against floods, reducing erosion and improving ground water supplies, In Thailand, it has been shown that an annual expenditure for watershed protection relation to the Nam Pong Reservoir of about US$ 1.5 million from the World Bank, justified on the basis of the protection of the park provided to a major irrigation project in lowlands below. However this function is very complex and relatively few data are available to support any particular conclusion. (Bosch and Heleft).

Natural vegetation cover and litter can provide good soil protection for agricultural activities and provide productive capacity of protected areas, prevent dangerous landslides, safeguard riverbanks and prevent the distraction by siltation. In Malaysia, the suspended stream sediment load following logging increased by 70 to 97% (Kasran 1988). Thus, protected areas can contribute significantly to the longevity of downstream reservoirs and irrigation systems. A good example of the value of soil conservation is provided by the Royal Chitwan National Park of Nepal (Roberts and Johnson 1985). Outside the park, villagers have cleared and grazed the North Bank of the Rapti River (which forms the park boundary) so intensively that is the subject of rapid

erosion. Within the park on the south bank, the protected binds the soil so that when monsoon rains swell the river it is only the north bank that is washed away.

Many protected areas are sources of agricultural products and useful genetic resources, many tropical forests may also be source of new genetic materials for commercial crops or biological controls. Biological control makes use of indigenous and introduced natural enemies to provide sustainable control of pest population. Diversity is probably depressed in agro-ecosystem due to cropping practices which excluded some important to conserve natural enemies such as fungi and ants. Natural vegetation around the crops is important to conserve natural enemy diversity, and possibly more so in tropical than in temperature systems. (Wage 1991)

2.4. The Impacts of Agriculture on Protected Areas

People live inside and near protected areas use plants and animals to meet their basic livelihood needs depending on the type of management practices, farmers and foresters will have varying impacts on habitant quality which can increase or decrease pressure on biodiversity within and around protected areas.

The greatest losses in biodiversity worldwide have been attributed to the expansion and intensification of agriculture and land use is often characterized by a transformation of complex ecosystem and land scopes into simple ones, resulting in reduced biodiversity. (Robinson and Sutherland 2002, Tillman et al 2002)

Agriculture may often cause environmental problems because it changes natural environments by harmful products, some of the negatives effects are loss of biodiversity, surplus of nitrogen and phosphorous in rivers and lakes. Detrimental effect of herbicides and other biocide have contributed conversion of natural ecosystem of all type into arable land, consolidation of diverse biomass into few species, soil erosion, deforestation, depletion of mineral in the soil. As human population, markets and infrastructure have grown in Africa, land use adjacent changed rapidly, the increase of increasingly postural and forested lands that historically surrounded protected areas in Africa have been converted to other land uses, predominantly agriculture. (Ottichiloetal2001).

Fencing and construction of roads which has been used for more than a half century by wildlife managers in Africa to prevent the transmission of disease between wildlife and cattle, and to provide additional security for threatened species for African protected areas. Through out Africa, the impact of the fencing of reserves on migratory wildlife population has been severe in for example Etosha National Park in Namibia Wildebeest population declined *by 85%* between 1955 and 1973 following the fencing of park, similar in wildebeest populations were recorded in Kruger national park in south Africa where one of three sub population of wildebeest in the central district plummeted by 87% between 1965 and 1978 (Whyte and Joubert 1988)

However in African for instance lions, Ethiopian wolves and African hunting dogs have suffered well documented population declines as a result of disease caught from domestic animals. In a 2004 paper in the journal animal conservation, national zoo veterinarian Sharon L. Deen and her colleagues reported on their investigation of the potential for the diseases of domestic animals to spillover into populations of wild carnivores including bush dogs, Jaguars, pumas, ocelots and other cats. (Fiorello and Dubrovnik 2004).

In Tanzania there is the dramatic declines in the abundance of many migratory species within and adjacent to Tarangire National Park due to increase in population and expansion in agricultural activities. Between 1988 and 2001 wildebeest and hartebeest population in Tarangire ecosystem declined by 88% and 90% respectively due to rapid expansion of agriculture adjacent to the park (Jawiri 2001).

The elevated nitrogen and phosphorous levels in aquatic system have led to extensive eutrophication and reduction of fresh water and marine ecosystem in many areas where agriculture is concentrated. Synthetically compound of nitrogen in fertilizer poses multiple risks for both wildlife population and human health. Dissolved nitrate of 2ppm or greater are known to interfere with normal development of amphibians with the level above lOppm known to be lethal (Environmental Canada 2002), (Bugy and Trenham 2003).

Agro system around protected areas impacts wild diversity from engineering crops hence transgenic crops pose a suite of ecological risk to native and cultivated ecosystem through the spread of trans genes to related wild types via crop weed hybridization, reduction of

fitness of non targeted organisms, the evaluation of resistance of insects, pests to pesticide producing crops, soil accumulation of insecticide produced by transgenic crops, un anticipated affects on non target herbivorous insect and creation of new pathogenic organs via horizontal gene transfer and recombination (Altier 2001).

The use of pesticide i.e. herbicides, fungicide, rodenticide and insecticide posses both known and unknown risks to biodiversity, impacting wild life in many different levels from indirect lethality to non lethal but severely debilitating effects. Each of these impacts has the potential to interfere with the success of wildlife and further reduce the habitat quality and biodiversity of agriculture and surrounding eco systems (Adge 2000) it is estimated pesticide and 25-50% of aerially applied pesticide reach their target (WWF 1999) and the remaining amount is releasing into surrounding ecosystem and enters into the food chain affecting animal population at every trophic level (Gliessman 1999). Birds exposed to sub lethal doses pesticides are often afflicted with chronic symptoms that affect their behavior and reproductive success.

However pesticide are also known to have negative effect predators population dynamics in agro ecosystem and to dis-proportionality effect insect predator population resulting in pest population resurgences and development of genetic resistance of pest to pesticide (Flint 1998) in addition endocrine disrupting compounds found in many pesticides still pose an additional and unknown long term risk to wild biodiversity (EPA 1997), (Environmental Canada 2000).

Conflicts between agriculture and protected areas, despite the example quoted about the relationship between protected areas and agriculture is not always positive, for example crop may become important sources of food for some wild animals and birds which may create the negative attitude against the wild animals. This force a greater land use conflict on margin lands between impoverished farmers and conservationist. (Mary and Michon 1987).

Agriculture may also lead to unbalanced wildlife population because many of the effects of forests which exhibit considerable synchrony in the production of fruit and seeds with a year of substantial fruit and seed production being following by several years of low production.

Frungivores and seed predators tend to be satiated in mast (high production) years, leading to increased population, but then starved in the subsequent year of low production.
Agro forestry practices that increased the year to year, availability of seeds and fruits may contribute to longer population of the seed eater, parrots and hornbills, for example may move between oil palm plantation and forest patches, providing an example where a mosaic of agriculture and forest creates an array of habitats that would lead to long term deterioration of the forest if too many of the seeds needed for forest generation are consumed.

2.5. Efforts carried out so far to reduce the adverse impacts of agriculture on PAs

As a means of promoting a more positive relationship between people and protected areas, IUCNs new system of categories of protected areas (IUCN 1994) recognizes that human activities and protected areas can co exist productively under some management regimes. For example category V, protected landscape include areas of land, with cost and sea as appropriate where the interaction of people and nature over time has produced an areas of distinct character with significant aesthetic, ecological and cultural values and often with high biological diversity

Fencing and the use of road systems which have been used for more than half century by wildlife managers in Africa to prevent the transmission of diseases between the wildlife and cattle and to provide additional security for threatened species for example Etosha National Park in Namibia, Kruger national park in south Africa.

The introduction of National Policy for National Parks, the introduction of National Policy for National Park aims primarily to preserve the wild diversity within protected areas, for example the Tanzania Wildlife Policy (1998) state that the wild life is a natural resources for great biological, environmental cleaning, climate amelitaring, water and soil conservation, nutritional and economic values. The existence of wildlife will be achieved through the system plan of participatory appraisal network whose overall objectives are to enhance conservation and promote social economic development of the people of Tanzania.

However IUCN (1994) define National Parks as a nation area of land and or sea, designated to (a) protect the ecological integrity of one or more ecosystem for present and future generation (b) exclude exploitation or occupation economical to the purposes of designation of the area and (c)

provide a foundation for spiritual, scientific, educational recreation and visitors opportunities, all of which must be environmentally and culturally compatible, this also provide the guideline for the use of National Parks resources.

Integrations of agriculture, fishery and forestry sectors, these sectors are directly depended on biodiversity and affect it directly. The private sectors can make significant contribution for example by adopting a certain agricultural practices. Many companies show a greater responsibility in conservation of biodiversity.

The introduction of buffer zones, Buffer zones are used in protected areas to delineate areas where human activities such as grazing, non extractives agro forestry, under -story cropping, hunting and gathering may occur, these areas are intended to remain under wild cover or be managed in such a way to ensure that human land use is compatible with the maintenance of a high degree of biological connectivity buffer zones link protected areas to one another through the preservation of habitat.

In Tanzania, the Tanzania National Parks (TANAPA) recognizes its social corporative responsibility and appreciates the need to work with the communities surrounding its parks. The organization states that the conservation of our natural resources is the responsibility of all people including our neighbor. TANAPA provide education to adjacent communities including school groups. The purpose of conservation education is to create awareness on conservation so that the effort is being made on sustainable conservation. This helps in minimization of the negatives effects of the surrounding community activities the protected areas of Tanzania (Gerald Bigurube 2004)

CHAPTER THREE: METHODOLOGY

3.1. Introduction

The research method will be designed according to the nature of the area, population, structure and time frame. This includes the use of primary and secondary data.

3.2. Research design

The problem of the effects of agriculture on ANAPA will be looked at using variables as reasons why agriculture is carried out around the park, major effect of agriculture on the wild diversity of ANAPA and the effort of local community and Non Governmental Organization (NGOs) to address the effects of agriculture on ANAPA.

3.3. Area and Study Population

Tanzania is located in the eastern part of Africa. It lies between latitudes 4 north and 4 south and longitude 34 East and 41East. The country is bordered by the India ocean, Somalia, Ethiopia, the population of Tanzania has grown from 12.3 million persons in 1967 to 17.5 million 1978, to 23.1 in 1988,to 34.6 in the last census of august 2002, over the period from 1967 to 2002 the population of Tanzania has almost tripled.

Studies regarding human population growth and distribution and around mount Meru have particular relevance given the populations impact on the environment. The forest and foot hills provide thousand of people with the resources with which to carry out their daily life activities such as farming, livestock keeping, logging for fuel wood and building materials, game hunting and tourism. All of these activities have different types and levels of impact on the wild live and habitats and on the people themselves.

3.3.1. Location

Arusha national park is located in northern part of Tanzania in Arusha region in the Arumeru District (Bugurube 2007).

3.3.2. Climate

The climate varies with the attitude and the area is within the regime of two rainy season, the short rains of November and December and the long rains of mid - March to late may although rainfall is recorded for every month. Considerable cloud cover from April to September keeps the area green through much dry season. (Bugurube 2007)

As a result of mount Meru and mount Kilimanjaro stands out as wet islands in a dry sea, the higher south western slopes receive up tot 2,000 mm of rainfall per year, the northern slope 500-600 mm/year and the entire Meru- Kilimanjaro area is enclosed in the 500 -750 mm isohyets. The hottest season is in January and February with temperature rarely exceeding 27°c while the cloud season is from June to August with the temperatures at midday do not drop much below 15° c.

3.3.3 Social economic situation

The main economic activities surrounding Arusha National Park are agriculture and livestock keeping. The major permanent crops are Banana and coffee, sustained year round by small scale irrigation systems, the important cash crops are maize, beans and other vegetables, livestock keeping in the villages surrounding the park is well developed and includes cattle, sheep, donkey, goats and poultry farming. In the western area the land is under particular pressure, already intensively grazed, the shortage of land for additional grazing and for agriculture has led to increase in illegal activities and encroachment in the forest reserve.

3.3.4. Hydrology

The forest catchments covering the Volcano of mount Meru act as condenser and are very important source of water for local people and pastoralists supplying areas of population density and intensive agriculture.

3.3.5 Geology and soils

Mount Meru natural system is a large area of a pile of extrusive volcanic rocks (porphyries, basalts trachytes etc) on the eroded surface of Precambrian metamorphic basement with intrusive granites and gramodiritic platoons. These metamorphic rocks of the Mozambique organic belt

range from various kind of schist to gneisses and granulites, this kind of soils is alkaline rich in calcium and magnesium and poor in phosphorous and nitrogen, (Bugurube 2007)

3.3.6. Wildlife

Arusha National Park and new annexation host a great variety of wildlife due to the diversity habitats ranging from alkaline to fresh water lakes bush grassland and swamps mountain forest. The most common mammal in Arusha National Park is buffalo, bushbuck, Giraffe and Primates such as Baboon, Blue monkey, black and white Columbus Monkey (Bugurube 2007)

3.4. Sample Selection and Size

A number of respondents will be selected where a sample will be at least 10 people per different group of respondent of the community living around ANAPA, staff of the ANAPA, NGOs concerning on environmental conservation around ANAPA and the local leaders of the community living around ANAPA.

3.5. Data Collection Methods and Research Instrument

During the field research various methods will be used by the researcher to collect the valid information and valuable data, this will include primary and secondary data.

3.5.1. Primary data

The following method will be used in collecting primary data oral interview, observation and photograph and questionnaires.

3.5.2. Oral interview

The researcher used selective method in interviewing various groups of individuals randomly on Arusha National Park and individuals living around Arusha National Park. These groups will include workers in ANAPA, students, community living ground ANAPA will be interviewed about the impact of agriculture on the Arusha National Park.

3.5.2. Observation and photography

The researcher used direct observation in observing various parts of the National Park and its nearest environs on how agricultural activities are practiced, various areas of interest will be observed by researcher to see type of farming methods used and ways of keeping livestock around ANAPA, helped the researcher to identify the impacts of agricultural activities on the National Park and then compare it with the literature reviewed.

The researcher used several questionnaire formats to gather information from the staff of ANAPA, local leaders and local communities living around the Park about the effect of farming practices and livestock keeping around park on wild diversity.

3.5.3. Secondary Data

This will enable the researcher to define more precisely of the impacts of agricultural activities on PAs. Literature review from relevant materials used to collect the secondary data. Information, collected from various publications from books, published reports and journals.

3.5. Procedure of collecting data

Permission to carry out the research will be obtained from Kampala International University and the questionnaire shall be administered to ANAPA, Local residents living around the Park and the local leaders of the communities living around the Park.

3.5. Data processing and presentation analysis

Quantitative analysis will be used to analyze data and this will be done by using both qualitative and quantitative method, the qualitative data will be obtained from an interview guide on focus group discussions and data from questionnaires to describe the impacts and quantitative data will be presented in frequency table, percentages and pie charts.

CHAPTER FOUR: PRESENTATION AND INTERPRETATION OF RESEARCH FINDINGS

4.1 Introduction

The greatest losses in biodiversity worldwide have been contributed to the expansion and intensification of agriculture and land uses is often characterized by transformation of concept ecosystem and landscapes into agricultural land use resulting into degradation of protected areas diversity. Agriculture intensification happens at different spatial levels, local intensification includes adverse effect such as shortened crop rotation cycles and increasing in- put of agro chemicals.

Agriculture land use around ANAPA does not first mean habitat destruction, traditional and low intensity land use practices may create species rich habitants, for example coffee and agro forestry, shaded by diverse natural or planted trees, represent the last remaining forested habitant in many tropical landscapes.

4.2 Major reasons of practicing agriculture around ANAPA

The main economic activities of communities surrounding ANAPA are agriculture and livestock keeping. Markets for agricultural and livestock products is available in Arusha town. The major permanent crops are banana and coffee sustained yearly round by small irrigation systems. The important crops grown are maize, beans and other vegetables, few farmers do commercial flower farming. The areas bordering the Eastern and Southern side of the forest are intensively cultivated. Livestock keeping in villages surround the parks is well developed and includes cattle, sheep, donkeys, goats and poultry farming. In western area the land is under particular pressure already intensively grazed, the shortage of the land for additional grazing and agriculture has led to increased illegal activities and encroachment in the forest reserve.

Factors influencing major Agriculture Activities around ANAPA

Availability of water resources, the forest catchments covering the Volcano of mount Meru act as condenser and are very important source of water for local people and pastoralists, ANAPA is the core of the Mount Meru natural system and the source for several perennial and seasonal rivers

that provide water to Arusha town as well as to many settlements in the dry areas. These rivers provide water for irrigation and domestic use.

The climate of ANAPA varies with the attitude and the area is within the regime of two rainy season, the short rains of November and December and the long rains of mid - March to late may although rainfall is recorded for every month which influence agricultural activities around ANAPA due to its two rain season.

As a result of mount Meru and mount Kilimanjaro stands out as wet islands in a dry sea, the higher south western slopes receive up total 2,000 mm of rainfall per year, the northern slope 500-600 mm/year and the entire Meru- Kilimanjaro area is enclosed in the 500 -750 mm isohyets which also enhance the practices of agriculture around the Park.

Geology and soil of ANAPA, Mount Meru natural system is a large area of a pile of extrusive volcanic rocks (porphyries, basalts trachytes etc) on the eroded surface of Precambrian metamorphic basement with intrusive granites and gramodiritic platoons. These metamorphic rocks of the Mozambique organic belt range from various kind of schist to gneisses and granulites. This kind of soils is alkaline rich in calcium and magnesium and poor in phosphorous and nitrogen which influence agricultural activities due its soil fertile this enhance growing different crops around mount Meru.

Table 1. Reasons for practicing agriculture around ANAPA

Reason for practicing agriculture	**Number respondents**	**Percentage**
Soil fertility	14	28
Availability of water for irrigation	20	40
Favorable climate for agriculture	5	10
Shortage of land	11	22
Total	**50**	**100**

By researcher in the field

Figure 1. Showing the Reasons for Practicing out Agriculture around ANAPA

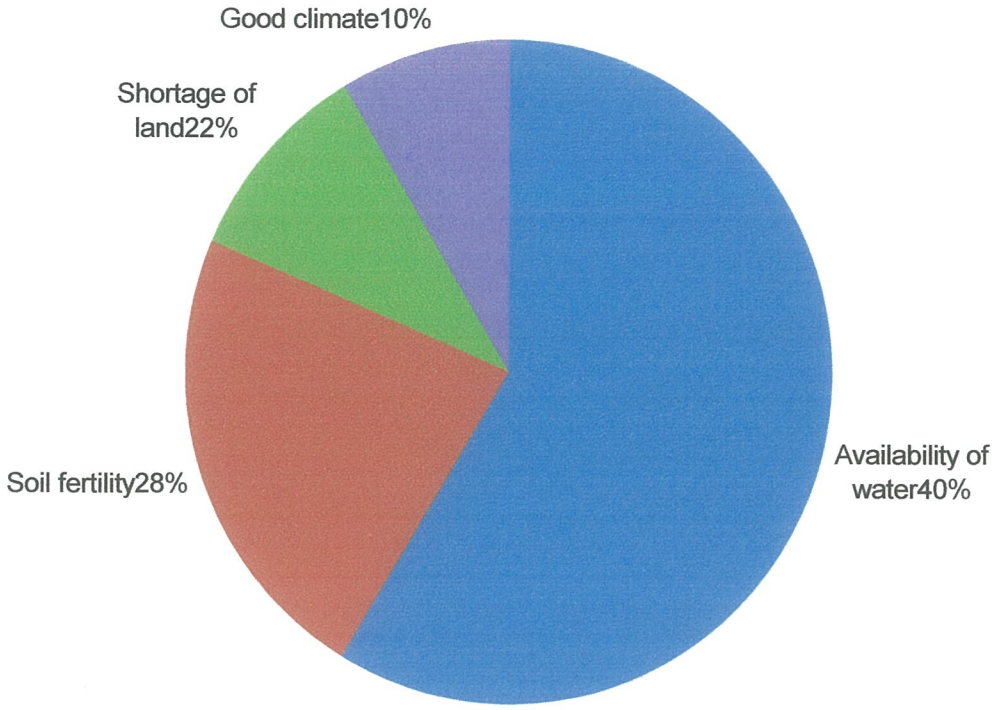
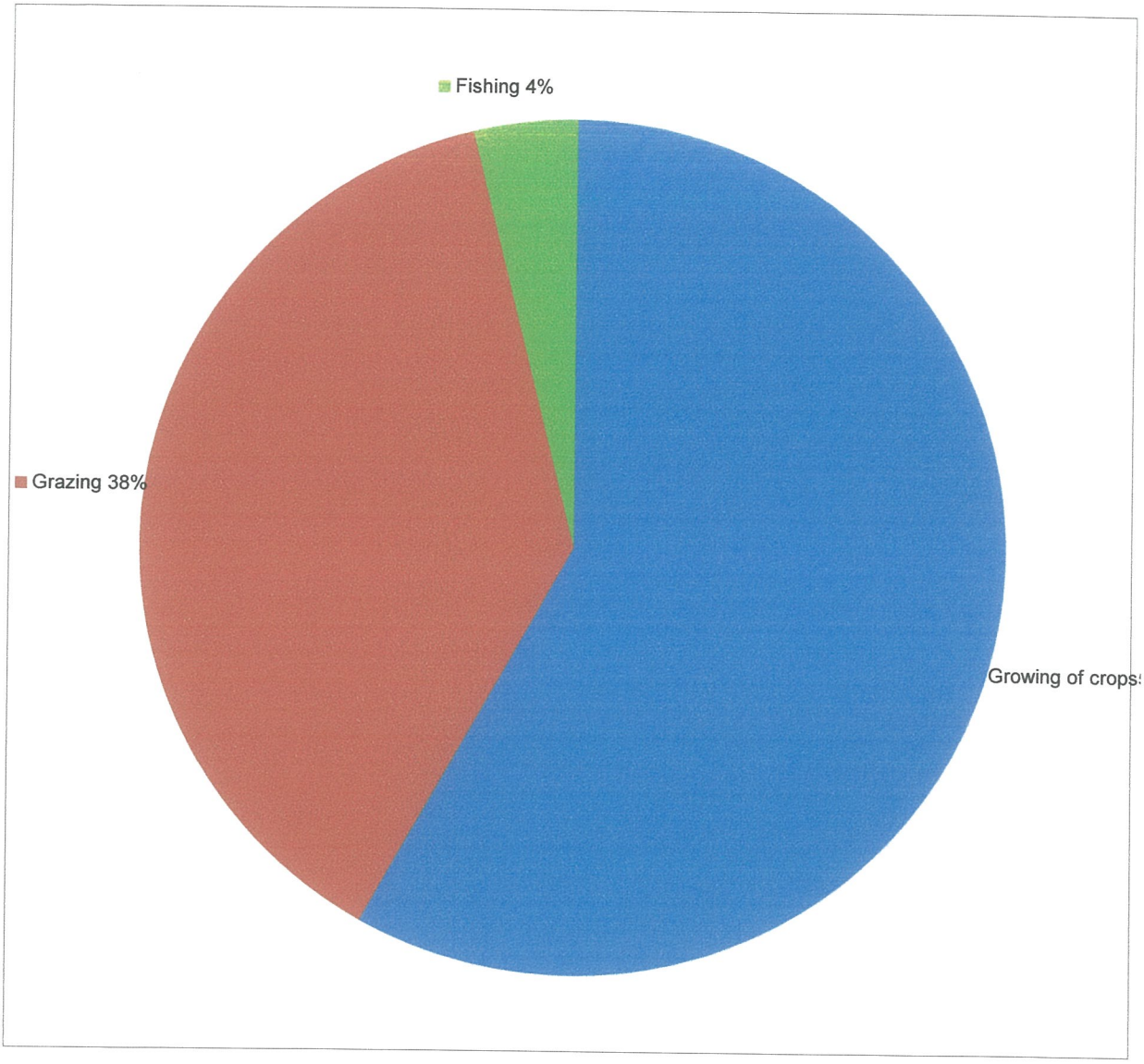


Table 2.showing type agricultural activities carried $_{out}$ around ANAPA

Types of agriculture activities	Number of respondents	Percentage
Crowing of crops	29	58
Grazing	19	38
Fishing	2	4
Total	**50**	**100**

By researcher in the field

Fig: Pie chart showing mains types of agriculture activities carried out around ANAPA



The most type of agriculture activities carried out around Arusha National Park is growing of crops which account for 58% and ranked number one (*refer to Table 2*) this is because it is from growing of different types crops that the residents around ANAPA can feed themselves and also because of the availability of water which flow from ANAPA and the favorable climate for growing crops.

Livestock keeping is practices by the residents and this account for 38% and ranked number 2 (*refer to Table.2.)* the residents around ANAPA keeps different type animals due to availability

pasture for feeding animals. It most a problematic in the west and north in the village mainly inhabited by Maasai pastoralist such as Okokola, Sambasha, Limbolo, and Olmotonyi.

Fishing is practicing to small extent due to shortage of fresh water which enhances the survival of fish, according to survey carried out in October- November 2000 by Istituto Oikos and TANAPA among the Arusha NP lakes only in Longil has the Cichlid, the Athi River has Tilapia.

However there are other legal and illegal activities carried on around ANAPA, legal activities include the collection of fire wood and bee keeping, illegal activities include illegal collection of wood, cultivation encroachment and collection of medicinal plants.

4.3 The Effects of Agriculture on the ANAPA

Arusha NP like all other parks of Tanzania doesn't have a buffer zone to minimize the effects of adjacent land uses. In many areas the forest plantation acts as a sort of buffer zone, providing fuel wood, grazing and bee keeping opportunities. A buffer zone for the park would help to maintain the ecosystem integrity, preserves the wildlife corridors and allow communities to benefit from ecotourism.
As the population around ANAPA increases, demand on the natural resource also increasing, unless this growth is properly planned and managed with the land use planning deforestation and habitat degradation and modification will continue.

Deforestation, there is evidence that the deciduous wood land which occupation and cultivation was not allowed in the forest catchments but there is a high level of encroachment in Eastern and Northern zone. In Ngarenanyuki area illegal cultivation are estimated to cover more than 700 hectares, the forest has been destructed and replaced with yearly crops mainly Maize and Beans. In Eastern side Leguriki Kimoni and Meru the encroachment is more serious as permanent houses were built and permanent crops such as coffee and banana have been planted.

The increasing settlement and cultivation of areas around Arusha National Park has reduced critical habitant and adversely effected the wildlife population by limiting between the adjacent lands. The increasing isolation of Arusha National Park and increase inability for wild life to move out of the park may potentially affect wild life population size and lead to in breeding.

Currently some migratory routes remain open allowing animals especially Elephants to move in and out of the park in small numbers every few years.

The interruption of domestic animals and wild animals end up with transmission of diseases from domestic animals to wild animals or the vice versa. Many angering of infectious disease of wildlife are associated with spill over of the pathogen from domestic animals to wild life population with the translocation of host or parasite by human being for example zoon tic disease which infects both domestic and wild animals. Each year significant sporadic cases and outbreak of rabies (zoon tic disease which affect both wild animals and domestic animals) in different animals species occur in ANAPA, the recent case occurred in much in Kingori village where a rabid (rabies infected) domestic tic dog bitten a donkey and in several days the donkey developed rabies symptoms and eventually bitted twelve cattle and ten sheep.

Plate 1-Showing Restraining and Administration of Rabies Vaccines to Control Transmission of Zoonotic Disease

By researcher in the field

The use of the chemicals in agricultures activities such as pesticide, and fertilizer result into negative effects on the wild life diversity of ANAPA, the insecticide and fertilizers used in farming practice around ANAPA decomposes during the rain season and run off into the water bodies (Momella lake part of ANAPA) and interferes with the favorable habitants of aquatic animals and some bird species such as flamingos, lesser and few species in some lakes.

Subsistence farming around ANAPA results into introduction of exotic species which interfere with existence of the nature species which is a favorable habitant for the animals as the well some of food for wild animals. Some of the exotic plant species interferes with hydrology of the Park hence ANAPA is the most source of water.

Plate 2. Big Momela Lake in ANAPA

By researcher in the field

Increase of water demand of the park from surrounding communities, the forest catchments is the very important source of water for local people and supplying the densely inhabited surrounding area and Arusha town. Much water is used for irrigation of coffee plantations, intensive agriculture, flower farms and small seed farms, therefore these results into increase of demand of water resource in ANAPA. On the other hand some of the water catchments areas will diminish due to increasing of clearing of forest to get enough land for agriculture.

Social effect (community wildlife conflict), the major problem that villages directly bordering the park face is crop raiding and liking people by wildlife, especially elephant and buffalo that come from the park. However some of the land use activities around ANAPA are not compatible with the conservation of biodiversity which make the park management to be against of these communities activities hence result into sourced conflict between the park and the communities.

4.4. Efforts carried out to minimize the impacts of agriculture on Arusha National Park

There some effort from NGOs which are try to minimize the extent of the impacts of agricultural activities on protected areas such as Communities Conservation Services (CCS) which is try to improve the inter relation ship between the parts and local communities in ANAPA, there is also a support from Support for Community Initiated Project (SCIP) for conservation and environmental education through workshops seminars and meeting, World Life Fund (WWF) for conservation of wild animals habitants. The purpose of conservation education is to create awareness on conservation so that the effort is being made on sustainable conservation. This helps in minimization the negatives effects of the sounding community toward the protected areas of Tanzania. (Gerald Bigurube 2004).

As a matter of priority in order to control the spread zoontic from domestic animals to wild animals, the Meru District Council through its District Vet nary Office solicited some funds and stated to implement a vaccination campaign to involve the affected Ward which will be extended to entire Division. Further more the district requested Assistance of ANAPA in this respect so that at least all villages adjacent to the park would be covered during the already stated vaccination campaign.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

This chapter presents the conclusion and recommendations required to minimize the impacts of agricultural activities carried out around ANAPA on the wild diversity of the Park.

5.2 Conclusion

From the research findings the major agricultural activities are cultivation and animals keeping. The mainly crops which are grow include maize, beans, coffee, banana, vegetables and commercial flower farming and the livestock include cattle, sheep, donkeys, goals and poultry farming, crop growing accounts for 58% (*Refer to table 2*) of which livestock keeping account for 40% and fishing accounts for 2%. However these agricultural activities result into loss of wild diversity and water catchments areas.

The research also identify the major reasons of practicing agriculture around ANAPA and the major factor identified was availability of water for irrigation during dry season, (*refer table1*), others factors also identified such as shortage of land for growing of crops as well the favorable climate for agriculture.

The research went far and identifies the impacts of agriculture on ANAPA and identifies the measures which should be taken to minimize the negatives effects of agriculture on the wild diversity of the park.

The research looked at the possible control measures for minimizing the impacts of agricultural activities around protected on the protected areas. Some communities had same suggestions such as improving the community participation where by the communities can have chance to air out their options and suggestions and also the park should provide employment to the local communities living around ANAPA to reduce the illegal activities around and on ANAPA.

5.3 Recommendations

Sustainable agriculture around ANAPA is still a problem and some measures must be put in to place to minimize the impact of agriculture on ANAPA for the sake of the wild animal's environment and the future generation. Therefore the following should be done through the following means.

Realizing awareness of the public and decision makers, effective minimization of the effect of agriculture on protected areas require the cooperation of the general public, practicing of sustainable agriculture around protected areas calls for creation of awareness about the importance of resources found in ANAPA for the present generation and the future generation. It is therefore important to ensure that public and decision maker's to have skills and knowledge on practicing agriculture activities which are compatible with the wild diversity on ANAPA therefore a strong and diffractive outreach and environmental conservation in order to change local perception and preserve the environment.

Defining a clear role of relevant agencies in management of PAs, a better coordination for effective implementation of management of PAs require a collaborative project of various agencies involved in management of the wild diversity in PAs. However there is no clear roles of different agencies which are trying to conserve wild diversity in ANAPA therefore to ensure the effective institutional support for collaborative project for management wild diversity, the roles and responsibilities of the various agencies involved should be defined clearly and a coordination mechanism to be established for effective management of wild diversity of ANAPA. A working involving also involving officials from the various agencies can be set up to discuss initially the roles and responsibilities of the respective agencies and working group can be later upgraded to an administrative committee or task force.

Using the bottom up approach, in order to ensure the promotion of better living strategies for individual's family and the community should be involved in all decision associated with the protected resources by community at a given particular PAs. Community participation is necessary because there are different beliefs, customs and protective rules which may affect the acceptability of the better and proper use of resources found in protected areas, therefore community participation, leaders, the different organizations, are very important decision making

APPENDIX 1: LETTER OF INTRODUCTORY FROM FACULTY;

KAMPALA INTERNATIONAL UNIVERSITY
EXPLORING THE HEIGHTS

Ggaba Road, Kansanga * PO BOX 20000 Kampala, Uganda
Tel: +256 (0) 41 - 266 813 * Fax: +256 (0) 41 - 501 974
E-mail: admin@kiu.ac.ug * Website: http://www.kiu.ac.ug

FACULTY OF SOCIAL SCIENCES

Date: 05-06-08

To. PARK WARDEN
ARUSHA NATIONAL PARK
P.O BOX 3134 - ARUSHA -

This is to introduce to you NYANGURI MATHIAS who is a bonafide student of Kampala International University. He/~~she~~ is working on a research project for a dissertation, which is a partial requirement for the award of a degree. I here by request you, in the name of the University, to accord him/her all the ~~necessary assistance he/she~~ may require for this work.

I have the pleasure of thanking you in advance for your cooperation!

KAMPALA INTERNATIONAL UNIVERSITY
FACULTY OF SOCIAL SCIENCES AND
BOX 20000, KAMPALA

Yours sincerely,

Ms. Sidonia Angom
Associate Dean

APPENDIX.II. RESEARCH QUESTIONNAIRES

SECTION A: QUESTIONNAIRES FOR COMMUNITY

PERSON INFORMATION

1. Name.....

2. Age.....

(a) 18-25 ☐

(b). 25-35 ☐

(c). 35-60 ☐

3. Number of household members.....

4. Occupation.....

5. Education level.....

(a). None ☐

(b). Primary ☐

(c). Secondary ☐

(d). Advanced ☐

e) University ☐

(f) Others ☐

SECTION B: ACTIVITIES CARRIED OUT AROUND ANAPA

9 .For how long have these activities are practiced around ANAPA

.....

.....

.....

10. What are the negatives effects do u normally experience in carrying out these activities around ANAPA

.....

.....

.....

11. In case of agriculture activities, what kind of materials do you normally use to improve soil fertility?

.....

.....

SECTION C: QUESTIONNAIRES TO ANAPA STAFF, THE IMPACTS OF AGRICULTURE ON ARUSHA NATIONAL PARK

12. Do you thing there is any effects of agricultural activities on the ANAPA

(a)Yes ☐

(b.) No ☐

13. If yes what are they?

.....

.....

.....

.....

14. What is the reaction of the park management on these effects?

.....

.....

.....

16. As the park management concern, what are the strategies pointed out to minimize impacts of agriculture on the park

.....

.....

.....

17 What has been done to minimize the effects of agriculture on ANAPA.

.....

.....

18. What are the ways pointed out to minimize the effects of agriculture on ANAPA

.....

.....

.....

18. What the contribution of the local community toward the impacts?

.....

.....

.....

19. Is there any organization which tries to approach and minimize the consequences of agriculture on ANAPA.

(a), Yes ☐

(b).No ☐

20. If yes which are they?

.....

.....

.....

21. In what way they do so?

.....

.....

.....

22. Do you think these effects of agriculture on ANAPA can be minimized?

.....

.....

.....

23 If yes how can these effects minimized?

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.....

.....

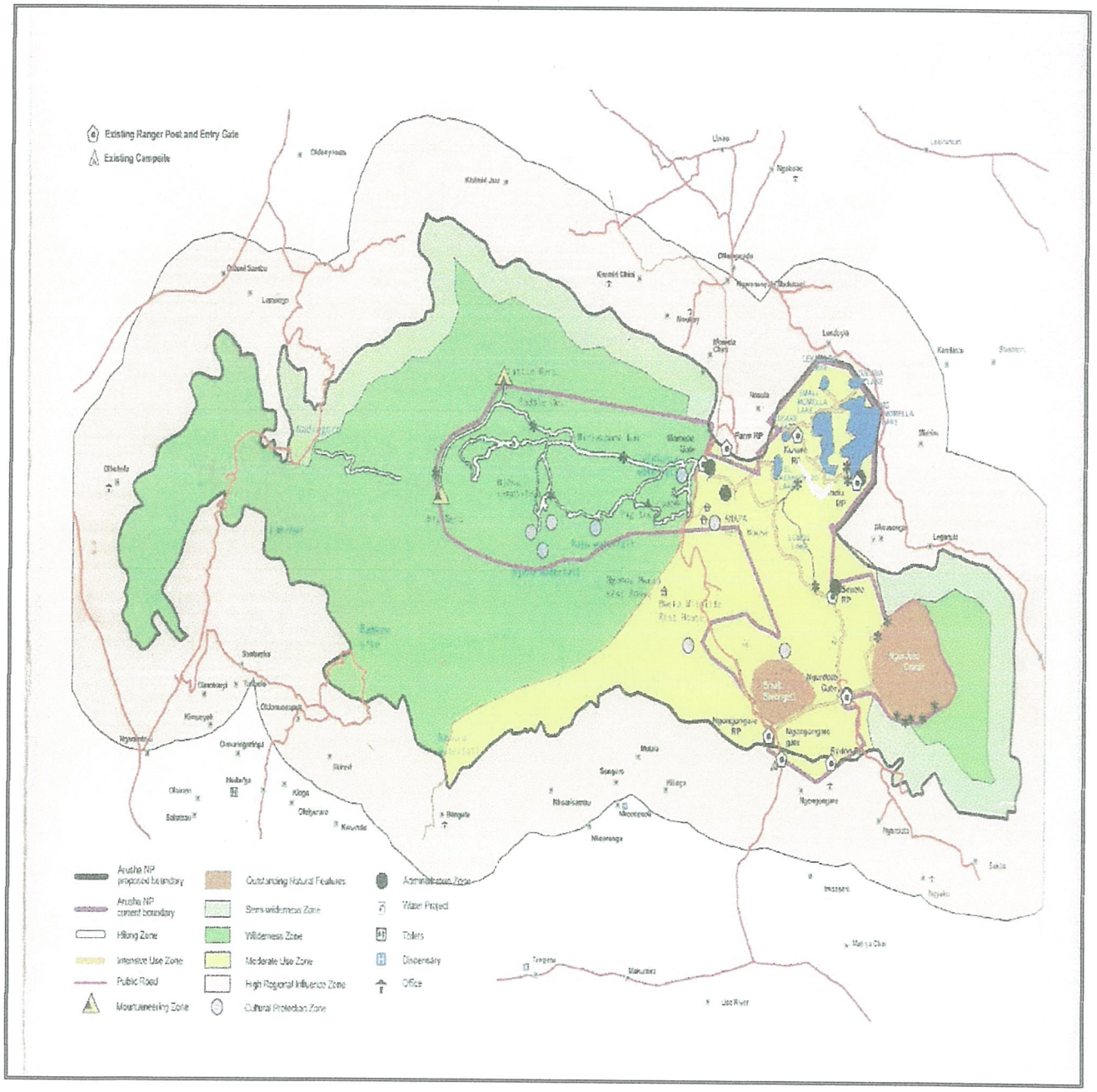
24. If not, why?

.....

.....

.....

APPENDEX III; MAP OF ARUSHA NATIONAL PARK



APPENDIX IV.MAP OF TANZANIA SHOWING ARUSHA NATIONAL PARK.

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