EVALUATING THE EFFECTS OF MILITARY ACTIVITIES ON THE DISTRIBUTION AND ABUNDANCE OF WILDLIFE ON MPALA RANCH, LAIKIPIA KENYA

AWUOR FRANKLINE OTIENDE

(B.Sc. Range Management, University of Nairobi)

A thesis submitted in partial fulfillment for the award of the degree of Master of Science in Range Management at the Department of Land Resources Management and Agricultural Technology at the University of Nairobi

NOVEMBER 2012

DECLARATION AND APPROVAL

DECLARATION

This thesis is my original work and has not been presented for award of a degree in any other university

Awuor F. O. A56/642399/2010

Signed.....

Date.....19th - NOVEMBER - 2012....

APPROVAL

This thesis has been submitted with our approval as university Supervisors

Prof. Jesse T. Njoka

Seniour Lecturer, College of Agriculture and Veterinary Sciences, Dept. of Land Resources Management and Agricultural Technology

Signature.....

Date...21st November, 2012

Dr. Margaret F. Kinnaird

Director, Mpala Research Centre and Conservancy

Signature: Margaret F. Kinnaird

Date: .....19th November 2012.....

DEDICATION

I dedicate this thesis to my mother Elizabeth Adhiambo, my step mother Angeline Anyango and my dear siblings

ACKNOWLEDGMENTS

First, I would like to thank Prof. Jesse T. Njoka for connecting me with Mpala where I had the opportunity to meet Dr. Margaret F. Kinnaird who enabled me to get a scholarship. Many thanks again to them for their able supervisory guidance. I owe much gratitude to Dr. Tim O'Brien of Wildlife Conservation Society for his time, professional and statistical advice with the work. Without him, there is very little I could have done.

Secondly, many thanks to Mr. George Odhiambo and Miss Veronica Teresa for helping me with maps, graphs, and GIS issues. Last but not least, I appreciate the excellent work of my field assistants Mr. Christopher Tenai and Mr. Elimlim.

The project for this thesis was funded by Mr. Donald Graham and Mr. Dennis Keller, Mpala Wildlife Foundation Trustees, and the Centre for Sustainable Dryland Ecosystems and Societies. Classwork was supported by a Levinson/Smithsonian Tropical Research Institute Fellowship.

Above all, glory be to God who sustained me by His grace throughout the study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND GLOSSARY

BATUK: British Army Training Unit IN Kenya

Cluster Density: The number of groups of individuals of a given species per unit area. It is given as number of clusters per unit area

Cluster Size: The number of individuals of a given species in a group or a cluster

D: Density (Individual) measured as number of individuals per unit area

ER: Encounter Rate meaning the frequency per unit time at which an individual species is encountered in the study area

GIS: Geospatial Information System

GPS: Global Positioning System

INRMP: Integrated Natural Resources Management Plan

IUCN: International Union for Conservation of Nature

MRC: Mpala Research Centre

NDVI: Normalized Difference Vegetation Index

Ordnance: Military cannon, artillery, supplies; munitions. Explosives, chemicals, pyrotechnics, and similar stores, e.g., bombs, guns and ammunition, flares, smoke, or napalm (thefreedictionary.com)

PHAT: Probability of Detection

RDX: Royal Demolition Explosive. An explosive chemical remains of which are considered as chemical pollutants at military training ranges

TNT: Trinitrotoluene. It is a chemical pollutant found in military training ranges

UK: United Kingdom

UN: United Nations

WICE: World Institute for Conservation and Environment

WWF: World Wide Fund for Nature

ABSTRACT

Military training is becoming a lucrative land use option in Laikipia County but there is little information on the effects of training on wildlife distribution and abundance. This study was designed to evaluate the effects of military training on wildlife distribution and abundance of wildlife at Mpala Ranch and the effects of the same on the socio-economics of Laikipia residents. Wildlife data were collected through wildlife surveys, military traffic data was collected by manual counts while socio-economic data was collected by means of questionnaires. Ranch owners (n = 11) and local community members (n = 106) from three communities were interviewed.

This study focused on six study species, namely; Guenther's dik-dik *(Madoqua guentheri)*, impala (*Aepyceros melampus*), Plains zebra (*Equus quagga*), Grevy's zebra *(Equus grevyi)*, Reticulated giraffe (*Giraffa camelopardalis reticulata*), and the African elephant (*Loxodonta africana*). Research findings indicate that there were no significant effects of training on the density distribution of Guenther's dik-dik ($F_{3,20} = 0.63$, ns), impala ($F_{3,20} = 0.91$, ns), Plains zebra ($F_{3,20} = 10.51$, *ns*), and Grevy's zebra ($F_{3,20} = 1.98$, *ns*). However, training had significant effect on the density distribution of Reticulated giraffe ($F_{3,20} = 5.30$, $p < 0.05$) and the African elephant ($F_{3,20} = 0.02$, $p < 0.05$). It was not confirmed whether this poses a conservation threat to their populations at the ecosystem level. Further investigation is therefore needed

Training activities did not significantly affect the distribution and abundance of any of the study species within 1km buffer of the watering points within the training area. Vehicular traffic significantly affected the distribution and abundance of Plains zebra *($t(6) = 3.66$, $p < 0.05$)* within the 0 - 100m buffer of the road and that of dik-dik *($t(8) = 2.32$, $p < 0.05$)* within

the 100 – 200 m buffer of the same road. The rest of the study species were not significantly affected.

On the socio-economic aspects, most (66.7%, n = 3) of army hosting properties would not be economically viable without the revenue from the army. Therefore, it may be argued that the army helps in securing "protected land" for wildlife on the ranches where they train. Noise disturbance from helicopters and bombs, littering and non-adherence to the norms of hosting properties were the major complaints against the army. Noise pollution causes loss of business to tourism enterprises but it has not led to a reduction in the number of tourists visiting Laikipia County. The number of tourists visiting has been increasing over the years (Laikipia Wildlife Forum, 2012).

Seventy two percent (n = 106) of community members bordering training areas are tolerant to military activities but would appreciate more development initiatives. Eighty two percent (n = 11) of ranchers interviewed believe that military training can be managed in a manner to be harmonious with biodiversity conservation and wildlife based tourism in the County.

This study concludes that military training activities: 1) do not permanently displace wildlife from the training area; 2) do not displace wildlife from watering points in the training area; 3) military vehicular traffic significantly affects the distribution and abundance of dik-dik and Plains zebra along the roadsides; and 4) noise and light pollution negatively affects tourism in Laikipia. It is thus recommended that: 1) the military stick to designated flight paths, 2) train with explosives in the day to minimize noise disturbance, 3) BATUK come up with a cooperate social responsibility program for those communities which are adversely affect by their training activities as a means of compensation for inconveniences caused, and 4) more

research be carried out to establish, at an ecosystem level, where elephants and giraffes get displaced to during military training activities.

Key words: military training, displacement of wildlife, British army in Kenya, tourism in Laikipia, training on private lands, biodiversity conservation

CHAPTER ONE

1.0 BACKGROUND INFORMATION

1.1 Introduction

The Ewaso ecosystem in Kenya is the largest "unprotected" area where wildlife lives on private and communal lands (Georgiadis, 2011). It has the largest population of critically endangered Grevy's zebra in the world, hosts most of Kenya's critically endangered black rhino, and Kenya's only viable population of Lelwel hartebeest (Laikipia Wildlife Forum, 2010). It is home to the second largest population of elephants in Kenya. It also has Africa's only expanding population of wild dogs. Ewaso ecosystem encompasses the whole of Laikipia County and parts of Samburu County.

Various economic activities take place in Laikipia County. There are over 40 tourism operators, ranging from small lodges and tented camps to ranch houses and adventure based operators specializing in walking, camel and horse riding safaris (Laikipia Wildlife Forum, 2010). Some of the wildlife based tourism properties include Suyiun, Loisaba, Chololo, Koija and Il Motiok. Approximately 6,500 people in the region are directly dependent on the tourism sector (Laikipia Wildlife Forum, undated, unpublished report). Wildlife tourism has been growing over the years. The combined annual revenue generated from tourism in 2007 was US $ 20.5 million up from US $13 million in 2001 based on the average seasonal non-resident /resident rack rate. Other economic activities include livestock husbandry, irrigation farming, and leasing of land for training by the British Army Training Unit in Kenya (BATUK). These economic decisions are made at the ranch or conservancy level and

sometimes without consideration of what the spillover effects may be to the economic activities of the neighbouring ranches and conservancies. In Laikipia, there is concern that properties that host the army for training may negatively affect those properties that border them, especially those which operate tourism enterprises.

The success of Laikipia's wildlife based tourism depends on how wildlife is distributed on these properties and their conservation. This study aimed to understand if military activities affect wildlife behavior. Specifically, it targeted to find out if wildlife distribution shifts due to military activities and if these shifts vary among species.

1.2 BATUK in Kenya

The British Army has been training in Kenya since 1964 when the Kenyan and British governments signed off a memorandum of understanding. BATUK'S training area stretches from Laikipia to Samburu Counties and covers a wide range of climatic conditions from arid savannah to upland forest. Since the wars in Afghanistan and Iraq began, Kenya's training grounds have become increasingly relevant to the British Army because of the great similarities in climatic conditions (hot in the day and cool in the night) and the terrain (hilly, open spaces and high altitude; (Wadhams, 2009). Mpala Ranch in Laikipia, Kenya became their first training ground. Over the years Ol Doinyo Lemboro, Loldaiga and Ol Naishu ranches were added to the list of hosting ranches. In 2009 BATUK expanded these grounds to 11 privately owned ranches, including Sosian, Ol Maisor and the Laikipia Nature Conservancy (Figure 1). With the expansion of lands used for training, the numbers of battle groups also increased to 7 from 3

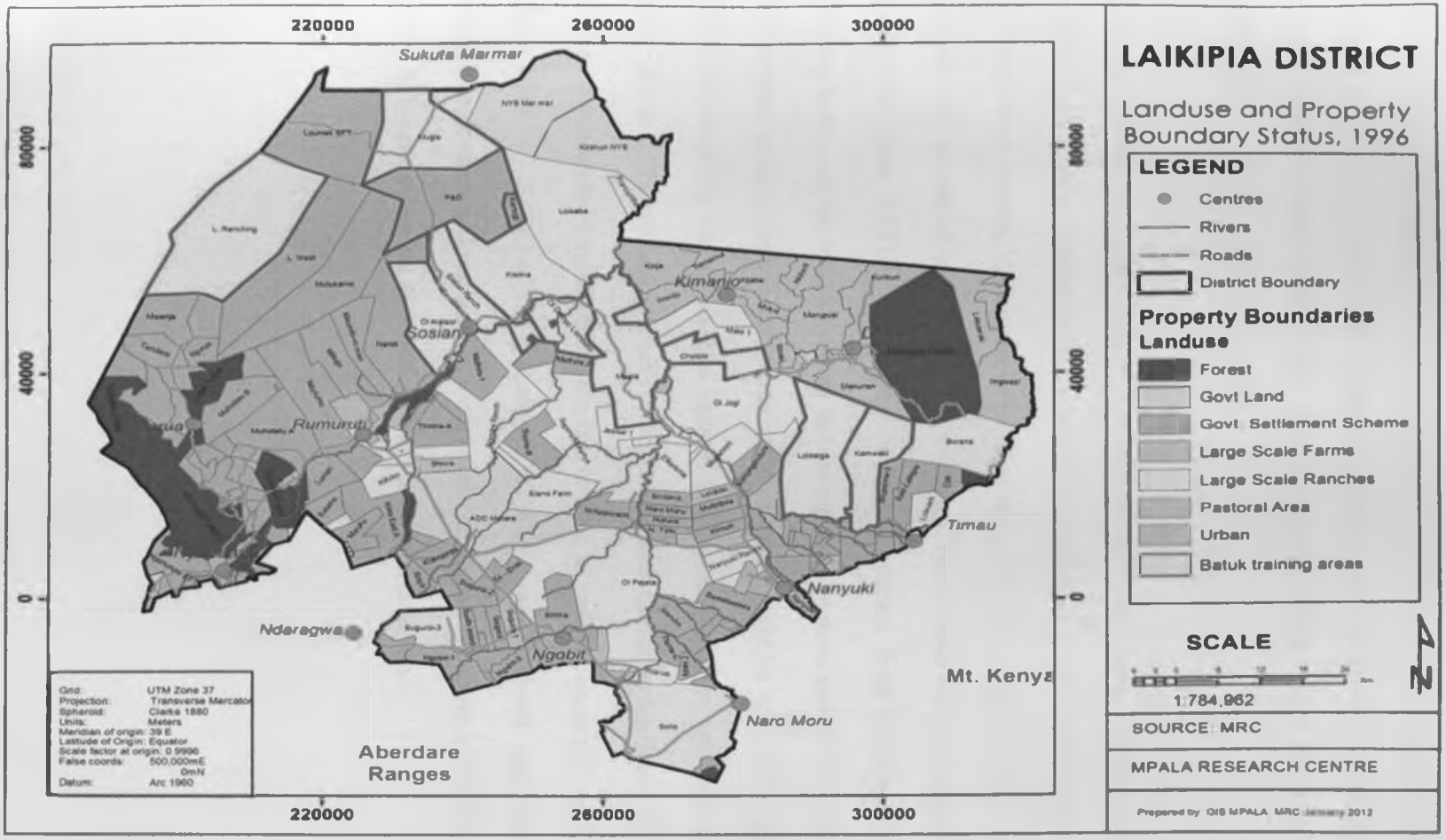

Figure 1: BATUK training ranches (bordered in purple) in Laikipia County. *Map source: Mpala Research Centre.*

Training exercises take varied forms from mere drills to heavy use of weaponry. Sometimes there is use of aircrafts and helicopters. Low level live firing involving light arms is done in Laikipia while heavy artillery live firing takes place in the Kenya Army's northern training grounds in Isiolo County and Archer's post in Samburu County. Live firing in the ranches typically takes 5 days in designated areas.

BATUK provides substantial benefits at the national and local levels. At the national level the government of Kenya receives annual revenues and intensive training of her armed forces. At the local level Sartain, (2010) reported that ranch owners, lodge owners, traders, and residents who are employed on permanent and casual basis (about 900 People in total) benefit significantly from BATUK expenditure in wages, salaries, food contracts, vehicle hire, building works, and the regular grading and maintenance of roads and bridges. Infrastructural development projects include the construction of schools, clinics and police posts. Sartain (2010) estimates that direct financial input in these expenditures go well over £ 17 million (about Kshs. 2.323 billion)* annually; besides personal soldier expenditures on goods and services. Documented wildlife-based tourism revenue in Laikipia amounted to $ 20.5 million (about Kshs. 1.7 billion) in 2007, (Laikipia Wildlife Forum, undated, unpublished report). Laikipia landowners and residents as a whole may be getting more money from BATUK than from wildlife based tourism as revealed from these financial reports.

* Estimates on 30/10/2012 exchange rates

1.3 Justification

There are increasing concerns on the effects of military training on the Ewaso ecosystem wildlife populations and the socio-economic aspects of the people living in Laikipia County but there are no data with which to adequately address these issues. To date, information is anecdotal and speculative. No study has been carried out in the region to understand the effects of Laikipia's unique case of military training on private lands bordered by other private and communal lands. There is no data with which to address complaints from conservationists, tourism entrepreneurs and local community members. This study is an attempt to provide the necessary data to address these issues.

1.4 Objectives

1.4.1 General Objective

To evaluate how wildlife species respond to seasonal military training activities.

1.4.2 Specific Objectives

1. To evaluate the impact of military training activities on the distribution and abundance of wildlife on Mpala Ranch.
2. To explore ways forward in view of the stakeholders' concerns on the possible impacts of military activities on wildlife conservation and wildlife based tourism.

1.5 Hypotheses

1. Military training does not displace wildlife species from the critical watering points in the training area and from the training area itself.
2. Increase in vehicle traffic due to military training activities does not displace wildlife species from roadsides.
3. Military training activities does not adversely affect wildlife based tourism.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 History of Military Training on Private Lands

Military training is meant to take place on government lands unless available land is not suitable for training or would unnecessarily increase the cost of doing so. Since World War I more land whether government or privately owned has increasingly been committed to military use especially for training needs (Doxford and Hill, 1998; Elwood, 2008). Aguilera and Steele (2011) observed that after the Cold War, the use of private training grounds has been on the rise. According to Vertegaal (1989; cited in Doxford and Hill, 1998) 1-3% of land use in western European countries is for military use. Vertegaal also notes that demand for land for military use has been increasing over the years because of growing fire power and radius of weapons, the increasing mobility of army units and new training tactics.

Another factor that has made private lands suitable alternatives for training is budgetary limitations. Foreign missions budgetary constraints may not make it possible to train on suitable bases at home without compromising military readiness. This may create the need to use suitable private land near the place or region of conflict. Unique conditions (e.g climate and terrain) at the place of conflict may also necessitate that the military look for similar areas to train before going to battle. Other scenarios that may necessitate the use of private land for training are to allow old government training bases to recover from the effects of training so that the training base can be sustainable, and to allow for endangered species of flora and fauna to recover (Stein, 2008). This occurred in USA's biggest military training

base at Fort Bragg in North Carolina, where the army was forced to go into partnership with private land owners in order to help the base recover and conserve the endangered Red-cockaded woodpecker (Stein, 2008). Encroachment by human settlements near military bases may greatly restrict training activities which consequently may be shifted to other training bases or be done on private lands (Elwood, 2008).

Military training on private lands is a lucrative business for those who welcome it (Aguilera and Steele, 2011). It comes with no initial investment required other than the drafting of a memorandum of understanding. However, unless well managed, military training on private lands can leave costly or irreparable damage on the biotic and abiotic resources which may trickle out into adjacent properties and communities. This may lead to conflicts between the army and the affected persons or people, reduced biodiversity, environmental pollution, loss of ecosystems and cessation of training in the area.

Kite (2004) observed that training on private lands is an indispensable and growing need of military training. It should therefore not be expected that training on private lands will come to an end. Many private lands that qualify as military training grounds because of their vastness and remoteness also tend to be habitats for many wild species of fauna and flora, many of which may be endangered or threatened. This raises the critical need for private landowners together with the military to manage their lands for biodiversity conservation.

2.2 Effects of Military Training

Effects of military training are many and vary ranging from ecological to economic and from social to political. These effects interplay to give overall effects which are often difficult to separate.

2.2.1 Ecological Effects

Machlis and Hanson (2008) observed that war is the single most far reaching and intensive human activity that causes ecological change yet studies to evaluate its effects are limited in depth and fragmented by discipline. Ecosystems provide us with services (provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious, and other nonmaterial benefits) and goods (e.g timber, rafts, wood fuel e.t.c) (UN, 2000). However, military training has the potential to comprise the integrity of the ecosystem to provide us with these services and goods. An ecosystem means the entire assemblage of organisms (biotic community) living together in a certain space with their environment (or biotope), where they function a loose unit (WICE, 2012). The environment consists of other living organism and non-living matter (abiotic community). An ecosystem can be compromised at its biotic or abiotic components. At its biotic component various life forms (aquatic, terrestrial, soil inhabiting and arboreal) may get reduced in diversity, numbers or even get extinct, each vanishing with its ecological functions to the ecosystem. At its abiotic component, soil may get eroded or compacted, water polluted, sedimentation may occur and non-biodegradable litter left behind to pollute the soil. All these will in turn have an effect on the biotic component of the ecosystem. These two components are too intricately linked to be easily separated.

Even though there is usually some element of environmental conservation mindedness in military training exercises, this is not often the case with war and civil unrest. In such instances there do occur 'epidemics' of poaching and logging of trees. Habitats are destroyed and soils left bare and susceptible to erosion (Quist ***et al.***, 2003). These may lead to the listing

of certain species as threatened or endangered in the International Union for Conservation of Nature (IUCN) list. Endemic species may be more at risk than any other because they have no other known habitat than the one they currently inhabit. Military training when not well managed may lead to the same results because weapons do not discriminate between war and training. Their effects will be fully felt on the environment in either case.

Military training can threaten certain wildlife species (especially those that are endemic to the training area) with extinction. There are many examples in the west. Walsh (1990) notes that the red-cockaded woodpecker was threatened with extinction at Fort Bragg in North Carolina until recovery measures were put in place. In Hawaii the construction of a range complex at Pohakuloa Training Area caused significant damage to rare plant species (Shaw and Laven, 1993). These few examples together with others not mentioned here make a strong case for the need to have biodiversity conservation as an indispensable priority in military training areas.

Military vehicles compact soils. This becomes more pronounced in wet seasons than in dry seasons (Guretzky ***et al.*** 2006). In dry seasons the soil surface is loosened, rills develop which may turn into gullies if not managed. Off road tracks destroy vegetation, leaving the soil bare, which during the rains get eroded (Guretzky ***et al.*** 2006). Grenades and other similar weapons leave the same results. All these affect water systems by siltation which in turn affects aquatic life. Soil erosion washes away the habitat for soil organisms while soil compaction makes soils unsuitable for the habitation of soft bodied soil organisms such as worms, some burrowing insects and rodents. When these effects are widespread and uncontrolled they affect habitat health which in turn diminishes biodiversity. Even though wildlife and livestock are capable of compacting soils when in large concentrations over a long period of

time at the same place, such scenarios are not common in nature and the compaction that can occur due to the hoof action of wildlife is less in severity compared to that by military vehicles (Guretzky ***et al.*** 2006).

Military weapons which are increasingly becoming sophisticated by the day leave harmful residual chemicals, like Mercury, Perchlorate, Nitroglycerine, Hexachloroethane, Cadmium, Chromium, Royal Demolition Explosive (RDX) and Trinitrotoluene (TNT) (Siegel and Henry, 2002); long after the army has vacated the area. Unexploded ordnances such as mines and hand grenades among others pose a threat to wildlife, civilians and the soldiers themselves, (Dudley ***et al.*** 2002). These weapons and their parts when not cleaned up from the training area can lead to soil and water pollution which in turn poison the plants, animals and people who use them for food and/ or other services like medication. These may lead to chronic ill health, disability or even death.

Effects of military training are not all negative on the ecosystem. Some can be beneficial to biodiversity conservation (Gibb and Ferris, 2008; Quist, ***et al*** 2003). Many endangered species have recovered under Integrated Natural Resources Management Plans (INRMP) of a number of military bases (Gibb and Ferris, 2008). Examples include Fort Bragg, Pope AFB, and Camp Mackal for red-cockaded woodpecker, bald eagle at Aberdeen Proving Ground, the gray wolf at Camp Ripley, the red-legged frog at Camp San Luis Obispo and the Mohave ground squirrel at Fort Irwin (Gray ***et al.*** 2008; U. S Army Environmental Command, 2008). This is because of the adaptive management approach of military bases and the tight security in such areas. The endangered species act in the US and other similar laws in various nations have forced the military to become conservation minded, and as a consequence, many training bases have become sanctuaries for the conservation of endangered species. Military

bases are largely free of humans and other developmental pressures that cause habitat loss and fragmentation. An example is the conservation of Palos Verde Blue butterfly (which was believed to be extinct) at Defence Fuel Support Point, San Pedro in California after its last known population was crushed by the city of Rancho Palos Verdes (Johnson and Owen, 2008).

2.2.2 Economic Effects

Military training has direct and indirect effects on the economy of the area where it occurs. These effects can be negative and positive and may be felt at individual, community or regional level in varying degrees depending on the magnitude of the impact.

Military training promotes the economy of the localities where they occur (Quist *et al* 2003). This occurs in employment of the local community members as drivers, cooks, office messengers among others. Expenditure on food and other supplies creates business. Individual soldier spending on curios, recreation, tourism and other goods and services add to the package of revenue to the local business owners. Maintenance of roads and bridges improve transport which is a plus for the local economy reducing expenditure on vehicle repairs and time spent travelling from one point to another. There is also the aspect of improved and pleasant experience traveling on well-maintained roads.

War and civil unrest have devastating effects on tourism. The post-election violence that occurred in Kenya in early 2008 had negative effects on Kenya's tourism industry due to travel bans and the perception of lack of safety for tourists. Military training, though organized and ostensibly safe, might have the same effects on tourism destinations not by arousing fear of violence but by disturbance from lights, bombs, dust, vibrations, aircraft

noises and heavy military presence. Research elsewhere however revealed that majority of tourists are not aware that training occurs in their destination areas and that of the few who are aware, a majority do not mind the activity (Cope and Doxford, 1997). This probably is because training activities take place at a discrete distance where disturbance of tourists is unlikely. Areas where such discrete distances are observed include NASA and Eglan air force base in Florida, Otterburn training area in the Northumberland National park and on Dartmoor National Park (UK, Defence Estates, 2005). However, in a conversation with A. King and M. Ogada on the 11th October 2011, they observed that when training takes place on private land adjoined by another where tourism takes place, complaints of disturbance and loss of business is not uncommon This is the case in Laikipia County which to some extent generated the need for this research. Such disturbances may lead to degenerative relations between affected neighbours and army hosting ranches, sometimes involving threatened court cases as has been witnessed in Laikipia. This is worsened by the fact that one benefits and another loses because of the training. Can military training and tourism co-exist on private lands? The answer or possible answers to this question is one to which Laikipia's landowners are in earnest quest.

2.2.3 Social Effects

Military training has direct and indirect social impacts on the communities that host them. It changes attitudes and perceptions on the military and its activities, biodiversity conservation issues among others. Depending on how the military interacts with the communities where they train, the impacts can be desirable or not. Where the military builds schools, children are exposed to knowledge which alters their perceptions and attitudes about life. Maintained roads and bridges enhance transport and communication which improve interactions among community members and between communities. Where the military offers employment to the

locals, living standards of those employed are improved. Due to these benefits, the local community and the military may become friends increasing the community's willingness to endure noise and other nuisances from training activities that would otherwise not be tolerated (Elwood, 2008).

The social effects may also be negative. If the military does not work to conserve natural resources, and if the local communities depend on those resources for a living, their livelihoods may be lost. If the army does not respect the local norms, friction may rise between them and the local communities. A case example was the accusation of British soldiers for raping about 2000 local women in Laikipia but lack of sufficient evidence did not permit this to be brought to court (Wadhams, 2009). If and when such incidences occur, families are bound to be broken, the resulting children and their mothers to be stigmatized, and the military may be forced to pay retributions as observed by J. Nakolonyo in a conversation on the 15th February 2012 and by Cultures of Resistance (2011).

Social effects are not limited to humans. Larkin (2010) pointed out that some explosive noises have adverse effects on wildlife and humans in his review on the effects of military noise on wildlife, . Such effects included but were not limited to the destruction of the ear and interference with vocal communications. The explosions affect the communication between wildlife individuals and species that use sound to communicate. Human presence and noise to unaccustomed wildlife may cause fright. All these affect the quality of social interaction between the individuals thus affecting the quality of their life.

2.2.4 Habituation

Wildlife to some extent adapts to disturbances in their environments and can become habituated to certain levels of disturbance (Millspaugh ***et. al***. c.2005), or show behavioral changes like being drawn to or away from the disturbance. This is called attractive or avoidance habituation (Geist, c.2005). Habituation in itself is neither bad nor good (Gill, c.2005) but whichever direction it will take depends on the management objectives, the wildlife species involved and the perception of stakeholders.

Habituation to noise from weaponry and soldiers' voices as they train are the most likely in training areas. Habituation to the soldiers' physical presence is unlikely because during training wildlife is often flushed from the area (e.g. flushing and pushing elephants with low-flying helicopters) to avoid physical injuries to them and the soldiers. However for highly territorial animals, human intrusion into their territorial space may cause stress which beyond a given limit, can prove to be harmful to their health (*Stress: Portrait of a killer*, 2011).

Klein, (1973) documented that unless associated with mortal harm, noise does not cause wildlife to flee from their habitat. Wrege ***et al.*** (2010) showed that the distribution and activity of elephants in West Africa was less affected by mining blasts than with human presence. Birds in airports respond less to the noise of aircrafts than to the vocalizations or sightings of birds of prey (Guerrera, 2009). These observations evidence wildlife habituation to noise. This could be a possibility in Laikipia. The danger that would arise to wildlife in Laikipia in the event of acoustic habituation is that of not fleeing at the sound of gunshots. Since the sounds from the gunshot of a ranch security officer, a BATUK soldier or a poacher are bound to sound the same, this could increase the risk to poaching of wildlife in the County. This would be of grave concern especially in Laikipia which is home to elephants

and the endangered black rhino, wildlife species which are greatly sought for by poachers. Poaching has recently been on the rise in Laikipia (Kinnaird, 2012).

In national parks and game reserves, non-evasive responses to human disturbances pose the greatest danger to humans particularly if the involved persons do not know the aggression signs of the encountered wildlife (Geist, c.2005). However the same type of responses enables man to share habitat with wildlife as he goes about his activities (Millspaugh ***et al.*** c.2005). This would be the ideal situation for military training activities if the animals just stay outside the firing zone to avoid injuries from military weapons. Evasive responses by wildlife to human activities gives soldiers the space to train but may have grave consequences to the wildlife, especially if wildlife abandon their habitat/territory for less favourable areas where they are exposed to higher risks of predation, human-wildlife conflict and poaching. A more accurate measure of these responses to military training requires global positioning system (GPS) tracking of wildlife species of interest. This will make it possible to measure how soon given wildlife species leave the training area, how far do they go from the training area, and how long do they take before they revisit the training area if they do return at all. This will also make it possible to know the refuge areas of such wildlife species. These are areas that need urgent research in this field.

2.3 Training on Private Lands Successes and Research Gaps

The success of military training on private lands, wherever such success has been recorded, has been due to the good relations between the military personnel, the land owners and the community (UK, Ministry of Defence 2011).The many benefits the presence of the military accord to the community (Doxford and Hill, 1998), the lucrative returns the land use option offers land owners over other options are factors that have sustained the acceptance of the

military on private lands and communities. Careful implementations of Integrated Natural and Cultural Resources Management Plans have enabled landowners to sustain training activities on their properties. For these plans to be relevant to biodiversity conservation, thorough inventories, surveys and continuous monitoring of involved resources are required (Gibb and Ferris, 2008).

There is a lot however that still needs to be done with respect to the effects of military training on biodiversity conservation efforts, and the socio-economic and political life of the people and communities that host them. Besides the research areas mentioned in the last paragraph of section 2.2.4 of this work, other researchable areas include but are not limited to:

1. Does military training as a land use option pay better than wildlife-based tourism?
2. How does military training affect carnivores, which in most cases are not welcome in local community areas due to predation?
3. How does military training affect the socio-economic aspects of the communities that host them?
4. How do different species respond to military training activities?
5. Does military training improve the security of the communities in which they are situated?

Laikipia represents a unique case of military training on private lands. It is largely owned privately interspersed with community lands. Training currently takes place on private lands which are not large enough to contain the negative effects of the training. They necessarily spill over onto adjacent properties and communities. These private lands are home to wildlife, some of which are endangered. The region is also a world renowned tourism destination

whose brand name, it is feared, the arming is tarnishing. This study is the first of its kind in the region attempting to evaluate the effects of military training on the distribution and abundance of wildlife species on Mpala Ranch, Laikipia County and explore ways forward with respect to stakeholders' views and concerns.

CHAPTER THREE

3.0 METHODOLOGY

3.1 The Study Area

Mpala Ranch, a 48,000 acre property located at the heart of Laikipia County (Figure 2) northwest of Mt. Kenya has been the primary training area for BATUK since 1964 (Graham, 2008, unpublished). Training on the ranch was formalized in August 2003 when Mpala Wildlife Foundation signed a lease with the British Army (Graham, 2008, unpublished). The lease was renegotiated in 2008 bringing with it changes in the location of the training area (2 Km west away from Ewaso N'giro river), an increase of training periods (5 periods not to exceed a total of 75 days/year), and an increase in man training days (a maximum of 15,000 man training days with no more than 200 men exercising at any one time) (Graham, 2008, unpublished). Mpala is a limited company and a working cattle ranch that also welcomes wildlife presence.

Mpala Ranch is1800 m asl. and 0°17, N, 37°52, E. Rainfall averages 500–600 mm per yr., and is weakly trimodal with peaks in April – May, July – August, and October – November. January – February is usually a distinct dry season. The mean monthly maximum temperature ranges from 25 to 33° C, and minimum temperature from 12 to 17°C (Young ***et al.*** 2003; McCauley ***et al***. 2006; Young ***et al***. 1998). Mpala gently slopes from the southwest (1850 m) to the northeast (1550 m) above sea level. The rainfall gradient follows the same pattern with the southwest receiving an annual of 650 mm and the northeast 500 mm of rainfall (Young ***et***

al. 1995, 1998). The mean annual rainfall from 1999 to 2010 was about 612.93 mm with 2009 being the driest of them all having only received 324.28 mm of rainfall (Figure 3).

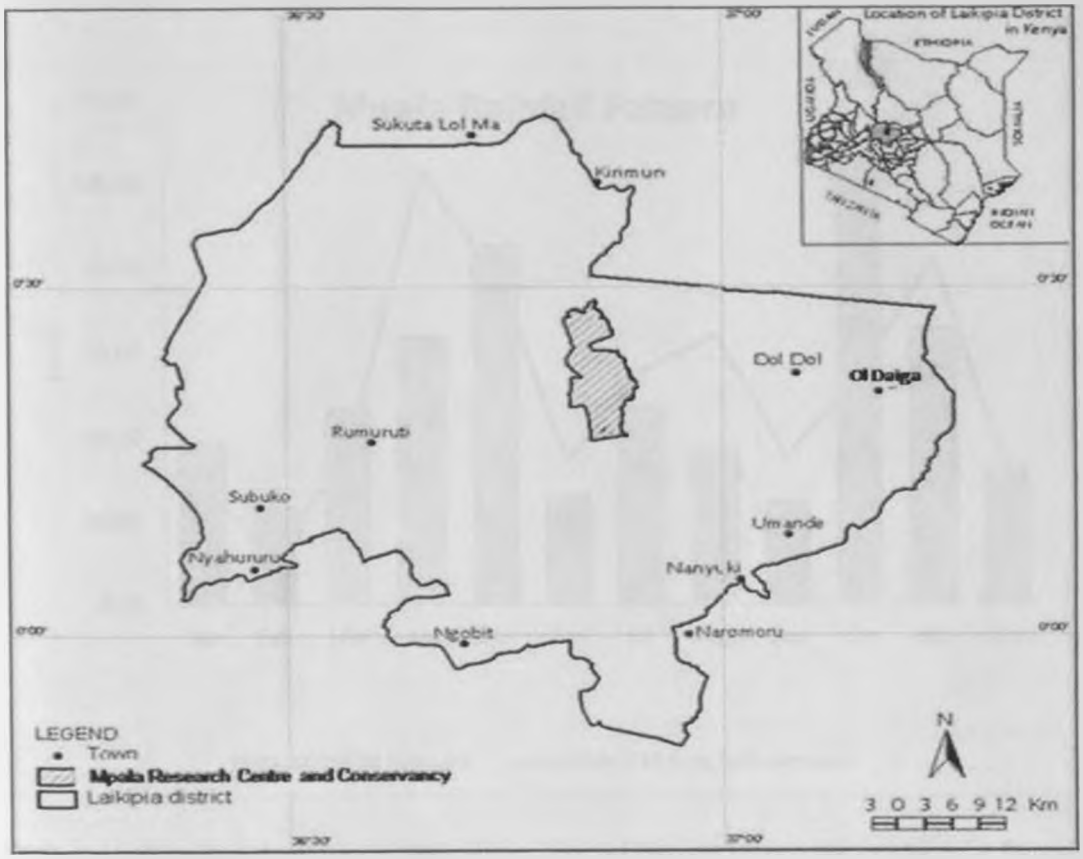

Figure 2: Map of Mpala Ranch showing location within Laikipia District (Map courtesy of George Aike)

The northern two thirds of Mpala, where my study took place, is predominantly red soils, latosols (Snow, 2007, unpublished), while the southern one third is black cotton soils characterized by impeded drainage (Figure 4). The red soils support a predominantly grassy bushland vegetation cover type with some patches of Acacia woodlands and open grasslands (Odadi, 2010). The bushes are largely of *Acacia mellifera* and *Acacia etbaica* while on the black cotton soils the vegetation cover is grassland patched with bushes of *Acacia drepanolobium* and some *Acacia mellifera* (Odadi, 2010). Figure 5 shows the vegetation cover types of Mpala Ranch. Mpala is home to more than 75 mammal species including the

critically endangered Grevy's zebra and about 280 native bird species some of which are rare and included in the IUCN list (MRC, 2012; Snow 2007, unpublished).

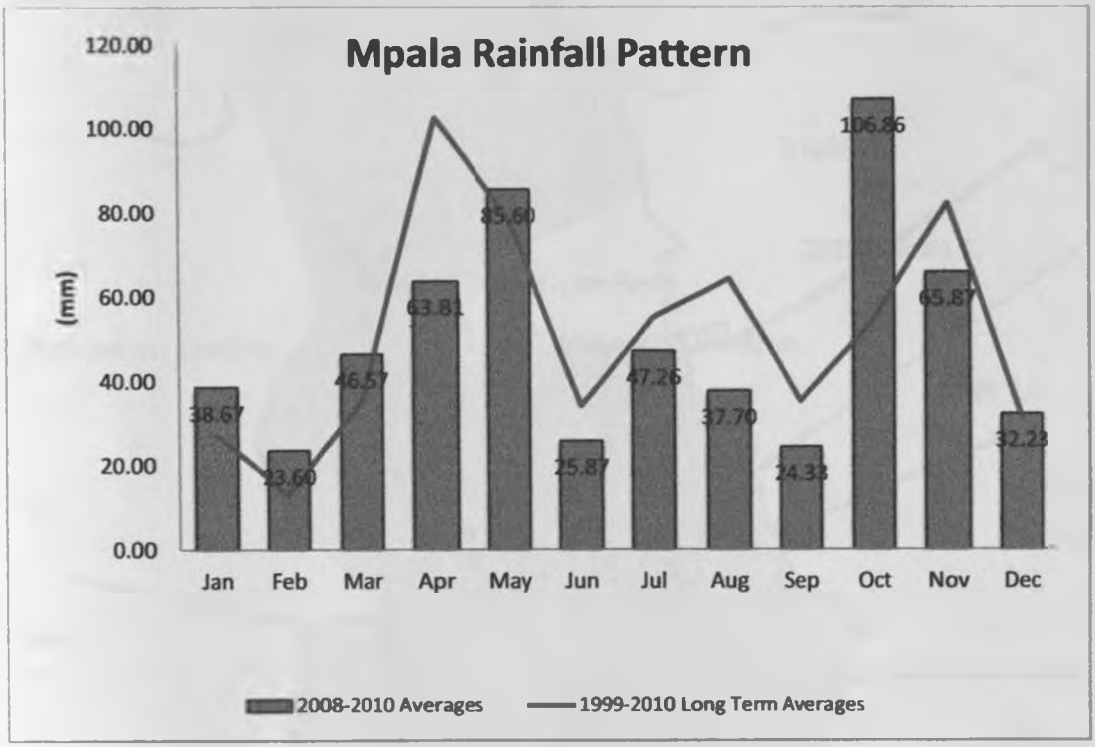

Figure 3: Monthly average rainfall on Mpala 2008 – 2010 and the long term monthly averages for the years 1999-2010. *Source: Mpala Research Centre*

Scattered all over Mpala are granitic inselbergs most of which are within the central of Mpala, the largest of them, Mukenya, 1864 m at its highest (Snow, 2007, unpublished), being the shield of BATUK firing range (Figure 5). The terrain around this area is the prime BATUK training ground on the ranch. It has dense vegetation cover at its base in which solders can hide as they train.

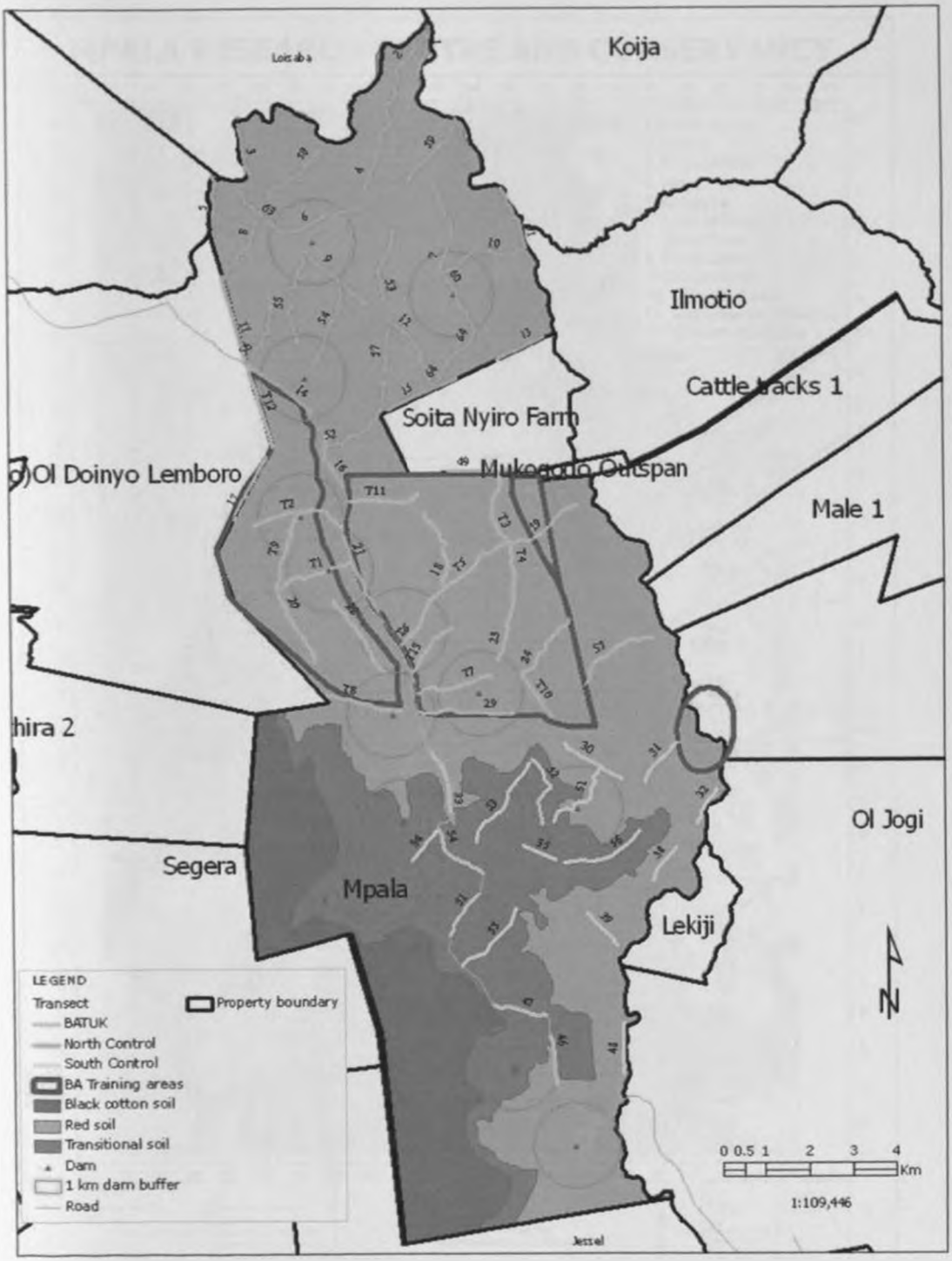

Figure 4: The Study area, showing the layout of transects, study blocks and the 1 km buffer areas around dams/watering points. *Source: Mpala Research Centre*

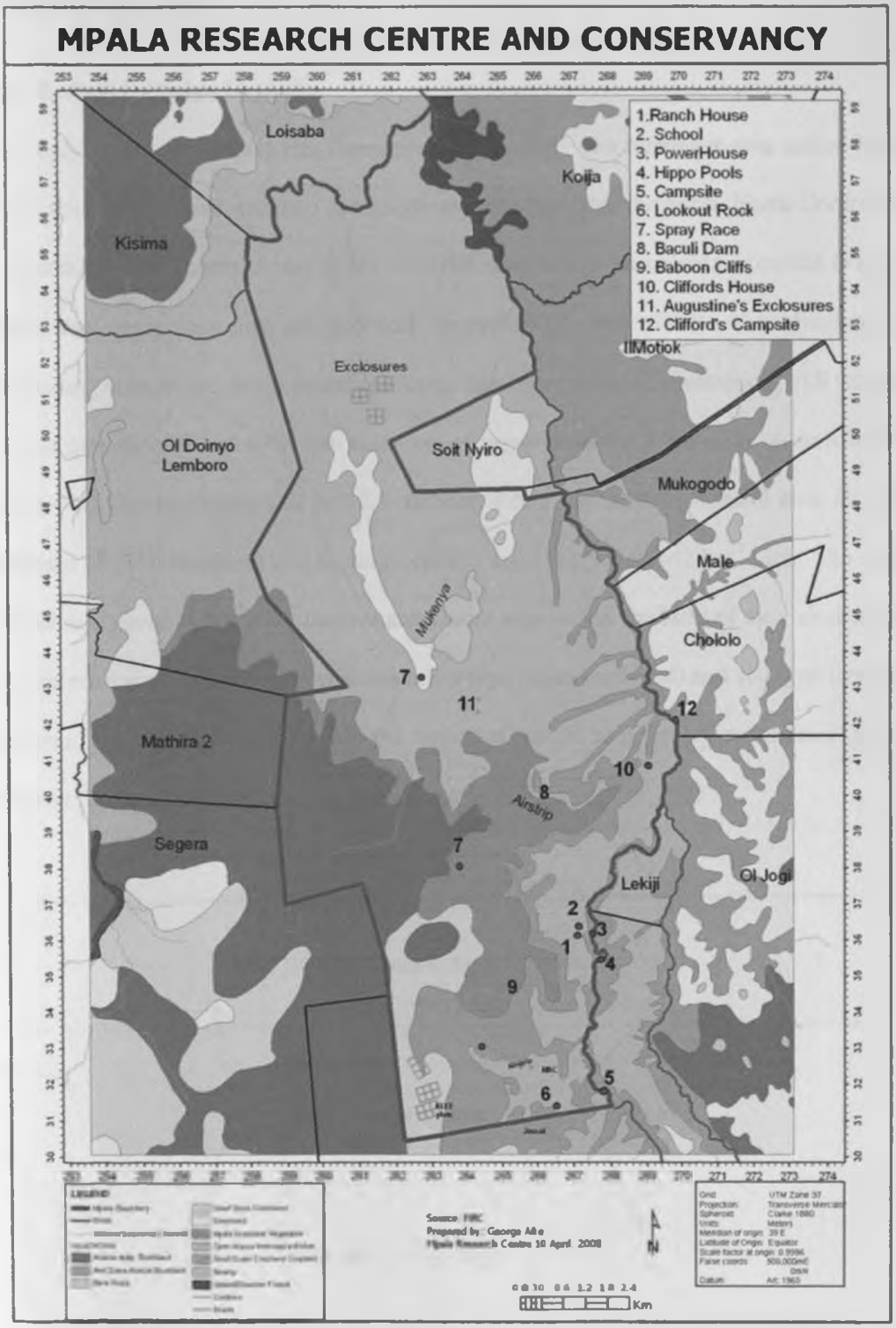

Figure 5: Vegetation cover types of Mpala Ranch. At the centre is Mukenya, the BATUK firing range shield.
Source: Mpala Research Centre

3.2 Research Design

3.2.1 Research Design Layout

The study area was divided into three strata or blocks: one treatment area called BATUK where training occurred, and two control areas immediately to the north (North Control Area) and south (South Control Area) of the BAUTK area where no training occurred (Figure 4). The control areas were thus selected with the probability that wildlife when displaced from the training area would move into these areas. See figure 6 for an illustration. All three areas were systematically laid with line transects of approximately 2 km each on existing roads (Figure 4). The treatment area had 28 transects while the northern control area 25 and the Southern 18. The treatment and northern control areas were about 42 km^2 each. The southern control was about 36 km^2. The control areas were selected on the basis of their similarity with the treatment area in terms of vegetation cover type (open bushland) and soil type (red clay or latosols). The soil is red all through the Southern control area having some transitional soil between the red and black cotton/Chromic vertisols (Warui ***et al.*** 2005).

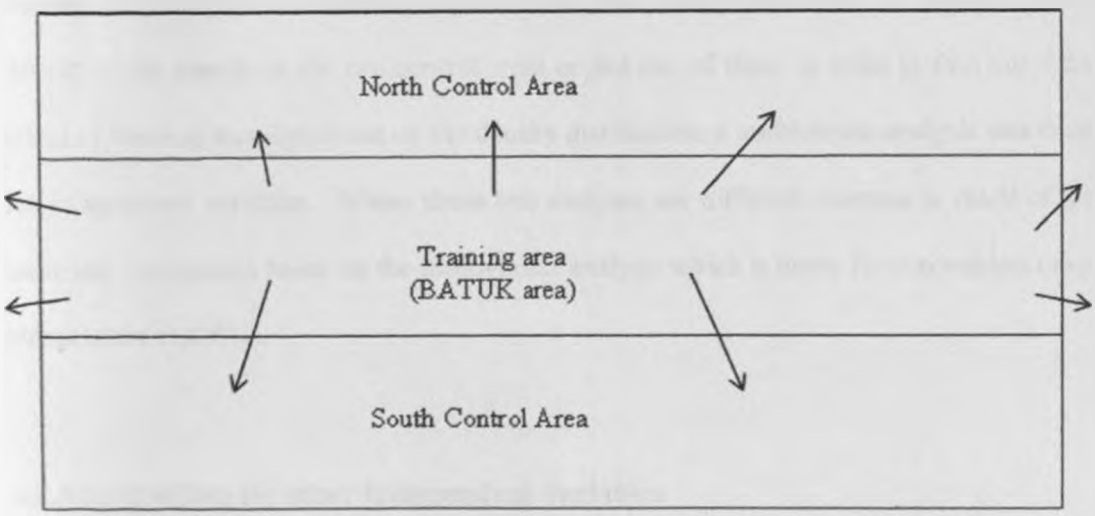

Figure 6: Sketch of study areas with directions of possible wildlife displacement.

3.2.2 Treatment and Control

Wildlife data was collected by means of wildlife surveys from all the study blocks within 9 days after training and classified as data collected 'during' training activities. Military rules and regulations for the safety of the public could not allow for data to be collected concurrently with training activities. The best that could be done was to collect data immediately after training. After such data was collected, a period of about one month was allowed to elapse before wildlife data could be collected for all the study blocks. These data was classified as data collected when there were no training activities going on. Wildlife data for periods that no military activities were going on were likewise collected within 9 days. The 9^{th} day would sometimes include the last day before the next training session would resume on the property. Data collected during no training activities acted as controls for all the study blocks. They were considered as the baseline data. Comparing densities (using t-test) for training and no training for each block would give evidence whether there were significant density changes due to military training. Significant density difference for the training block would indicate significant displacement of the given wildlife species from the training area into the two adjacent control areas. This would reflect into an increase of the density of the species in the two control areas or just one of them. In order to find out if the effect of training was significant on the density distribution, a multivariate analysis was done for independent variables. Where these two analyses are different, mention is made of the same and discussions based on the multivariate analysis which is better for it considers other independent variables.

3.2.3 Controlling for other Independent Variables

Since many factors such as season (wet or dry), block, forage and surface water availability among others affect the distribution and abundance of wildlife in nature, data on rainfall

amounts were collected and their effects on wildlife distribution and abundance also evaluated through multivariate analyses. These data were categorized into rainfall amounts in the month, previous month and in the last one year. Rainfall amounts for the wet and dry months of the study year were also summed and categorized as wet and dry seasons. Their effects on wildlife distribution and abundance were also evaluated through multivariate analysis. These analyses would give evidence if these factors confound the effects of training on wildlife distribution and abundance. There were three blocks in this study namely:

a) The north control area (North)

b) The training area (BATUK)

c) The south control area (South)

3.2.4 Buffers around Watering Points and along the main Public Road

The first objective of this study was to evaluate the impact of military training on wildlife distribution and abundance on Mpala Ranch. Under this objective this study was to evaluate whether military activities displaces wildlife from along roadsides and watering points. In order to achieve this all watering points were given a 1 km buffer round them and the public road that experiences a lot of vehicular traffic was buffered into sections of 0 – 100 m and 100 – 200 m from the centre of the road. (Arch Geospatial Information System (GIS) software (ESRI 2010) was used to do this). Wildlife numbers in these areas for training and no training for the BATUK block would then be tested by t-test to see if they are significantly different. All t-tests in this study were two tailed, two sample assuming equal variances. If the numbers are significantly different then it would be concluded that increased vehicular traffic displaces wildlife from along the roadsides and that military activities displaces wildlife from watering points in the training area. The north and south control areas had 3 and 4 watering points respectively whereas the BATUK area had 5 watering points.

3.3 Data Collection

3.3.1 Wildlife Estimation

Distance sampling method (Buckland ***et al.***, 1993) was used to measure the abundance and distribution of wildlife populations in the training and control areas. The study focused on 6 key species: African elephant (*Loxodonta africana*), reticulated giraffe (*Giraffa camelopardalis reticulata*)), Plains zebra (*Equus quagga*), Grevy's zebra (*Equus grevyi*), impala (*Aepyceros melampus*) and Guenther's dik-dik (*Madoqua guentheri*). These were chosen because they are abundant on Mpala and would generate significant data for study. They are also easy to spot because of their size or behavior.

Wildlife data was taken in the morning hours between 6:30 and 9:30 am and 3:30 and 6:30 pm when it was relatively cool and the wildlife were more active than at any other time of the day. For each survey, while seated on the roof of a Land Rover Discovery with a point of view approximately 3 m above the ground, and driving at an average speed of 8.5 km/h, wildlife was scanned for in the study areas. When a group of animals was spotted, the vehicle was stopped, the animal species identified and their number counted and a Geographical Positioning System (GPS) location of the vehicle taken. A 10×40 binocular was used to verify the number of individuals spotted and their species identity in case they were a little too far to be identified by the naked human eye. For every citing of wildlife, records of the transect bearing and of the animals were taken using a High Gear Traildrop II Compass. The distance between the vehicle and the animal was measured using a Bushnell Elite 1500 Rangefinder, a laser rangefinder accurate to 1 m over 1, 385 m. See appendix 1 for the wildlife data collection form that was used.

3.3.2 Wild Dogs Data

At Mpala Research Centre and Conservancy, there is an ongoing project on Wild dogs called the Laikipia-Samburu Wild dog project. This project has a number of GPS collared wild dogs belonging to different parks. Courtesy of the manager of the project, Dr. Rosie Woodroffe, GPS locations of wild dog packs in the study area during training were got and analyzed to see if they occurred within the training area during training.

3.3.3 Vehicle Traffic

Vehicular data was collected by manual counting. This data was collected for both training and non-training times. Unlike for wildlife data, vehicular data could be collected during the actual training. The vehicles were counted on their way before they could get to the restricted training zone. This data was used to analyze how wildlife responds to an increase of vehicular traffic due to training. There were times when BATUK passed through Mpala to go for training on Ol Doinyo Lemboro Ranch. The traffic data was still collected and classified as BATUK to reflect that exercises were going on. See appendix 2 for a sample of the vehicle traffic data collection form.

3.3.4 Socio-Economic Impacts

Questionnaires were used to collect the views of ranch managers in regard to the positive and negative effects of military training on wildlife and tourism. The views on how the positives could be maximized and the negatives minimized were also noted. A separate questionnaire was used to interview communities bordering training ranches as to how they were affected by the military training in the region. See appendices 3 and 4 for the questionnaires that were used. Thirteen ranches were targeted for interviews but only eleven were interviewed (why?). Of those interviewed, three hosted the army for training, 4 were ranches adjacent to training

grounds and the other 4 neither hosted the army nor were adjacent to those hosting the army. A total of 106 people from 3 communities of Il Polei, Il Motiok (also a group ranch) and Kinamba were also interviewed. These communities are adjacent to training ranches.

3.3.5 Forage Availability

The availability of forage and cover for wildlife in the study areas was assessed by use of Normalized Difference Vegetation Index (NDVI) method (Rouse ***et al.***, 1973). Mean values were taken for points where wildlife were observed for each stratum rather for the whole stratum. This improved the accuracy of the values by not incorporating values of unutilized areas.

3.3.6 Statistical Analyses

Statistical analyses of wildlife densities and abundances were conducted using Program Distance version 5 release 2. (Thomas ***et al.*** 2010). Data were divided into two categories: BATUK –those collected immediately after training exercises and, NO BATUK –those collected immediately before training exercises or during months in which there were no training exercises. In each category data were combined for all surveys per stratum.

Density estimates were calculated at both global (whole study area) and stratum (control and treatment areas/blocks) levels. The rest of the estimates (encounter rates, probability of detection and cluster sizes) were calculated only at the stratum level. The estimates were post-stratified according to the stratum and label (name/identity). The global density estimates were the sum of all the stratum estimates. The key functions were half-normal, uniform and hazard rate all cosine expanded. (These are Program Distance software detection functions for distance analyses)

Statistical Program for Social Scientists (SPSS) version16.0 for windows (SPSS Inc. 1984) was used to test the effects of block , season (wet and dry), training (active and inactive) and rainfall (annual, month of training and month prior to training activities) on the density, probability of detection and encounter rates of the study species. Analysis of variance (ANOVA) was conducted to control for the effects of the blocks (which come inseparably tied with their vegetation covers which provide food, shelter from the sun, wind, rain, and cover from detection by predators) the season and rainfall amounts (which determine the quantity and quality of both forage and surface water availability) on the distribution and abundance of the study species in the ranch.

CHAPTER FOUR

4.0 RESULTS

4.1 Wildlife Estimation

Table 1 below shows the number of surveys done and their classifications. There were 10 surveys in total; 5 immediately after training exercises (classified as BATUK) and 5 conducted during months when there were no training exercises (classified as NO BATUK). Four surveys were done during dry seasons while 6 during wet seasons.

Table 1: Survey dates, category and season

DATE SURVEY DONE	12 -23rd Feb.'09	23rd Mar - 1st Apr. '09	17th - 27th Apr '09.	31st May - 9th Jun '09	22nd - 29 Jul '09	17th - 26th Aug. '09	23rd - 30th Sept '09.	26th Oct. - 2nd Nov. '09	23rd Nov. - 1st Dec. '09	12th - 20th Jan. '10
CATEGORY	BATUK	BATUK	BATUK	NO BATUK	NO BATUK	NO BATUK	NO BATUK	BATUK	BATUK	NO BATUK
SEASON	Dry	Dry	Wet	Dry	Wet	Wet	Dry	Wet	Wet	Wet

Baseline data showed that there is a higher density and abundance of wildlife in the training area than in the control areas whether there is training or no training (Figure 7). This includes all wildlife species that were observed on Mpala Ranch during the surveys and not just the six study species. This data is however dominated by dik-diks which are abundant on the ranch. For the study species, both the Grevy's and Plains zebra were lowest in the BATUK area during training and show the highest proportion of increase in numbers in the same area in the absence of training (figure 8 for Plains zebra and figure 9 for Grevy's Zebra). These increases were however only significant for Plains zebra on the north control area *(t (8)* =

2.62, $p < 0.05$)[*] and the training area *(t (8) = 2.82, $p < 0.05$)*. Contrary to this t-test, multivariate analysis did not show any significant effect of training on the density distribution of Plains zebra *($F_{3,20} = 10.51$, ns)*.In the absence of training activity, Impala showed a relative increase in density in the training area albeit not statistically significant *(t (8) = 0.83, ns)* (Figure 10). This shows that military training activities had no significant effect on the distribution and abundance of impalas in the study area.

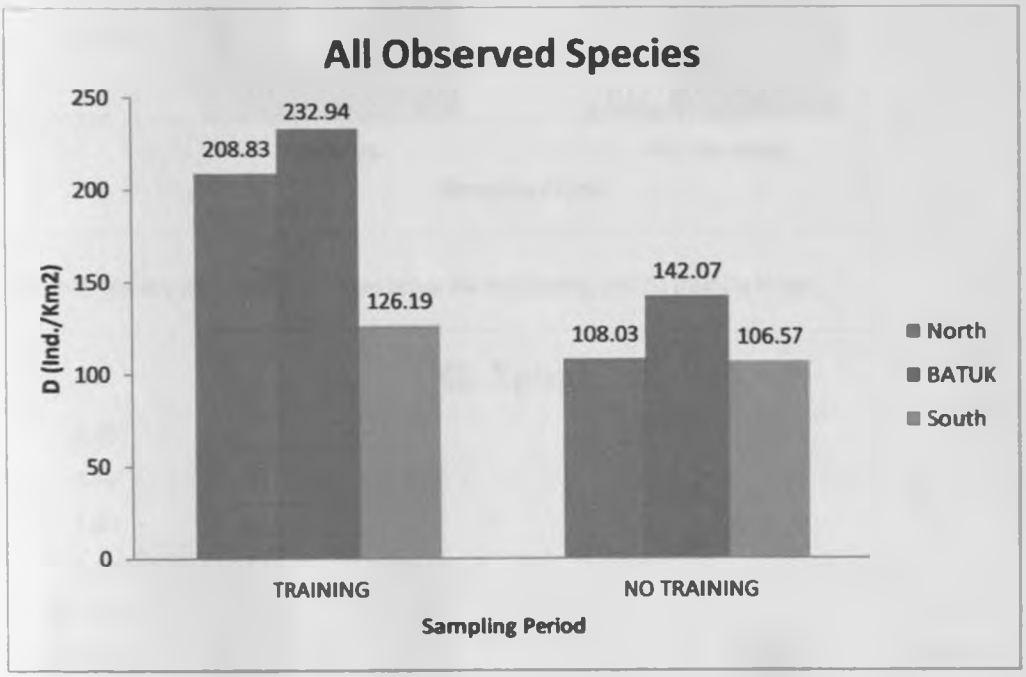

Figure 7: Baseline density data for all wildlife observed in the Study areas. The training area had the highest density of wildlife training or no training. This data is however dominated by dik-dik.

[*] As mentioned earlier in the methods, all t-tests in this study were two tailed, two sample assuming equal variances

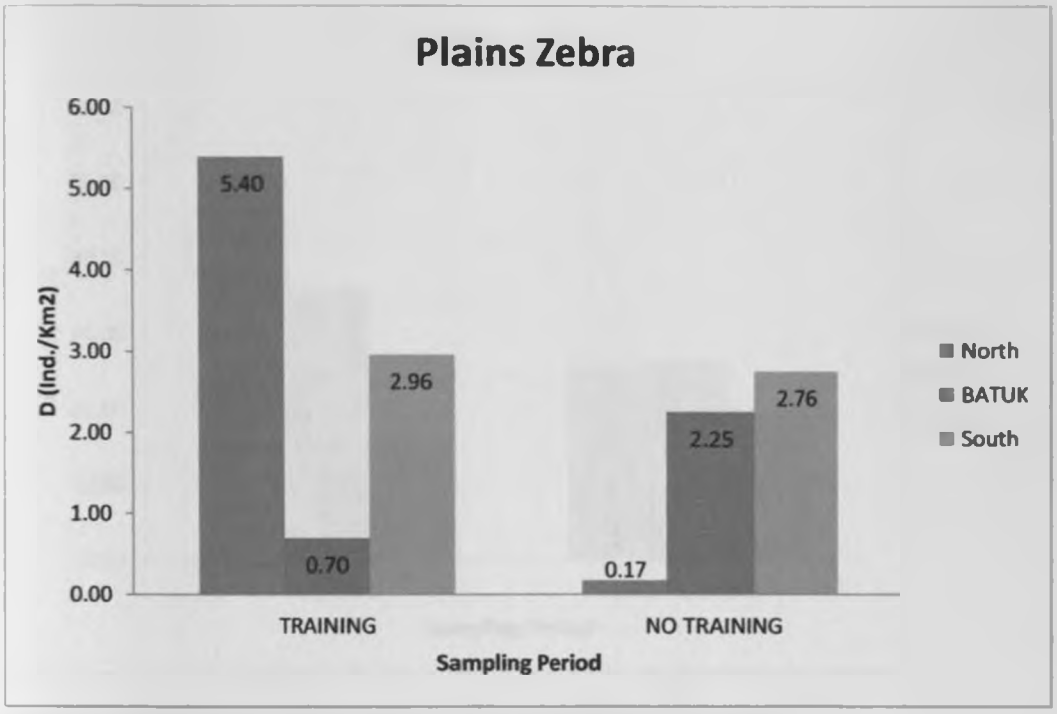

Figure 8: Density distribution of Plains zebra during training and no training times

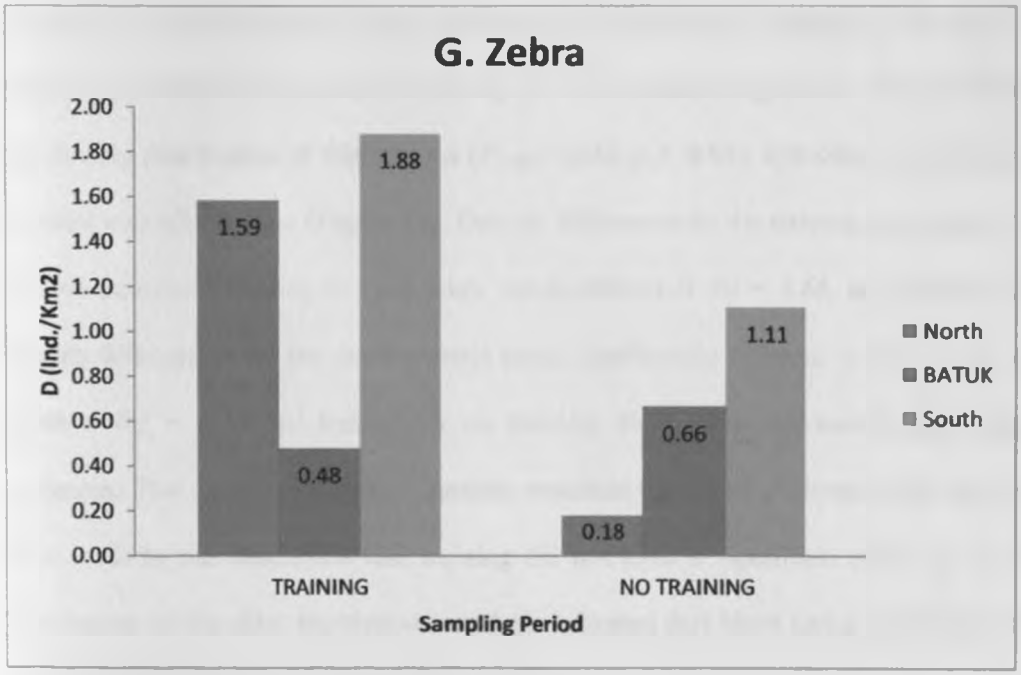

Figure 9: Density distribution for Grevy's zebra during training and no training times

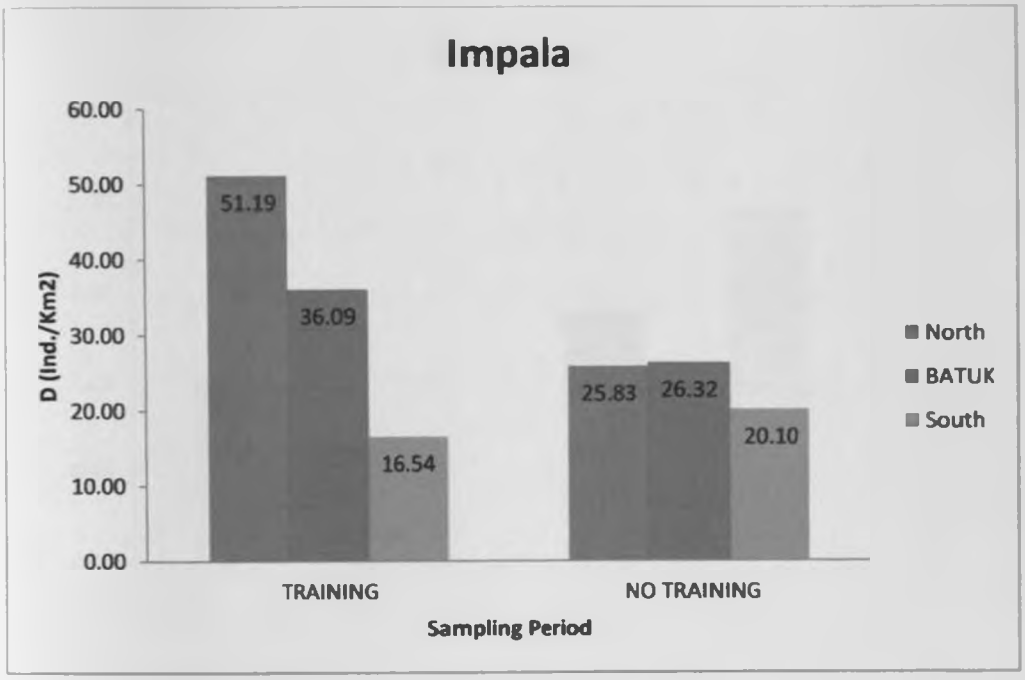

Figure 10: Density distribution of Impalas during training and no training times

Elephants avoided the training area whether there was army is training on the ranch or not (Figure 11). Multivariate analysis contrary to t-test indicated significant effect of training on the density distribution of this species ($F_{3,20} = 0.02$, $p < 0.05$). Dik-diks were highest in the training area all the time (Figure 12). Density differences in the training area during training and no training according to t-test were not significant *(t (8) = 1.65, ns)*. Neither were the density differences for the north control areas significantly different *(t (8) = 1.68, ns)* and south *(t (8) = 0.52, ns)* training or no training. Both were two sample assuming equal variances. The density distribution pattern remained the same all through the study period. This leads to the conclusion that training did not have a significant effect on the density distribution of dik-diks. Multivariate analysis indicated that block had a significant effect on the density distribution of dik-diks ($F_{3,20} = 0.63$, ns).

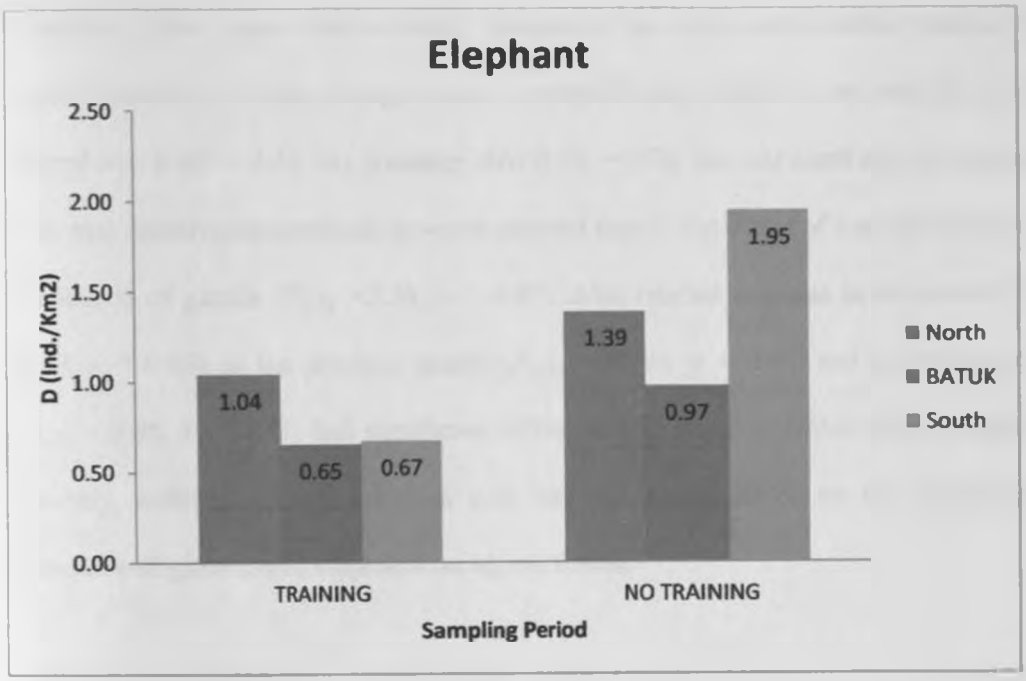

Figure 11: Density distribution for elephant during training and no training times

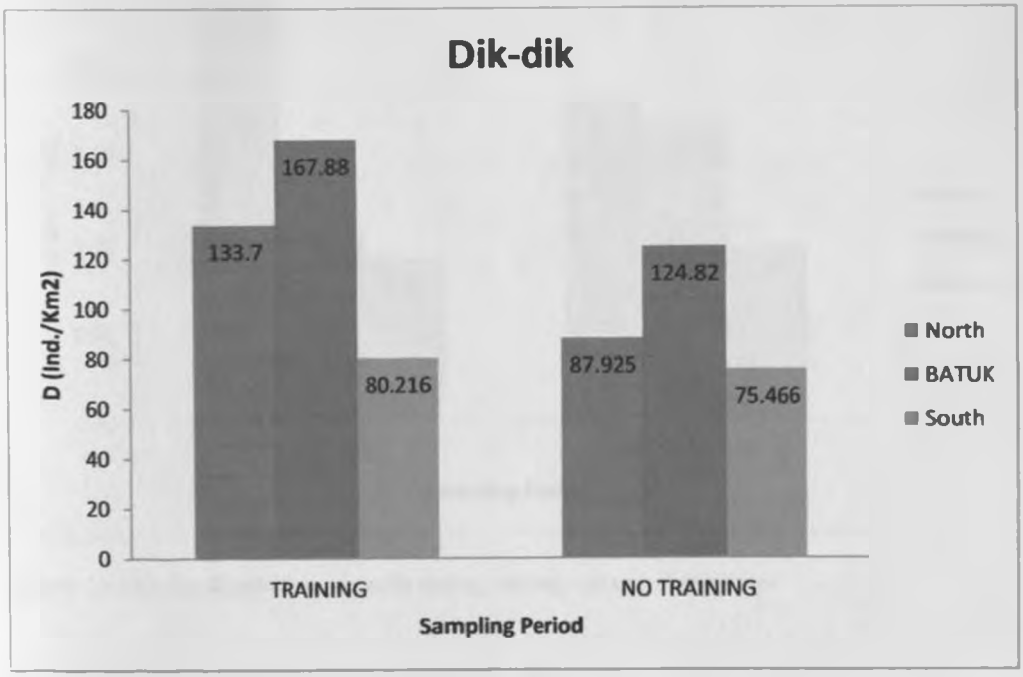

Figure 12: Density distribution of dik-dik during training and no training times

Giraffe density distribution pattern remained the same throughout the study period (Figure 13). Their densities were highest in the north and lowest in the south control area irrespective

of training. There were relative density changes in the study blocks during training and no training periods but these changes were not significantly different for each block. *(North control area (t (8) = 1.50, ns), training area (t (8) = 0.76, ns) and south control area (t (8) = 1.48, ns)).* Multivariate analysis however showed significant effect of training on the density distribution of giraffe *($F_{3,20}$ =5.30, $p < 0.05$).* Also rainfall amounts in the month ($F_{1,22}$ = 77.77, $p < 0.05$), in the previous month ($F_{1,22}$ = 92.04, $p < 0.05$) and in the last one year ($F_{1,22}$ = 9.06, $P < 0.05$) had significant effect on the detection probabilities of giraffes. In summary, military training activities only had significant effects on the distribution and abundance of giraffes and elephants on Mpala Ranch.

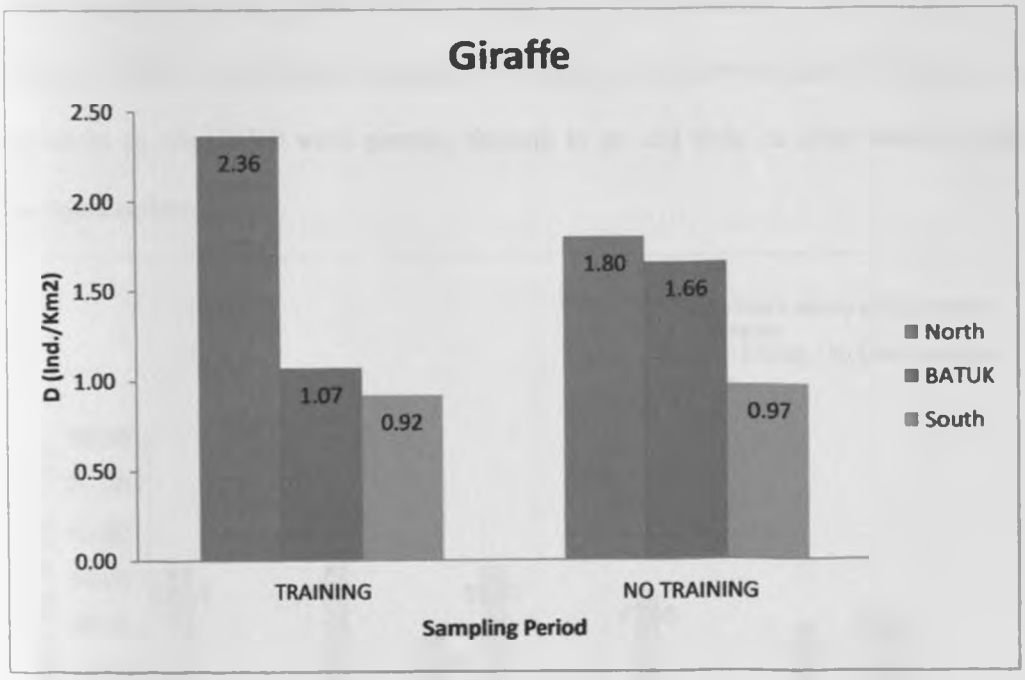

Figure 13: Density distribution of giraffe during training and no training times

4.2 Effect on Wild dogs

Four wild dog packs incorporate Mpala Ranch into their home ranges (Woodroffe, 2009, unpublished data). Two wild dog packs (Sosian and Loisaba) were observed within the training area on 5 different training days.

4.3 Vehicular Traffic

Traffic flow increased considerably during BATUK training days as shown in figure 14 (per sampling period) and figure 15 (all sampling periods combined). The numbers of vans and trucks that were counted during training were significantly different from those counted when there was no training. *(Vans: $t(12) = 4.26$, $p < 0.05$; Trucks: $t(12) = 5.44$, $p < 0.05$).* Vehicle Traffic activity still increased on Mpala on days when BATUK had no training exercises on Mpala but were passing through to go and train on other ranches such as Ol Doinyo Lemboro.

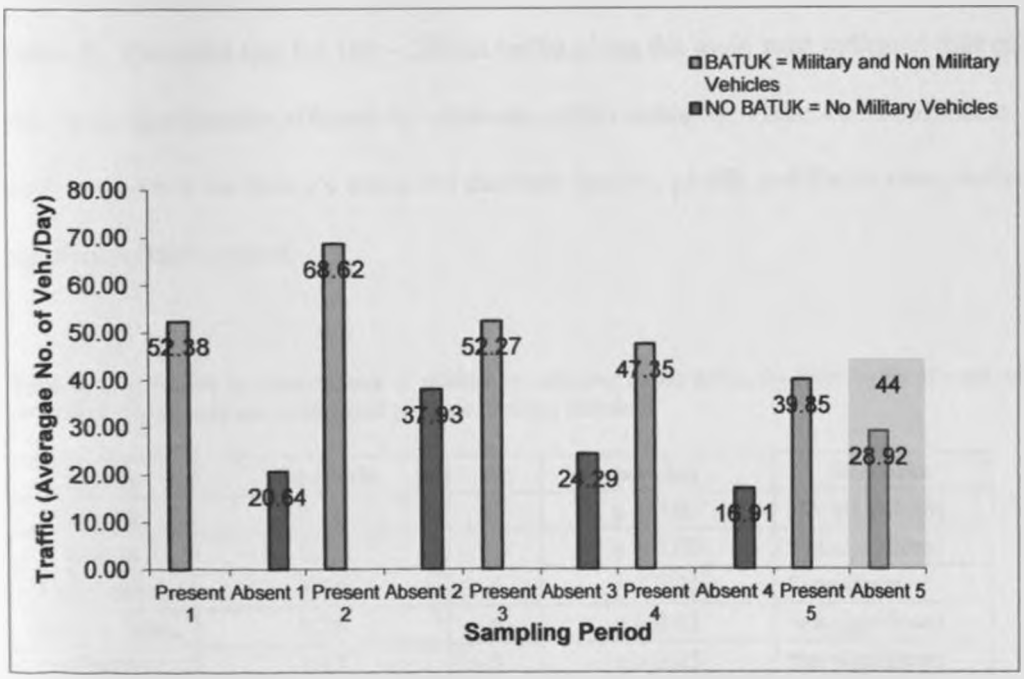

Figure 14: Vehicular volume during each sampling period. Last bar in light green indicates military vehicular volume passing to Lemboro Ranch

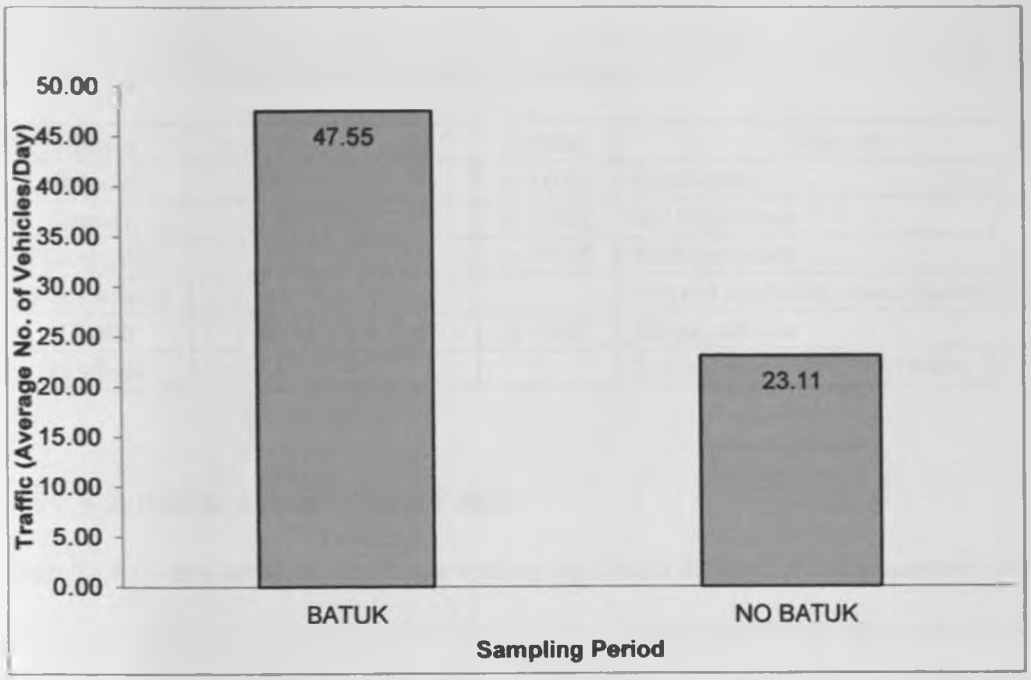

Figure 15: Vehicular volume for all training and no training sampling periods combined

A t-test whether the displacement of wildlife within the 0 - 100 m buffer area was significant between training and no training indicated that only Plains zebra was significantly displaced (table 2). The same test for 100 – 200 m buffer along the main road indicated that only dik-diks were significantly affected by vehicular traffic (table 3). There was insufficient data to carry out a t-test for Grevy's zebra and elephant. Impala, giraffe and Plains zebra indicated no significant displacement.

Table 2: t-test results for displacement of wildlife by vehicular traffic within 0 - 100m buffer of road. All tests two tailed, two sample assuming equal variance. Source: this study

Species	t- statistic	df	p-value	Remarks
Dik-dik	0.44	12	$p > 0.05$	Not significant
Impala	0.55	10	$p > 0.05$	Not significant
Plains zebra	3.66	6	$p < 0.05$	Significant
Grevy's Zebra	0.25	6	$p > 0.05$	Not significant
Giraffe	1.17	8	$p > 0.05$	Not significant
Elephant	1.77	4	$p > 0.05$	Not significant

Table 3: t-test results for wildlife displacement by vehicular traffic within 100 – 200 m buffer of road. All tests two tailed, two sample assuming equal variance. Source: this study

Species	t-statistic	df	p value	Remarks
Dik-dik	2.32	8	$p < 0.05$	Significant
Impala	1.14	10	$p > 0.05$	Not Significant
Plains zebra	1.3	4	$p > 0.05$	Not Significant
Grevy's zebra				Test not applicable. Insufficient data
Giraffe	0.47	4	$p > 0.05$	Not Significant
Elephant				Test not applicable. Insufficient data

4.4 1 Km Buffer around Water Points

Results for t-test indicated that there was no significant difference in the number of wildlife during training and no training in the training area. The same test for the north control area indicated no significance for all the study species except elephants. For the south control area data was generally insufficient for the test except for Plains zebra which indicated no significant difference in the numbers within 1 km buffer of its dams (table 4).

Table 4: t-test results for the training area for the 1 km buffer round watering points. Source: this study

Species	t-statistic	df	p-value	Remarks
Training Area				
Dik-dik	0.79	8	$p > 0.05$	Not Significant
Impala	0.23	6	$p > 0.05$	Not Significant
Plains zebra	0.53	2	$p > 0.05$	Not Significant
Grevy's zebra				Not applicable. Insufficient data
Giraffe	0.11	2	$p > 0.05$	Not Significant
Elephant	1.7	4	$p > 0.05$	Not Significant

4.5 Forage Availability

NDVI results indicated that there was not much difference between the mean values for the different strata during the surveys (table 5).

Table 5: Mean NDVI results for the study blocks for the periods of wildlife surveys. Source: this study

STRATUM	Feb '09	Mar '09	Apr '09	Jun '09	Jul '09	Aug '09	Sep '09	Oct '09	Nov '09	Jan '10
NORTH CONTROL	0.22	0.21	0.22	0.26	0.22	0.21	0.20	0.24	0.29	0.37
BATUK AREA	0.22	0.22	0.22	0.26	0.22	0.21	0.20	0.25	0.28	O.37
SOUTH CONTROL	0.22	0.22	0.22	0.26	0.23	0.21	0.20	0.25	0.29	0.37

4.6 Socio-Economic Issues

All ranch managers interviewed said that they had observed negative effects of training on the environment. Those hosting the army for training reported negative effects on wildlife, mainly wildlife displacement from the training area and wild dogs abandoning dens. The leading complaints that this category of ranchers received from their adjacent neighbours were loss of business, light pollution, noise pollution from blasts and over flights. The leading complaints against the army from those not hosting the army, be they adjacent or not to hosting ranches, were noise pollution from over flights, bomb blasts, tarnished image of Laikipia for tourism, irate wildlife, dust, light pollution and loss of business in decreasing order of gravity. Figure 16 shows the proportion of these complaints.

The leading reason as to why those who were formerly hosting the army (2 out of the 3) stopped hosting them was soldiers' non-adherence to social norms (behaved in an unpleasant manner) of the hosting ranch. Of the 8 who did not host the army, only 2 complained of loss of business. Road grading, bridge maintenance and use of tourism facilities in increasing order of appreciation are the benefits enjoyed by those who do not host the army. Figure 17 shows the proportion of these benefits. In spite of these benefits, 88% (n = 8) of those interviewed (who currently do not host the army) would not consider hosting the army in the future. Eighty two percent of those interviewed (n = 11) proposed cooperation between

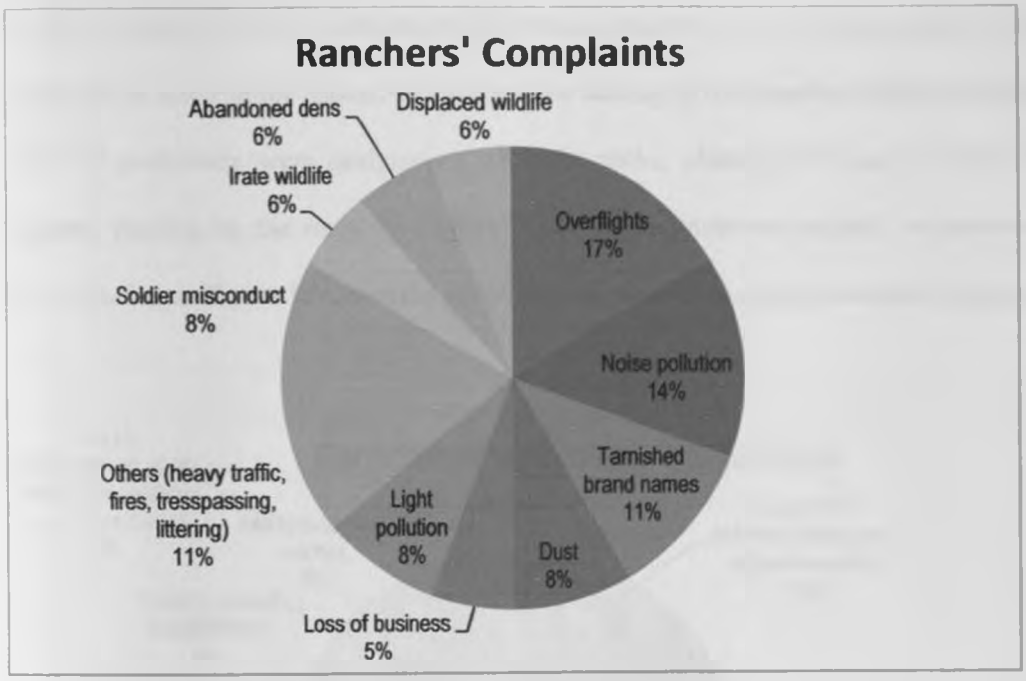

Figure 16: Ranchers' complaints and observations against military training activities

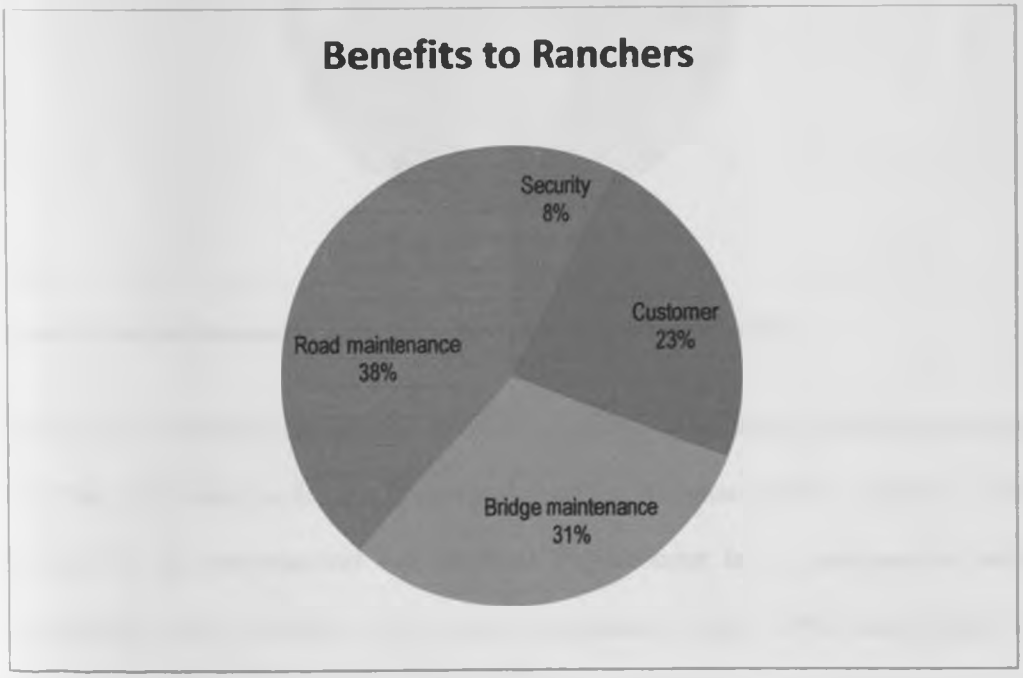

Figure 17: Benefits ranchers get from military activities. This excludes money ranch owners are paid for training on their ranches

hosting ranches and their affected neighbours as the best way of mitigating the negative effects of the army in the region. Other views for managing the negative effects in descending order of preference were designation of flight paths, planning training for low tourism seasons, funding by the army for environmental impact assessments and compensation for loss of business. Figure 18 shows the proportion of preference of these recommendations.

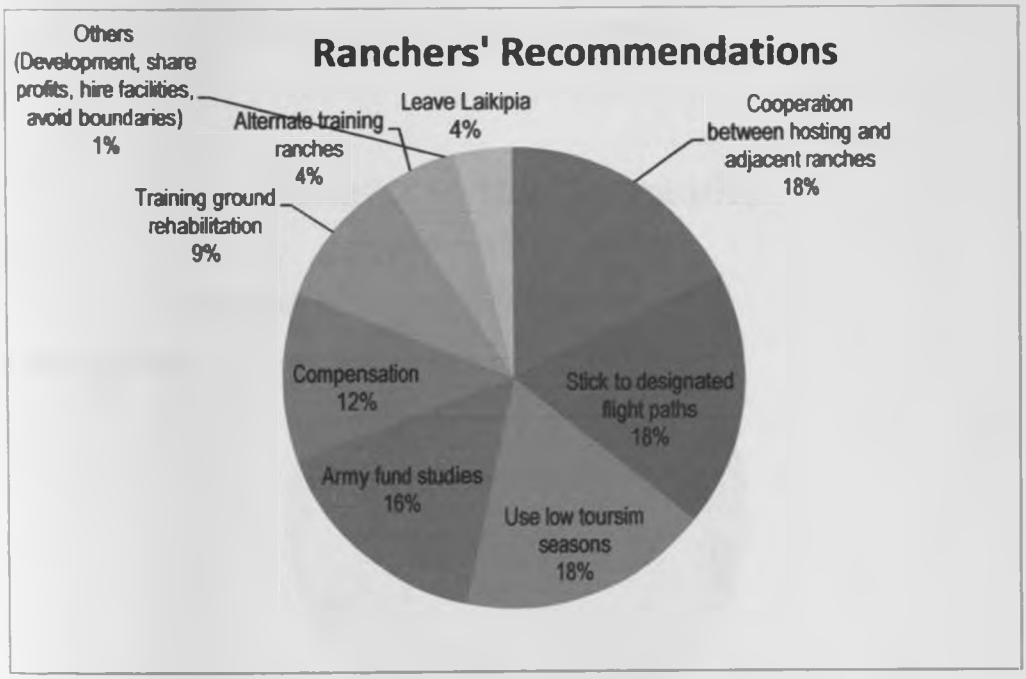

Figure 18: Ranchers' recommendations to address the negative effects of military training

Twenty-two percent of community members consider the soldiers as their customers because they buy traditional goods such as carvings, beads, and Maasai cloth or "*shukas.*" There was recognition of infrastructural and facilities improvement in the communities with 12% recognizing road grading and bridge maintenance, and 29% recognizing schools infrastructural improvement. Figure 19 gives the summary of these and benefits in proportion

form*. Twenty eight percent appreciated the army's employment of the locals for various wage jobs but with a reservation that the number taken from the communities (about 4 people or so) was very low compared with the number taken from Nanyuki and that it was restricted to a few members who stood to benefit most of the time. An overwhelming 76% (n = 106) agreed that they observed wildlife being displaced from the ranches during training. The most affected species were elephants (74%), buffaloes (32%), zebras (25%), lions (19%) and hyenas (10%). Only 8% observed giraffes being displaced.

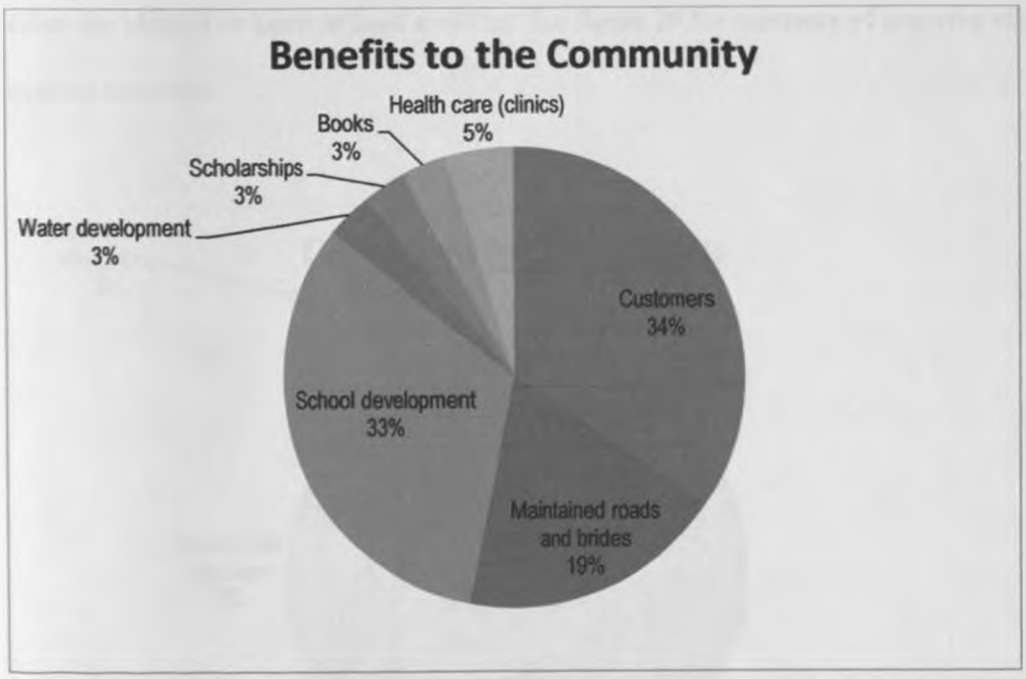

Figure 19: Benefits communities in Laikipia enjoy from the army

About 72% (n = 106) testified that they were adversely affected by the effects of military training, which they listed as sleepless nights due to blasts (54%), danger from irate wildlife (52%) and dust (28%) for those who stay near the road. Noise though not of a level to cause

* The actual percentages got in the field for the benefits were summed up and taken to represent 100%. Each benefit was then taken and its proportion of the 100% calculated. These are the percentages represented in the charts. They are just proportions for the purpose of ranking the benefits. The actual percentages are included in the text. The same applies for figures 20 and 21 that are to follow.

hearing problems robbed many of sleep. Low helicopter over flights temporarily interfered with the grazing of their livestock since they would respond by scattering and fleeing as it were. Even though the communities are used to wildlife they reported that a sudden increase of elephants and buffaloes in their villages made it hard and more risky for pupils and students to go to and leave school, for women to fetch firewood and water and for men to graze their livestock. There were reports that some had died of such wildlife. An increase of lions and hyenas meant an increase of predation on their livestock, many protested. Direct bodily harm to humans was from unexploded ordnances as testified by the 11% who were either the victims or knew at least a victim. See figure 20 for summary of negative effects of training activities.

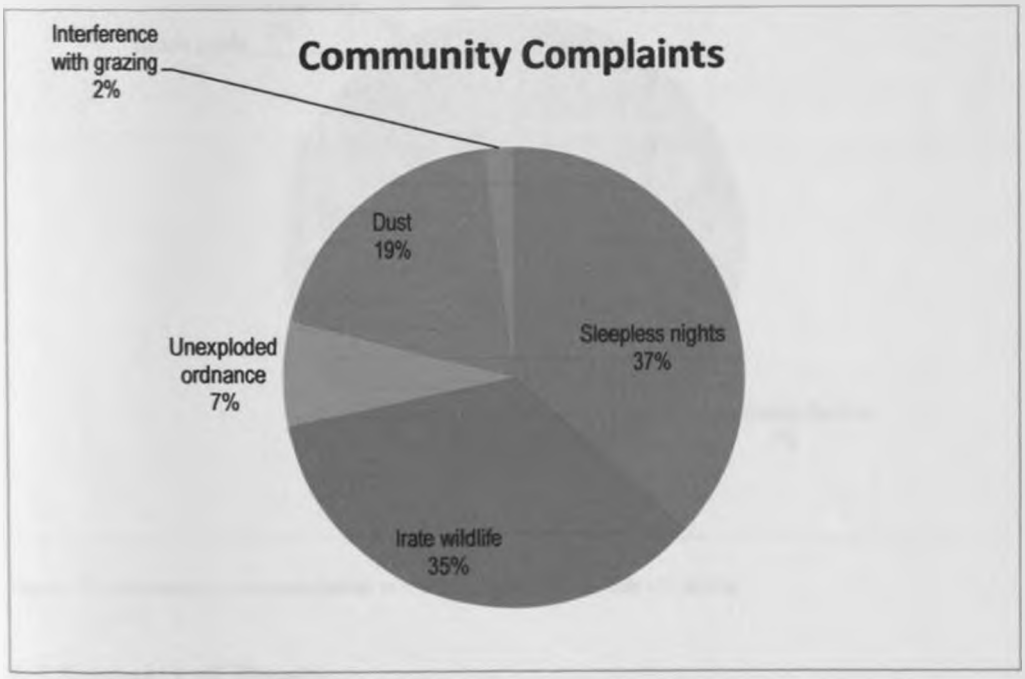

Figure 20: Community complaints against military training activities

When asked any solutions to the negatives they had observed, the three leading ones were to train in areas where the negative effects would not spill into the community (28%), fencing

either the training ranches or the community (16%) and to blast during the day (9%). Many also suggested ways in which the army would help them seeing that they are the ones that bear the brunt of the undesirable effects of the training. Such suggestions included to improve community infrastructure (dams, clinics, roads, bridges) (29%), increase employment of the locals who bear the brunt of the training rather than many from Nanyuki (25%) and to help improve education in the region by improving schools and offering scholarships to deserving but qualified pupils and students (13%). See figure 21 for summary of community recommendations.

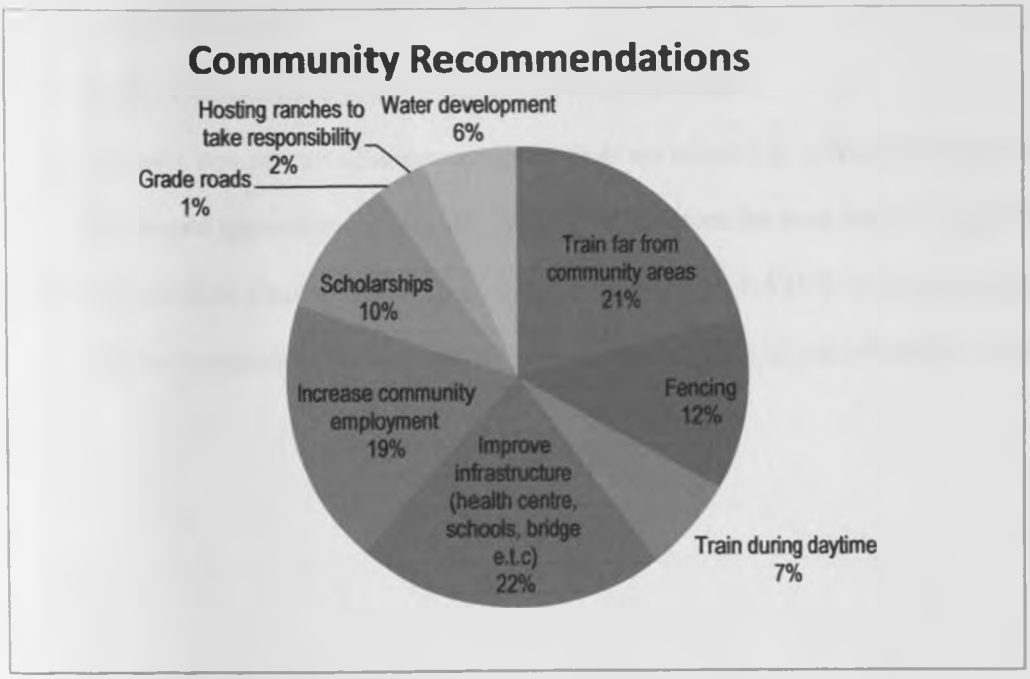

Figure 21: Community recommendations to address the negative effects of training

4.7 Summary of Results

1. Military training activities significantly affect only the density distribution and abundance of giraffes *($F_{3,20} = 5.30, p < 0.05$)* and elephants *($F_{3,20} = 0.02, p < 0.05$).*
2. Other independent variables (block, season, rainfall amount in the month, rainfall amount in the previous month, and rainfall amount in the previous year) had no

significant effect on the density distribution of the study species. Block had significant effect on the density distribution of dik-dik *($F_{2,22} = 11.22, p < 0.05$)*.

3. The displacement of wild dogs from the training area depends on the type of training going on. Trainings with explosives displace wild dogs from their dens.
4. Increased vehicular traffic significantly affected the density distribution of Plains zebra *($t(6) = 3.66, p < 0.05$)* in the 0 - 100m buffer of the main road.
5. Increased vehicular traffic significantly affected the density distribution of dik-diks *($t(8) = 2.32, p < 0.05$)* in the 100 – 200 m buffer of the main road.
6. Forage availability according to NDVI results were considerably the same for the whole study area.
7. Light, vibrations and noise affect wildlife based tourism
8. Seventy two percent of community members are tolerant to military training activities but would appreciate more development initiates from the army and hosting ranches
9. Cooperation among hosting and adjacent ranches and BATUK was recommended by 82% of ranchers as the best way to mitigate the negative effects of military training.

CHAPTER FIVE

5.0 DISCUSSION

5.1 Wildlife Estimations

Many factors influence the distribution and abundance of wildlife, including the availability of breeding grounds, food, water and habitat, predation, and human activities. In thus study, the effects of block, season, rainfall amounts in the month, the previous month and the previous year were statistically controlled since they could also affect the density distribution of the study species. All study species with the exception of dik-diks showed avoidance of the training area to some extent.

Dik-diks' density distribution was not affected by training but by block. This could be explained by the fact that the training area is the prime dik-dik area and has an abundance of dik-diks in that block than in the control areas. They are also territorial and it is hard for one family to move through several territories to secure another one elsewhere. Unless threatened by immediate and direct death, they have to live with the disturbance in their current territories. This is why dik-diks were not displaced by training. Larkin (c.2010) pointed out that noise that would otherwise be associated with danger, when repeated frequently and predictably without realization of the supposed danger, will result in habituation by wildlife. This appears to be the case with dik-diks however, they might be paying for staying put in the training area by increased stress levels. Tracy (2010, unpublished data), who did assays on dik-dik droppings to examine levels of corticosteroids which is released when animals are stressed, observed that the dik-diks in the BATUK area were under more stress than those in

the North control area. Much more interesting to note is that dik-diks in the South along the road to Clifford, where there is more vehicular traffic than elsewhere in the ranch, showed the highest levels of corticosteroids. Stress has been known to affect the reproductive life of animals (Sapolsky ***et al.*** 2000) and if the levels suffered by dik-diks in the training area are of significant biological consequence, to what degree is something that needs further investigations.

Plains and Grevy's zebras' density distribution was not significantly impacted by training activities. Even though t-test results indicated that Plains zebra's densities for the training area and the north control area were significantly different, multivariate analysis which incorporates other variables thus more precise than the t-test showed no significant effect of training on Plains zebra density distribution for both blocks. A consideration of their cluster density patterns during training and no training showed that in the absence of training, Plains zebra move from the north control area and Grevy's zebras from the South control area into the BATUK area as more but smaller groups. With no significant density changes for both species due to training, this simply indicates a reorganization of grouping. Training makes zebras congregate into larger groups. Zebras naturally utilize woodlands and savannah plains for habitat (Fischhoff ***et al.*** 2007) and prefer woodlands for security reasons from predators (Fischhoff ***et al.*** 2007), providing an explanation as to why they move into BATUK and South control areas (which have more of that habitat) in the absence of training activities. This suggests that training activities may be pushing the zebras into areas where they are more likely to face a higher probability of predation. The use of bush by BATUK for cover during training forced the zebras to use the open places more than they often do when there is no training.

Plains zebras are generally known to be found near water sources (Fischhoff ***et al.*** 2007) unless there are other restraining factors more serious than water availability e.g nutrition as observed by Redfern ***et al.*** (2003). An immediate consequence of rainfall downpour is that surface water availability is suddenly increased. This would to a greater or lesser shift the distribution of zebras on the ranch from the north control area that receives less rain on the average to the south control area that receives more compared with the other two study areas. From the distance analysis, it is evident that the density gradient of Plains zebra followed the ranch's rainfall gradient which slopes from south west to south east. With this gradient, it is possible that zebras might have been climbing up this rainfall gradient in pursuit of more readily available and high quality pastures. Indeed the density distribution pattern of this study species only disobeyed this gradient in the month of October 2009 when the ranch began to receive abundant rain across all its landscape. Rainfall amounts and water availability could to some extend also affected the density distribution pattern of Plains zebra. The same is true for Grevy's zebras as they are grazers and prefer areas that are open with short green grass, except for lactating females that look for cover for their young (Sundaresan ***et al.*** 2007; Animal Info, 2012; Wildlife at animal corner, 2012). Since open patches are in scarcity in the training area compared to the control areas, and coupled with the fact that the density differences observed between times of training and no training are not significantly different, there is a possibility that the density differences could to a greater degree be attributed to habitat choice and seasonal movements of zebras and less to training.

Giraffe densities did not change significantly between training and no training periods for the three blocks according to t-test results. However, according to analysis of variance, training had a significant effect on the density distribution of giraffes on Mpala Ranch. When elephants get flushed from the training area in preparation for training, giraffes because of

their size also get flushed out in the process. This flushing breaks giraffe clusters into many groups. This is evidenced in the lower cluster densities of the training area (0.16 clusters/km^2) during training when compared to the no training times (0.63 clusters/km^2).

This study indicates that training and rainfall in the month of surveys, the previous month of surveys, and in the last one year had significant effect on the detection probability of giraffes while training had additional significant effect on their density. Since giraffes are less affected by surface water availability (Redfern ***et al.*** 2003) the rainfall amounts in the month, the previous month and the last one year must have had much to play in determining forage quality and quantity available for the browser to forage on. With much plant cover, it would not be so easy to spot giraffes. These rainfall factors thus only affected detection probability. Giraffe home range covers approximately 160 kms (The Animal Files.com, 2010) and can exceed 1600km^2 depending on different factors (Fennessy, 2009). They can cover approximately 7kms (Fennessy, 2009) in a day meaning they can also cover the whole of the training area of Mpala Ranch in a day. Training on Mpala Ranch thus only affects a portion of their habitat. Currently training is spread across the Ewaso ecosystem with the implication that various portions of the giraffe habitat and home range are affected. How this plays out at the ecosystem level would be something of interest to know. Giraffe population in Laikipia is showing a declining trend (Kenya Wildlife Service, 2010). This decline is attributed to habitat factors such as habitat loss, fragmentation and encroachment, severe poaching, increasing human populations and human-wildlife conflict rather than to military training (Kenya Wildlife Service, 2010). Whether military training activities are contributing to these factors directly or indirectly is an area that needs urgent research.

Elephant densities for the north and south control areas are significantly different for the training and no training times according to t-test. The same test shows no significant difference for the training area. This is could be explained by the fact that elephants have good memories (Briggs, 2001) and have, over time, associated the training area with danger thus consequently tend to avoid it. When they move into Mpala Ranch, they have a preference for control areas. Analysis of variance however showed that training had significant effect on elephant density distribution. Elephants were actively flushed out by helicopters from the training area thus reducing their density in the area. This as was with giraffes had the effect of causing elephants to aggregate into larger but fewer groups than when there was no training.

Other studies elsewhere have been conducted to evaluate the response of elephants to human activities that generate noise and vibrations. One such study by Wrege ***et al.*** (2010) observed that blasts from mines did not cause mountain elephants to flee Loango National Park on the coasts of Gabon. Instead, the elephants decreased their day time activity and increased their night time activity in the areas being explored. The same change in behaviour (avoidance/minimization of human contact) had been observed among elephants in areas with high human activity (Lewis 1986; Ruggiero 1990; cited in Wrege ***et al.*** 2010; Graham ***et al.*** 2009). These studies lead to a conclusion that elephants were avoiding human presence rather than blasts. Other observations by the researcher in this study and other real life experiences however suggest that this human presence must be associated with danger in order to be avoided. Elephants seem to have just enough intelligence to discern which human presence seems to be associated with danger. In Laikipia as with national parks, elephants do not flee the presence of tourists. At Mpala research centre, elephants have on many occasions been observed in the day and night grazing and browsing near the offices and *bandas* (modern

huts) without appearing to avoid the human presence there. However, it is hypothesized that if human presence is coupled with sounds of gunshots, for security reasons elephants will avoid that human presence.

Block had no significant effect on elephant densities, encounter rates or detection probabilities because elephants roam beyond the scale of the ranch (up to 70km a day: Viljoen ***et al.***, 1990; Leggett, Fennessy & Schneider, 2003: cited in Fennessy, 2009). Season, rainfall amounts in the month and previous month significantly affected their probability of detection because these factors affect forage quality and quantity, and surface water availability. These in turn dictate to a greater extent when and to which part of the ranch elephants will move in search of water and forage. Elephants are highly water dependent and need water to drink daily and to wallow in for cooling purposes. Of all the mentioned factors, training seemed to have taken the greater proportion on the detectability effect because during training, the probability of detection of elephants increased. They could easily be seen from a distance which was not often the case when there was no training. Training forces elephants out of bushes into more open places where they can easily be seen. Season significantly affected the encounter rates. This dictates where water will be available thus where elephants go to drink and wallow.

Density changes for Impala for all the study blocks did not change significantly training or no training. Study results (figure 10) indicate that the same forces that influenced the changes operated at the scale of the ranch because the pattern of the density changes was the same for all the study blocks. In the absence of training there was a general decrease (though not significant) in the density of impala across the ranch. Training thus had no significant effect on the distribution and abundance of impala on the ranch. The changes observed could

plausibly be attributed to the seasonal movement of the species in search of habitat factors. The south control area always had the lowest individual density but the highest detection probability. This is because it had more open grassy areas and bush edges that impalas love to utilize for security reasons than the rest of the study areas (Oliver ***et al***. 2007). Impalas usually utilize open areas at night and bush edges in the day for protection against predators. Use of bush in the day by the military for training might expel them from their safe zones into open areas like roadsides thus increasing their risk of predation. Predators have a liking for hunting along roads and paths (Hurst, undated).

For a higher resolution of results for all the study species further investigations needs to be done with GPS collared individuals. This will disclose exactly how wildlife behave in response to training activities, where they take refuge in and how long they take before resuming use of their habitat. It will also reveal change in behaviour patterns with different kinds of training and how they place themselves with reference with critical habitat resources like watering points.

5.2 Effects of Training Activities on Wild dogs

Wild dogs are affected in various ways depending on the training type. Trainings with no bomb blasts as done on Mpala do not force wild dogs out of their dens. It may however restrict them to the peripheries of the training area as observed on Mpala. Where blasts are involved, wild dogs have been observed to abandon their dens as observed in Suyian Ranch. Wild dog is an endangered species and before training can take place, a search should be done for the presence of their dens so that appropriate conservation measures can be taken.

5.3 Effects of Vehicle Traffic

The findings of this study indicate that vehicular traffic only had significant effect on the numbers of Plains zebra observed within the 100m buffer and for dik-diks in the 100 – 200 m buffer areas along the main public road. These tests were not applicable for Grevy's zebra and elephant within the 100 – 200 m buffer because of insufficient data. However, Gubbi ***et al.*** (2012) from a research on the impact of vehicular traffic on the usage of highway edges found that large mammals such as elephants avoid highway edges with high vehicular traffic. Li ***et al.*** (2009) also observed that Przewalski's gazelle kept away from road edges when vehicle traffic, especially of heavy vehicles, increased. This effect is the case with Plains zebra and dik-diks.

The roadsides were however not void of wildlife. There was no total avoidance of the roadsides. Gubbi ***et al.*** (2012) observed reducing encounter rates of elephants with reducing distance from highways, while Hurst (undated) reports decreased use of roads and trails with high human activity by turkeys. Li ***et al.*** (2009) observed a positive correlation between the frequency of resting of Przewalski's gazelles and the number of passing vehicles. All these studies suggest that wildlife do not completely abandon roadsides because of vehicular traffic. They change their behaviour patterns to better suit their survival. When traffic reduces, or the road is closed, they slowly regain their normal use of the roadsides. Gubbi ***et al.*** (2012) observed a higher use by wildlife of roadsides of a road segment that had been closed for 34 months than other sections of the same road that had not been closed.

Roads through wildlife habitats increase wildlife mortalities due to collisions with vehicles as they cross the road. The researcher of this study had observed dead wildlife killed by vehicles along the road passing through Mpala Ranch. A rancher that was interviewed in this study

reported having found a Grevy's zebra hit by a vehicle. The interviewee supposed it to have been knocked by a BATUK vehicle. Since the road through Mpala is a public road, if and when such incidences occur they may not necessarily be restricted to military vehicles. Road mortalities can be reduced by alternate roads through less wildlife populated areas, closing or restricting roads use at night when wildlife are at a greater risk of being hit and by use of bumps (Gubbi ***et al.*** 2012; Hurst undated) to slow down vehicles at wildlife black spots.

5.4 1 km Buffer around Watering Points

There were no significant differences between the wildlife that were observed within 1km buffer of watering points in the training area. This suggests that training activities did not limit the use of watering points by wildlife in the training area. Grevy's zebra did not yield sufficient data for analysis. With its endangered state, this calls for a closer study of this subject involving the literal count of animals that actually water at the watering points. The use of the number of individuals within 1 km buffer does not yield results of a higher resolution as would with literal counts of watering animals or GPS collared individuals. Wildlife within 1 km buffer could simply be hiding in the bush close to the watering points rather than actually drinking from the water point.

5.5 Forage Availability

From the mean NDVI results, there was not much difference among the strata as to the index of greenness within each survey. The difference between the means of any two strata within any survey was either 0.00 or 0.01 which does not mean much in forage quality. The mean difference across surveys ranged between 0.00 and 0.17 showing slight differences in forage quality with varying seasons. What all these suggest is that individual plant forage quality wherever wildlife was observed in any stratum may not have varied much from any other

within a survey but that the population of such plants might have varied with the blocks making wildlife move in response to quantity of forage and not so much as to the quality of forage. This to some degree might have influenced the seasonal movement of wildlife across the ranch.

5.6 Socio-Economic Effects of Training

Ranchers, adjacent and non-adjacent to training ranches, complained of over flights as their leading disturbance. The solution to this squarely rests on the shoulders of the military authority to give orders to their pilots to strictly adhere to the designated flight paths. Non adherence to this simply shows that: 1) the army does not have good will towards the prosperity of tourism in the County; 2) the army is not concerned with the harmonious co-existence between those who host and do not host them, and; 3) the army has no control over her pilots. Fifty percent of the ranchers interviewed complained that over flights and the ground presence of the soldiers' trucks as they travel to training sites create an artificial taste of the otherwise serene Laikipia wilderness. An independent confirmation of this from visiting tourists is necessary in order to see how frequent they meet the army in their travels in the region and how much it bothers them. Studies in Northumberland national park in the UK (Doxford and Hill, 1998) found that a majority of tourists do not know their destinations are army training areas and of the few who knew, less that 5% minded the activity. Are the complaints in Laikipia just from the ranch managers or do they register them from their tourists?

In order to preserve the image of the region as a wild touristic destination some (18%) of those interviewed were of the opinion that the army should lift from the region and go train in the vast spaces in the northern frontier. Whereas this is a viable option, it would be

reasonable to pursue it in the event that: 1) it can be proved scientifically that the activities of the army are doing irreparable damage to the economy of the region; 2) that adjacent ranches are economically crippled because of the activities of the army, and; 3) that wildlife in the Ewaso ecosystem are being displaced to areas where their populations are decimated due to human wildlife conflict or due to the inability of the areas to provide their habitat requirements. About 5 or so years ago, training on private ranches was only on a few properties. Currently training occurs in 11 properties. Concerns are rising whether this spreading of training all over the Ewaso ecosystem could be forcing elephants out of their historic refuge zones before BATUK expanded to 11 ranches. If it can be so demonstrated, it would be unfavourable for the elephant population in the ecosystem since their refuge zones will no longer be available for their use. They will necessarily be forced into areas that are less safe for them. This requires detailed investigations especially with the increased poaching now current in Laikipia (Kinnaird, 2012) triggered by the one-off sale of legal ivory stocks to Japan and China allowed by CITES in 2008. Seventy three percent of ranchers interviewed proposed that the army fund such investigations.

Noise disturbance is unlikely to be reduced unless training with bombs and firing ceases, and military planes discarded, or new technologies provide silent firing, silent bombing, humming war planes and helicopters. Noise, the most complained about effect of training in the region, and other military training bases (Snow 2007; Doxford and Hill 1998; Waitz ***et al.*** 2011) causes sleepless nights to most community members. Even though it is just for a few nights and many have learnt to live with it, its negative impacts can be reduced if blasts would be done during the day rather than at night when people sleep. Low flying choppers and other crafts interfere with grazing activities making livestock flee and scatter, some getting lost and sometimes preyed upon if not found in time. Some livestock in the process of fleeing stumble

on pointed dry stems and branches and brush through thorns that cause them wounds reducing their health and productivity. These all translate to economic costs which the army does not take care of.

The best way to manage noise pollution is to have buffer zones around training areas, buffers that slightly exceed the radius travelled by blasts (Elwood, 2008). This radius should also be large enough to accommodate craft and chopper manoeuvres so that adjacent ranches and communities are not affected even if they encroach to the very edge of the buffer zone. If this can be achieved, it will in one stroke also solve the problem of business loss. However, its achievement remains a challenge in the region. A suitable training site for explosives requires that there be suitable geographical features for that particular type of training. These features in the training ranches exist near their boundaries with the adjacent ranches and communities. The space between does not offer radius enough to act as a buffer zone. Thus prevention of noise pollution becomes a challenge. In view of this inevitable state of affairs, close cooperation with the adjacent ranches and the utilization of low tourism seasons for training (Pekins, 2008; Military Buildup, c.2012) become viable options. Compensation for loss of business was not much preferred by the ranchers interviewed. It can be prone to abuse (WWF, 1997; Eyre, 2010). However, this abuse can be overcome by use of the average historical bookings for the training season, with a slight adjustment for how business trend has been in the year for that particular ranch, if it has been on the increase. The need for compensation can efficiently be reduced or totally avoided by considering the enterprises of adjacent properties (UK, Ministry of Defence, 2011). Training ranches can then be chosen, from among those willing to host the army, by considering adjacent ranches that will suffer least from training activities. Training type (live firing, dry training, training with explosives, planes, choppers, aircrafts e.t.c) can be changed to that which will have the least or no

negative effect on the adjacent ranch (Michel, 2006; Christian, 2006). The only problem that can arise with this is if the ranch offers the best or the only suitable training grounds for a particular noisy training that must of a necessity affect the neighbouring enterprise.

Dust from vehicle traffic was another complaint against the army from the communities and ranchers. For communities dust settles on their roofs and clothes hung on cloth lines and bushes near their homesteads. This reduces their level of cleanliness. This however occurs on a few days in a month and should not be a serious cause of controversy. Dust production can be reduced by military vehicles moving at a moderate to slow speed (40 km/hr as stipulated in their driving standing orders). Ranchers' complaint of dust perhaps arises as they meet military vehicles on the dirt roads of the region. This inconvenience should only last for a short while as they bypass the trucks or as they follow behind them and as they overtake. This should be the case with any vehicle whether it is military or not and it is a normal part of life experience driving on loose surface roads. The complaint could only justify being addressed if the truck drivers delay to give way to non-military vehicles thus prolonging the rather unpleasant experience. Military drivers are under order to give way to non-military vehicles, unless they are not executing this order.

Military training activities have had positive and negative effects in the social and economic lives of the inhabitants of Laikipia County. Local communities have had facilities built in their schools, water holes dug in their communities, their goods and services bought, their members employed albeit on a temporary basis and part of the roads they use graded. However these development initiatives are not engrained in a community development program for those affected are not well known by the locals. Many of the community members were not sure of which facilities were built or improved by the army.

Those communities that are greatly affected by training activities should benefit more from the army. Community members were of the opinion that the army should hire more people from the communities that bear the inconvenience of irate and life threating wildlife like elephants, buffaloes and lions and sleepless nights due to bomb blasts. Currently the army hires more people from Nanyuki town (50 - 70 kms from the communities that were interviewed), than it does from the communities which are just adjacent to the training ranches. While the communities were affirmative that they did not want the army to train on community lands (because of past experiences which involved lawsuits against the army), they were not of a strong mind that they should leave the region. They preferred that they train in the private, commercial ranches. The communities, however, requested that the negative effects of tolerating wildlife be balanced by more development initiatives such as improving the schools' facilities, having a scholarship fund for best performing and deserving students in the region, building and or maintaining bridges that are very critical for the community members.

A majority of the community members interviewed proposed fencing as a solution to prevent the upsurge of wildlife into their communities. Fencing of community areas from problem wildlife, especially elephants, have worked in a number of places, and where they have failed is has been due to institutional collapse (poor maintenance), lack of satisfactorily involving the community from the start, poor design, poor construction and vandalism (WWF, 1997; Hoare, 2003). If it is to succeed in Laikipia's communities, these factors must be adequately considered. An alternative solution is for the community to be informed in advance of training activities so that they may take necessary precautions like avoid grazing in areas where they often see wildlife displaced into. The mental awareness of being informed in itself

would enable community members to plan where they would do their daily activities that would otherwise be done in areas where displaced wildlife move into. It will also enable them to be a little more watchful.

Those who formerly hosted the army for training quit the land use option suggesting reasons of unpleasant behaviour from the soldiers, littering and complaints from neighbours. Reports were that they make a lot of noise and when drunk care less for their safety. They roam in the wilderness where they are bound to get into conflict with wildlife, get wounded or even killed or kill the wildlife. In case the wildlife species is an endangered one, like rhinos, clamour for the army to leave the region is necessarily bound to rise. Such clamours have existed before (Tumaren, 2006). For peaceful accommodation of their activities in the region it behoves BATUK to improve on their soldier discipline and collective adherence to conservation norms avoiding littering (with plastics, shells, propeller remains, unexploded ordnances e.t.c) of the ranches where they train and transgressing into neighbouring ranches which at one time led to the killing of a rhino in Ol Jogi conservancy (Rice, 2006). Control and guidance of soldier movement during training can be improved by use of global positioning system (GPS).

Many ranches would be financially stressed without the revenue from the army; others could become unviable. By this very fact, the army helps to secure more "protected land" for wildlife especially carnivores (lions, wild dogs, hyenas, leopards, cheetahs) and herbivores like elephants and buffaloes which are not liked in community lands because of predation on livestock, crop raiding and aggression towards humans (Graham ***et al.*** 2009; Living with Lions, 2011). This is only so if it can be established that these same species are not being displaced by the army into their "population sinks"- areas where they get killed. In a

conversation on the 11th of October 2011, A. King and M. Ogada shared that lions do not share territories. This means that when they are displaced, if they do not overthrow another from its territory, they must seek neutral ground which is unlikely to be found except in community lands where they are bound to get killed. Wildlife-human conflict issues are limited if not non-existed on private ranches, where studies have shown that most carnivores are to be found (Frank, 1998).

The fear that those now hosting the army might go out of business should they quit has no solid foundation. All who once hosted the army but quit are still in business proving a strong case that it can be done, should they quit or the army find the area no longer relevant for their military mission. The fact that 88% of those who don't host the army would not receive them even if they had the opportunity to do so, is a strong statement to hosting ranches that they must work hard to make it work, not just for them but for the region if they are to agreeably persist. With close cooperation it can be done.

Damage to biodiversity, historical sites, landscape and geological features, even though not within the scope of this study, have suffered insignificant damage and measures have been put in place by both BATUK and the ranches that host them for their protection (Snow, 2007).

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

This study arrives at the following conclusions according to the hypotheses of study:

Hypothesis 1: Military training does not displace wildlife species from the critical watering points in the training area and from the training area itself

1. Military training does not displace wildlife from the watering points in the training area on Mpala Ranch.
2. Military training displaces wildlife from the training area on Mpala Ranch. This displacement is temporal but significant for giraffes and elephants. The other study species were not significantly affected.
3. Results from the social data lead to the conclusion that displaced wildlife negatively affect the communities in the following ways:
    a) Displaced predators prey on communities' livestock mounting losses
    b) Displaced wildlife such as elephants and buffaloes interfere with the daily activities e.g going to and leaving school, fetching of water and firewood, of the community members

Hypothesis 2: Increase in vehicle traffic due to military training activities does not displace wildlife species from roadsides

- Increased vehicular traffic significantly affects the distribution and abundance of Plains zebra and dik-dik within the 0 – 100 m and 100 – 200 m buffer along the main road respectively.

Hypothesis 3: Military training activities does not adversely affect wildlife based tourism.

1. Military training activities, especially noise and light, negatively affect tourism in the Laikipia County.
2. Conclusions from social data suggest that communities are affected in the following ways by noise and low flying helicopters:
   a) Bomb blasts give community members sleepless nights
   b) Low flying helicopters interfere with the grazing activities of livestock. Livestock sometimes flee and in the process get wounded and/or get lost leading to losses to the community members

In view of the above conclusions the following are recommended:

1. Since giraffes and elephants are significantly displaced by military training activities, further research is needed to find out where they get displaced to. Reticulated giraffe population is on the decline in Laikipia (Kenya Wildlife Service, 2010) and studies are needed to evaluate whether training activities are contributing directly or indirectly to the decline. Poaching of elephants has been on the rise recently in Laikipia (Kinnaird, 2012). Could training be displacing them to areas where they easily get poached? There is need for landscape level assessment rather on a ranch basis.
2. Since there was insufficient data to evaluate the effects of training on Grevy's zebra use of watering points, a study of the same is recommended. Use of GPS collared Grevy's zebra will yield high resolution results. Grevy's zebra is a critically endangered species and all efforts should be geared towards its conservation.
3. The army and the ranches that host them should have a community development program for the communities that are adversely affected by training activities. This will help

enhance tolerance to the negative effects of training on the communities. Such development initiatives may take the form of scholarships for bright but less fortunate pupils and students, schools development, water and sanitation projects, infrastructural developments like bridges e.t.c

4. The army should fund studies that investigate the effects of their training on biodiversity conservation and the socio-economic lives of the people in the areas where they train.
5. Hiring of community members who are affected by training activities should be at an agreeable balance with those being hired from Nanyuki.
6. It is recommended that a policy on military training as a land use be formulated for the region.
7. Since some ranchers had suspected that military vehicles knock dead wildlife, a study should be carried out to verify the claims by keeping records of wildlife mortalities during training and no training on the roads that the army uses.
8. Military pilots should stick to designated flight paths to avoid unnecessary disturbances
9. Military drivers to obey their standing orders and give way to non-military vehicles on the dirt roads
10. Benefits and costs should be fairly shared between those hosting the army and adjacent ranches and communities if no other solution works for them
11. For wildlife species like dik-diks, and Plains zebra which are not endangered and whose populations are stable the principle put forward by Tazik ***et al.*** (1992) and Bowles ***et al.*** (1993) applies. They recommended that in evaluating impacts of military activities, impacts that only affect a few individuals of a species should be considered insignificant so long as the population remains stable and relatively abundant.
12. Studies should be carried out to evaluate the effects of military training activities on big carnivores.

7.0 REFERENCES

Aguilera, E. and Steele, J. (2011). Private military training centres prove lucrative. [Available at: http://www.utsandiego.com/news/2011/may/25/private-military-training-centers-lucrative/?printandpage=all] [Viewed on 24/1/2012]

Animal Info. (2012). Endangered Animals *Equus grevyi.* [Available at: http://www.animalinfo.org/species/artiperi/equugrev.htm] [Viewed on 2/5/2012]

Bowles, A. E., McClenaghan, L., Francine, J. K., Wisely, S., Golightly, R., and Kull, R., (1993). Effects of aircraft noise on the predator-prey ecology of the kit fox (Vulpesmacrotis) and its small mammal prey. Paper presented at the 6th International Congress on Noise as a Public Health Problem, Nice, France.

Briggs, H. (2001). Why elephants don't forget, BBC new online [Available at: http://news.bbc.co.uk/2/hi/science/nature/1285532.stm] [Viewed on 10/4/2012]

Buckland, S.T., Anderson, D.R., Burnham, K.P. and Laake, J.L. (1993). *Distance Sampling: Estimating Abundance of Biological Populations.* Chapman and Hall, London. 446pp.

Christian, J. (2006). British Army Kills White Rhino on Neighbors Ranch. Tumaren. Weblog [Online] December 6. [Available at: http://tumaren.wildlifedirect.org/2006/12/06/british-army-kills-white-rhino-on-neighbors. [Viewed: 9/7/2011]

Cope, A. M. and Doxford, D. (1997). Visitor monitoring: the Otterburn Training Area, Managing Leisure, 2(4), pp. 217-229.

Cultures of Resistance, (2011). Film, The Rape of the Samburu Women. [Available at: http://vimeo.com/20808275] [Viewed on Jan 2012]

Doxford, D. and Hill, T. (1998). Land Use for Military Training in the UK: The Current Situation, Likely Developments and Possible Alternatives, *Journal of Environmental Planning and Management*, 41:3, 279-297

Dudley, J. P., Ginsberg, J. R., Plumptre, A. J., Hart, J. A., and Campos, L. C. (2002). Effects of War and Civil Strife on Wildlife and Wildlife Habitats in *Conservation Biology*, Volume 16, No. 2, Pages 319–329.

Elwood, J. (2008). Encroachment in Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers [Available at: http://www.dodbiodiversity.org/ch4/index.html] [Viewed on 16/1/2012] [U.S Department of Defence]

ESRI, (2010). ArcGIS Desktop: Release 10. Redlands, CA: Environmental Systems Research Institute.

Eyre, A. (2010). Disaster Funds, Lessons and Guidance on the management and distribution of disaster funds, Disaster Action, London ISBN:978-0-9538331-1-5

Fennessy, J. (2009). Home Range and Seasonal movements of Giraffes, *African Journal of Ecology*, Vol. 47. Blackwell Publishing Ltd

Fischhoff, I. R., Sundaresan, S. R., Cordingley, J., and Rubenstein, D. I. (2007). Habitat use and movements of plains zebra (Equus burchelli) in response to predation danger from lions. *Behavioral Ecology*. doi:10.1093/beheco/arm036

Frank, L. G. (1998). Living with Lions: Carnivore Conservation and Livestock in Laikipia District, Kenya,

Geist, V. (c. 2005). Habituation Of Wildlife To Humans: Research And Recreation Opportunity And Common Curse For Wildlife And Hapless Humans In Wildlife Habituation—Advances In Understanding And Management Applications

Symposium held during the Annual Meeting of the Wildlife Society September 27, 2005.

Georgiadis, N. J. (Ed). (2011). Conserving Wildlife in African Landscapes: Kenya's Ewaso Ecosystem. Smithsonian Institution Contributions to Zoology No. 632. Smithsonian Institution Scholarly Press, Washington, D.C

Gibb, D. M. and Ferris, J. S. (2008). Balancing Biodiversity Conservation with Multiple Uses in Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers [Available at: http://www.dodbiodiversity.org/ch5/index.html] [Viewed on 16/1/2012] [U.S Department of Defence]

Gill, R. B. [2005]. Wildlife Habituation: The Dark Side, The Light Side and The Prospects in Wildlife Habituation—Advances In Understanding And Management Applications Symposium held during the Annual Meeting of the Wildlife Society September 27, 2005.

Graham Max. (2008). British Army Training, Wildlife and Wildlife-Based Enterprises in Laikipia: Can these Be Compatible?

Graham, M. D., Hamilton, I. D., Adams, W. M., and Lee, P. C. (2009). The movement of African elephants in a human-dominated land-use mosaic in Animal Conservation 12 445–455

Gray J. B., Hohmann M., Frank P. and Campbell P. (2008). Partnerships: Fort Bragg, Pope AFB, Camp Mackall In Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers [Available at: http://www.dodbiodiversity.org/case_studies/ch_10_1.html] [Viewed on 16/1/2012] [U.S Department of Defence]

Gubbi, S. Poornesha, H. C. and Madhusudan, M. D. (2012). Impact of vehicular traffic on the use of highway edges by large mammals in a South Indian wildlife reserve in *Current Science*, Vol. 102, NO. 7, pp 1047-1051

Guerrera, O. (2009). Plans in place for airport bird battle where eagles scare [Available at: http://www.theage.com.au/national/plans-in-place-for-airport-bird-battle-where-eagles-scare-20090116-7j75.html /] [Viewed on 10/4/2012]

Guretzky, J. A., Anderson, A. B., and Fehmi, J. S. (2006). Grazing and Military Vehicle Effects On Grassland Soils and Vegetation, *Great Plains Research* Vol. 16 No. 1, 2006 p. 51-61

Hoare, R. (2003). Fencing and other barriers against problem elephants, Technical Brief Series,

Hurst, G. A. (undated). Roads and Wildlife, National Wild Turkey Federation, Wildlife Bulletin No.23

Johnson, J. and Owen, A. (2008). Managing for Threatened, Endangered and Sensitive Species (Case study: Endangered Species: Defence Fuel Support Point) in Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers [Available at: http://www.dodbiodiversity.org/case_studies/ch_6_1.html] [[Viewed on 16/1/2012] [U.S. Department of Defence]

Kenya Wildlife Service, (2010). Conservation planning for giraffes kicks off. [Available at: http://www.kws.org/info/news/2010/12conservation.html] [Viewed on 23/1/2012]

Kinnaird, M. F. (2012). Elephants in Crisis, Mpala Memos

Kite, M. (2004). Army 'forced to cancel exercises' as farmers revolt over hunt ban, The Telegraph online magazine. [Available at: http://www.telegraph.co.uk/news/uknews/1474927/Army-forced-to-cancel-exercises-as-farmers-revolt-over-hunt-ban.html] [Viewed on 24/1/2012]

presented at the XIth Conference, International Union of Game Biologists., Stockholm.

Laikipia Wildlife Forum, (2010). Conserving the Flora and Fauna of Laikipia, January 2010 Newletter. [Available at: http://www.visitguam.org/runtime/uploads/Files/Updates/0210/MilitaryTrsm%20Impct%20GVB%20020310.pdf] [Viewed: 13/4/2010]

Laikipia Wildlife Forum, (2012). Tourism Sector Support programme [http://www.laikipia.org/programmes-top/tourism-sector-support] [Viewed on 30/10/2012 at 10:58]

Laikipia Wildlife Forum, [undated]. Economic Contribution of Laikipia's Tourism

Larkin, R. P. [2010]. Effects of military noise on wildlife: a literature review, Illinois, USA Center for Wildlife Ecology, Illinois Natural History Survey.

Li, C., Jiang, Z., Feng, Z., Yang, X., Yang, J., and Chen, L. (2009). Effects of highway traffic on diurnal activity of the critically endangered Przewalski's gazelle, *Wildlife Research*, 36, 379–385.

Living With Lions. (2011). Conservation film for pastoral Communities. [Available at: http://www.youtube.com/watch?v=9zy9ykD4pNAandnoredirect=1] [Viewed on 10/4/2012]

Machlis, G. E. and Hanson T. (2008).Warfare Ecology. *BioScience* Vol. 58 No. 8 pp. 729-736

Mccauley, D. J., Keesing, F., Young, T.P., Allan, B. F., and Pringle, R. M. (2006). Indirect Effects of Large Herbivores on Snakes In An African Savanna, *Ecology,* Vol. 87, No. 10, pp. 2657–2663

Michel, L. (2006).). British Army Kills White Rhino on Neighbors Ranch. Tumaren. Weblog [Online] December 7. [http://tumaren.wildlifedirect.org/2006/12/06/british-army-kills-white-rhino-on-neighbors. [Viewed: 9/7/2011]

Military Buildup: Impact on Tourism (c. 2012). [Available at: http://www.visitguam.org/Runtime/Uploads/Files/Updates/0210/MilitaryTrsm%20Impct%20GVB%20020310.pdf] [Viewed on 20/1/2012]

Millspaugh, J. J., Cassirer, E. F., Gunther, K., and Washburn, B. E. (c. 2005) Consideration and Use Of Physiological Measures to Assess Costs Of Wildlife Habituation In Wildlife Habituation—Advances In Understanding And Management Applications Symposium held during the Annual Meeting of the Wildlife Society September 27, 2005.

Mpala Research Centre, (2012). Flora and Fauna of Mpala [Available at http://www.mpala.org/] [Viewed on 30/10/2012 at 11:26]

Odadi, W. O. (2010). Competitive and Facilitative Interactions Between Cattle and Wild Ungulates In A Semi-Arid Savanna Rangeland In Laikipia, Kenya, Ph D dissertation, Egerton University.

Oliver C. E., Skinner, J. D., and Merwe, D. V. (c. 2007). Territorial behaviour in southern impala rams (*Aepycerosmelampus lichtenstein*)

Pekins, C. E. (2008). Multiple Uses, Balancing Critical Species Protection and Armored Military Training, in Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers [Available at: http://www.dodbiodiversity.org/ch5/index.html] [Viewed on 16/1/2012] [U.S Department of Defence]

Quist, M. C., Fay, P. A., Guy, C. S., Knapp, A. K., and Rubenstein, B. N. (2003). Military Training Effects on Terrestrial and Aquatic Communities on A Grassland

Military Installation. *Ecological Applications* 13:432–442. [doi:http://dx.doi.org/10.1890/1051-0761(2003)013[0432:MTEOTA]2.0.CO;2]

Redfern, J. V., Grant R., Biggs H., and Getz, W. M. (2003).Surface-water constraints on herbivore foraging in the Kruger National Park, South Africa. *Ecology* 84, 2092–2107.

Rice, X. (2006). British soldiers shoot white rhino in self-defence. The Guardian newspaper onlinc. [Available at http://www.guardian.co.uk/environment/2006/nov/20/kenya.conservationandendangeredspecies] [Viewed on 13/3/2012]

Rouse, J.W., R. H., Haas, J.A., Schell, and Deering, D. W. (1973). Monitoring vegetation systems in the Great Plains with ERTS. Third ERTS Symposium, NASA SP-351 I: 309-317

Sapolsky, R. M., Romero, L. M., and Munck, A. U. (2000). "How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions." *Endocrine Reviews*. 21 (1) (2000): 55-89.

Sartain, R. P. (2010). British Army in Laikipia and Samburu, in Laikipia Wildlife Forum Newsletter, January 2010.

Shaw, R. B., and Laven, R. D. (1993). Environmental regulatory compliance on army lands a case study, *Environmental Management*, 17(3), pp. 387± 393.

Siegel, L. and Henry, T. (2002). Toxic Ranges, Center for Public Environmental Oversight

SPSS Inc. (1984). SPSS version 10.Software

Stein, B.A. (2008). Biodiversity and the Military Mission In Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers [Available at: http://www.dodbiodiversity.org/ch1/index.html] [Viewed on 16/1/2012] [U.S Department of Defence]

Stress: Portrait of a killer. (c. 2011). Film.Heminway, J. (Dir.), Klagsbrun, D. (Ed.), National Geographic, Special. [Available at: shopPBS.org] Co-produced by National Geographic Television and Stanford University

Sundaresan, S. R. Fischhoff, I. R., Hartung, H. M., Akilong, P. and Rubenstein, D. T. (2007). Habitat choice of Grevy's zebras (Equusgrevyi) in Laikipia, Kenya: *African Journal of Ecology*, 46, 359–364. Blackwell Publishing Ltd,

Tazik, D. J., Cornelius, J. D., Herbert, D. M., Hayden, T. J., and Jones, B. R. (1992). Biological assessment of the effects of military associated activities on endangered species at Fort Hood, Texas (Final USACERL Special Report N-92/XX): U.S. Army Corps of Engineers Construction Engineering Research Laboratory.

The Animal Files.com. (2010). Giraffes. [Available at: http://www.theanimalfiles.com/mammals/hoofed_mammals/giraffe.html] [Viewed on 20/1/2012]

The Free Dictionary, (2012). Ordnance [www.thefreedictionary.com/ordnance] [Viewed on 16/10/2012 at 12:07]

Thomas, L., Buckland, S.T., Rexstad, E.A., Laake, J. L., Strindberg, S. Hedley, S. L., Bishop, J. R. B., Marques, T. A., and Burnham, K. P. (2010). Distance software: design and analysis of distance sampling surveys for estimating population size. *Journal of Applied Ecology* 47: 5-14.

Tumaren. (2006). British Army Kills White Rhino on Neighbors Ranch. [Available at: http://tumaren.wildlifedirect.org/2006/12/06/british-army-kills-white-rhino-on-neighbors.] [viewed: 9/7/2011]

U. S Army Environmental Command. (2008). Army's commitment to endangered species unparalleled [Available at: www.army.mil/article/9198/] [Viewed on 5/26/2012]

United Kingdom, Defence Estates. (2005). [Available at: http://www.dartmoor-ranges.co.uk/Downloads/Conservation/Landscape_Review_Part1.pdf] [Viewed on 23/1/2012]

United Kingdom, Ministry of Defence. (2011). Training Over Private Land (TOPL), Practitioner Guide 02/11

United Nations. (2000). Ecosystems and Human Well-being: A Framework for Assessment

Wadhams, N. (2009). In Kenya, Can War Games Coexist with Wildlife? TIME Magazine Online. [Available at: http://www.time.com/time/world/article/0,8599,1931961,00.html] [Viewed on 24/4/2012]

Waitz, I. A., Lukachko, S. P., and Lee, J. J. (2011). Military Aviation and the Environment: Historical Trends and Comparison to Civil Aviation

Walsh, B.W. (1990). War games and multiple land use, American Forests, Nov/Dec, pp. 21-23 and 74- 75.

Warui, C. M., Villet, M. H., Young, T. P., and Jocque, R. (2005). Influence of Grazing By Large Mammals on The Spider Community of A Kenyan Savanna Biome, *The Journal of Arachnology* 33:269–279,

Wildlife at Animal Corner. (2012). Grevy's zebra. [Available at: http://www.animalcorner.co.uk/wildlife/zebra/zebra_grevy's.html] [Viewed on 2/5/3023]

World Institute for Conservation and Environment. (2012). The Ecosystem Concept (Available at: http://www.ecosystems.ws/ecosystem_concept.htm) [Viewed on 14/11/2012 at 9:41]

World Wide Fund for Nature. (1997). Electric Fencing Projects, Wildlife Management Series

Wrege, P. H., Rowland, E. D., Thompson, B. G., and Batruch, N. (2010).Use of Acoustic Tools to Reveal Otherwise Cryptic Responses of Forest Elephants to Oil Exploration *Conservation Biology*, DOI: 10.1111/j.1523-1739.2010.01559.x

Young, T. P., Maureen, L. S., and Caroline, E. C. (2003). Effects of natural and simulated herbivory on spine lengths of *Acacia drepanolobium* in Kenya, OIKOS 101: 171–179, 2003

Young, T.P., Okello, B.D., Kinyua, D. and Palmer, T. M. (1998). KLEE: A long-term multi-species herbivore exclusion experiment in Laikipia, Kenya. *African Journal of Range and Forage Science* 14:94–102.

Young, T.P., Patridge, N. and Macrae, A. (1995). Long term glades in Acacia bushland and their edge effects in Laikipia, Kenya. *Ecological Applications* 5:98–108.

APPENDICES

Appendix 1: Line Transect Survey Form

Line Transect Survey Form

Date:	
Transect #:	
Stratum:	

Observers:			
	Start	Stop	Distance:
Time:			Ave. Speed:
WP:			

Species	Number	Distance	Bearing Animal	Bearing Transect	Waypoint

Appendix 2: Vehicle Traffic Data Form

	Tarehe	Gari Naenda Nanyuki				Lori Naenda Nanyuki				Gari Naenda Kaskazini				Lori Naenda Kaskazini			
		Majoni	Mpala	Zingine	Jumla	Majoni	Mpala	Zingine	Jumla	Majoni	Mpala	Zingine	Jumla	Majoni	Mpala	Zingine	Jumla
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	

Appendix 3: Questionnaire to Ranchers

A QUESTIONNAIRE ON THE VIEWS OF LAIKIPIA'S LANDOWNERS ON THE EFFECTS OF MILLITARY TRAINING ON WILDLIFE CONSERVATION AND WILDLIFE BASED TOURISM

Introduction

This questionnaire is meant to collect the views of Laikipia's landowners on the observed effects of military training in the region on wildlife and wildlife based tourism. The results will be shared with the stakeholders.

Many thanks in advance for taking your time to read through this questionnaire and for offering your views for this study. I very much appreciate your contribution.

****

Details of the person filling the questionnaire:

Name: ..... Administrative Office held.....

Ranch Name: ..... Date: .....

Questions

1. Which of the following do you do as an economic activity? (Tick all that apply)

☐ Livestock Ranching ☐ Wildlife Based Tourism ☐ Host the Army for Training

☐ Irrigation Farming ☐ Other (s).....

In case you host the Army for training, kindly answer the following questions:

2. How do you rank it economically against your other economic activities?

(Considering the total inputs and outputs and the time taken to realize them)

☐ The best ☐ The second best ☐ The third best ☐ The least

☐ Other. Specify: .....

3. Would you remain economically viable without the military training as a land use?

□ Yes □ No

4. What other benefits do you gain from the military apart from the direct cash payments for land use?

□ Road maintenance

□ Use of facilities e.g camps sites/tents for hire

□ Supply of goods e.g Fuel

□ Construction and/ maintenance of facilities e.g School, Clinics, e.t.c

□ Other. Specify-

-

-

5. Which type of training do you host?

-

-

-

-

6. Have you observed any negative effects on the environment due to the training?

□Yes □ No

7. If yes, what could they be? (Tick all that apply)

□ Soil erosion

□ Wildlife displacement from the training area (specify specie(s): .....

□ Chemical pollution (water and soil)

□ Habitat destruction (bush clearance, bare soil)

□ Littering (shells, propellers tails, etc)

□ Unexploded ordnances

□ Other. Specify: -

-

-

8. Any observed negative effects on wildlife? □ Yes □ No

9. If yes, what could they be? (Tick all that apply)

□ Unusual behaviour. Specify.....

□ Physical injury from arms (bullets, unexploded ordnances)

□ Poisoning

□ Separation from family group

□ Abandonment of dens, breeding sites,

□ Avoidance/displacement from the training area. Specify affected species: .....

□ Killed wildlife. Specify species and number killed: ....

□ Other. Specify: -

-

-

10. Do neighbouring ranches complain of your hosting of the Army for training? □ Yes

□ No

11. What do they complain about?

□ Light pollution

□ Noise blasts (pollution)

□ Too many wildlife on their property (displaced from your property) putting a strain on their resources

□ Dangerous behaviour of wildlife endangering human safety

□ Loss of business by tourists cancelling their visits on learning of the military activities

□ Other. Specify:-

-

-

In case you do not host the Army for training, kindly answer the following questions:

12. Have you hosted the army before for training? □ Yes □ No

13. If yes, why did you stop?

□ End of contractual agreement

□ Environmental degradation on your ranch. Specify.....

□ Complaints from neighbours and other conservation stake holders

□ Other. Specify: -

-

-

14. Are you directly and negatively affected by training activities of the Army on other properties? □ Yes □ No

15. If yes, which aspects of the training affect you? (Tick all that apply)

□ Light pollution

□ Noise blasts (pollution)

□ Helicopter noises

□ Tarnished image/perception of Laikipia as a place that hosts the military for training

□ Dust from military vehicle traffic

□ The artificial nature created by the mere presence of the soldiers and the many military vehicles

□ Loss of business by tourists cancelling their visits on learning of the military activities

□ Dangerous behaviour of wildlife endangering tourist's safety

□ Other. Specify: -

-

-

16. Do you gain from any positive effects of the Army? □ Yes □ No

17. If yes above, what could they be?

□ Use of tourism facilities by the army

□ Security

□ Public Road maintenance (grading)

□ Maintenance of bridges

□ Purchase of your farm produces (Beef, vegetables, fruits etc)

□ Other. Specify:-

-

-

18. Would you consider having military training as a land use should you have the opportunity? □ Yes □ No

For all to answer

19. How in your opinion are the ways in which the negative effects of the military training activities can be reduced?

□ Planning of military training activities to occur during low seasons for tourism

□ Compensation for loss of business

□ Designation of flight paths

□ Soldiers to use tourism facilities

□ Cooperation between neighbours affected and those affecting them

□ Army to fund environmental impact assessment studies on their activities

□ Soil erosion control

□ Re-grassing training grounds

□ Planting trees on cleared training grounds

☐ Alternating among different suitable training grounds in your property

☐ Alternating among different ranches to minimize impact on any one ranch

☐ Use of low tourism seasons for training

☐ Other. Specify: -

-

-

20. Any comments that you may have on military training activities, tourism, wildlife and conservation that is not captured in the above questions may be written below.

-

THANK YOU VERY MUCH FOR YOUR VIEWS

Appendix 4: Questionnaire to the Community

QUESTIONNAIRE TO THE COMMUNITY

Introduction

This questionnaire is meant to collect the views of those communities that neighbour ranches in which military training activities usually take place. These views are on the effects of military activities on the environment, wildlife, their livelihoods and social wellbeing.

****

Date: .....

Name: ..... Village/Community: .....

1. What do you do for a living?

-

-

-

2. What benefits (direct and indirect) do you get from the military in earning that living?

(Tick all that apply)

☐ They are my customers

☐ The roads that they occasionally grade ease my transport

☐ The facilities (schools, hospitals, clinics etc) they have built have brought to us many customers

☐ Others:

-

-

-

3. What benefits does your community derive from the military? (Tick all that apply)

☐ Building of Facilities:

a) Schools. Name: .....

b) Maintenance and building of bridges. Name: .....

c) Water projects. Name.....

d) Police posts. Name: .....

e) Health Centres: .....

f) Other:

-

-

-

□ Employment as

□ Graded Roads

□ Scholarships

□ Other

-

-

-

4. Have you ever observed an increase of wildlife into your community area during times of military training in the neighbouring ranch (es)? □ Yes □ No

5. If yes above, which specific species?

-

-

-

-

6. Are there any disturbances that you suffer when the military trains around?

☐ Yes ☐ No

7. If yes above, what could they be? (Tick all that apply)

☐ Danger from irritated wildlife

☐ Sleepless nights from blasts

☐ Dust from military vehicles

☐ Chemical poisoning of water sources

☐ Other:

8. Have you, your community member (s) and your livestock suffered any physical or chemical injury that can be attributed to the military training process? ☐ Yes ☐ No

9. If yes above, what could they be?

☐ Being shot

☐ Injury from unexploded grenades

☐ Chemical poisoning of water sources

☐ Other:

-

-

10. If you are one who was compensated by the military for any injustice, how much were you compensated?

-

11. How has the compensation changed your life?

-

-

-

-

-

12. In your opinion, what do you think can be done to help reduce military disturbances?

-

-

-

-

13. Any comments on the relationship/interaction between military training and wildlife conservation and/or wildlife tourism?

THANK YOU VERY MUCH FOR YOUR VIEWS