

DISSERTATION

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MSc ENVIRONMENTAL MANAGEMENT

In the

DEPARTMENT OF ENVIRONMENTAL SCIENCE, UNISA

**ENVIRONMENTAL IMPACT OF THE FAST TRACK LAND REFORM PROGRAM
ON DINGWALL GAME RANCH AND CHESA FOREST ECOSYSTEMS IN UMGUZA
DISTRICT, MATABELELAND NORTH PROVINCE, ZIMBABWE.**

By

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ABSTRACT

The study examined the impact of The Fast Track Land Reform Program on natural ecological systems at Dingwall Game Ranch and Chesa Forest. It restricted itself to wildlife deterioration and timber poaching as these are attributed to human activity and have a direct link with the Fast Track Land Reform. Questionnaires, interviews, game counts, focus group and experimental plots were used as main methods of data collection. These were able to generate both quantitative and qualitative data. The major findings of the research were that the Fast Track Land Reform Program affected negatively the natural ecological systems. The attitudes and perceptions of settlers towards the protected areas were based on the access costs and benefits from the natural resources. The main recommendations are that the existing legislation on environmental issues must be strengthened and implemented.

DEDICATION

To my wife, who always believed in me.

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I would like to express my sincere gratitude to the following individuals and organisations for their assistance and support towards the completion of this study:

- Firstly, I would like to thank my Father God for giving me the opportunity to further my studies and then giving me the strength and determination to complete them.
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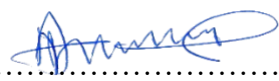
DECLARATION

I **ALBERT MVUNDLA NCUBE (46644741)** hereby declare that this dissertation, submitted for an **MSc in ENVIRONMENTAL MANAGEMENT (98001)** at the University of South Africa, is my own work and has not previously been submitted by me for a degree at this or any other institution. I declare that the dissertation does not contain any written work presented by other persons whether written, pictures, graphs, data or any other information without acknowledging the source. I declare that where words from a written source have been used and referenced and where exact words from sources have been used the words have been placed inside quotation marks and referenced.

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I declare that during my study I adhered to the Research Ethics Policy of the University of South Africa, received ethics approval for the duration of my study prior to the commencement of data gathering, and have not acted outside the approval conditions. I declare that the content of my dissertation has been through an electronic plagiarism detection programme before the final submission for examination.

December, 2019

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LIST OF ABBREVIATIONS AND ACRONYMS

Attitude-A relatively enduring feeling, belief and behavioral tendency directed toward specific individuals, groups of individuals, ideas, philosophies, issues, or objects (Ajzen and Fishbein, 1980).

CAMPFIRE-Communal Areas Management Program for Indigenous Resources (Chidumayo and Gondo, 2010).

Degradation of forests-A process that leads to a loss of forest structure, native species diversity, and the ecological processes that characterize natural forests and productivity (Dihn and Van Hung, 2006).

Demarcated forest-Any area protected by the third schedule of the Forest Act of Zimbabwe, a forest given full legal protection (Linde and Feris, 2010).

Environmental Impact Assessment (EIA)-A systematic process that examines the environmental consequences of developmental actions in advance or a procedure for evaluating the likely effects caused by a proposed activity on the environment (Bekchieh and Mercier, 2002).

Fast Track Land Reform Program (FTLRP)-Land redistribution which had to be done urgently and violently in Zimbabwe for political reasons (Raftopoulos, 2013), initiated in 2000.

Human encroachment-Intrusion of human settlement on a protected area or harmful human intrusions upon the environment (Hedley, 2002).

Jambanja-Physical force, excessive violence in occupying farms in Zimbabwe during the Fast Track Land Reform Program (Maposa *et al.* 2011).

Land cover-Is the observed (bio) physical cover on the earth's surface (Gregorio 2005).

Land use-Is characterized by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it (Gregorio, 2005).

Participatory Natural Resources Management (PNRM)-An integrated natural resources management that involves the participation of the communities in their management (Gonsalves, 2005).

Perception-An idea, a belief or an image one has as a result of how they see and understand things (Aliche, 2014).

Poaching-Any act that intentionally contravenes the laws and regulations established to protect wildlife and renewable resources (Lemieux, 2014).

Problem Animal Control (PAC)-Mechanisms or initiatives that seek to control or prevent damage to agricultural crops or human beings by wild animals (Chhetri, Barrow and Muhwezi, 2004).

Protected Areas (PAs)-An area of land or sea especially dedicated to the protection and maintenance of biodiversity, and of natural and associated cultural resources and managed through legal or other effective means (Thomas, Bishop and Emerton, 2006).

Settler-Any individual inhabiting the Dingwall Game Ranch or Chesa Forest or characterized by residential shift from a place of origin to a destination (Mizukami, 2007).

Sustainability-A process or state that can be maintained at a certain level indefinitely, (Musgrave 2009).

CHAPTER ONE: INTRODUCTION

1.1 Background

In recent times, there has been a growing recognition of the importance of considering the environment in all planning and decision making (Dalal-Clayton & Sadler, 2005). Such recognition stems from the increasing knowledge of the interlinkages between natural resources and livelihoods (Wynberg & Sowman, 2007). Issues of environmental sustainability now form an important part of developmental projects worldwide, including issues of land use changes. For example, the United Nations' millennium development goals provide a strong articulation of the importance of the environment and its impacts on reducing poverty, in achieving social and environmental justice, in gender issues and prevention of biodiversity loss.

Despite these strides in understanding the importance of environmental sustainability in all developments made, major limitations arise in the implementation of set policies. Environmental impact assessments are often overlooked, and in some cases, they are not done at all. For Africa in particular, with its history of contentious land tenure in the colonial and post-colonial eras, land reform programs should ideally be inclusive of environmental sustainability, but this is rarely done. This results in rapid decisions made mostly on a political basis which rarely is inclusive of environmental sustainability and results in rapid agricultural expansion and land-use changes.

Zimbabwe is one of the countries that has taken to fighting against colonial land inequalities through land redistribution; and the employment of several strategies to economically empower the local black African people (Manby, 2002). The land question had always been a source of conflict, and given the increase in the landless population (Kategile and Mubi 1993), and political pressure, the Zimbabwean government was pressed to act. As a result, the Fast Track

Land Reform Program (FTLRP) was rolled out in the year 2000, settling people on both previously farmed lands, and on virgin lands.

As a result, the FTLRP increased the presence of people in previously pristine lands. According to Chidumayo and Gumbo (2010), changes in agricultural activities have a tendency to set land use competition between human beings and wildlife. Lane (2001) raises a strong notion that the need to redistribute land, or improve agriculture in less developed countries, is likely to affect Protected Areas and the natural ecosystems. Amonor and Moyo (2011) suggest that the need for agricultural development causes changes in the society's land management system.

The FTLRP initially set large targets of previously white-owned land for acquisition and these were significantly exceeded as land invasions continued (Scoones *et al.* 2010). The land issue is undoubtedly crucial in Africa and in all former colonies of the world (Chaumba et al., 2003) with the unfair land distribution influencing revolutionary movements in the continent (Artola 2004). Considering that the political and economic success of any country hinges on the land, the land question remains crucial. Daily (1997, p.23), however, observes that "Societies often must choose between alternative uses of the natural environment, as this has critical importance for the viability of species in the habitats involved as well as the performance of the complex ecosystems of which they are a part," and according to Kategile and Mubi (1993) "Conflicts between arable cropping requirements and the normal use of natural pastures by both wildlife and domestic stock undermine the long-term productivity of the land, reducing the capacity of the arid and semi-arid land to support both human and animal life". Such observations show that resettlement is not only a historical event but a continuous process and there is need to for more systematic approach to land reform and much more should be invested on research in this particular subject.

In the post FTLRP era, Mukamuri *et al.* (2009) observed that the fast track land reform caused conflicts which spilled over to environmental degradation. One of the major driving factors in this work is to demonstrate how much the forest and wildlife resources have been exposed to the environmental degradation. Mukamuri *et al.* (2009) observes that there was excessive sale of fire wood and the subsequent destruction of forest resources. He further asserts that money is valued more than the environment, and there is no sense of ownership of the land, with settlers behaving like they are passing through. According to Mukamuri *et al.* (2009) most farmers are uncertain of the land tenure and ownership arrangements which then motivates destructive or irresponsible behaviour. Economic hardships that have plagued the country for the past two decades exacerbate the problem as settlers are forced to make a living from natural resources. Scoones *et al.* (2010) acknowledge that natural resources are a vital source of livelihood particularly for the poor and marginalised

According to Scoones *et al.* (2010) the FTLRP opened up opportunities for hunting, thereby reducing wildlife populations; and hunting being a precursor to other types of land use. Such degradations exacerbated the exceeding of the targeted land invasions (Scoones *et al.* 2010). Such disorder scarcely allows environmental considerations to be made, as there rarely is anytime for the valuing or consideration of natural ecological systems. This resulted in significant retrogressive planning of resettlements (Chaumba *et al.* 2003).

In addition to rapid land distribution, and land tenure issues, environmental degradation in the post land reform era is also influenced by the erosion of traditional methods of encouraging sustainability (Scoones *et al.* 2010). According to Blaike and Brookfield (1987), traditional approaches to resource management such as the protection of sacred groves or wetlands are important in traditional settlements, yet resources remain highly wasted in newly resettled areas, Zimbabwe included.

The mode of the Zimbabwean FTLRP significantly contributed to environmental degradation. According to Scoones *et al.* (2010) the ‘Jambanja’ period came to define the Zimbabwean land reform process. According to Chaumba *et al.* (2003), “Jambanja came to refer to all the illicit activities on these farms that rapidly became normalized, this included closing farm roads, cutting down trees, poaching, cattle theft and mutilation, starting fires, attacking game guards, demanding meat and mealie meal from white farmers, looting property and sugar cane.” The environmental consequences of the ‘Jambanja’ approach and its effect on sustainability needs to be explored. Scoones *et al.* (2010) contend that the Jambanja era threw the nation into environmental chaos. Chaumba *et al.* (2003) and Schoones *et al.* (2010) are in agreement that during the Jambanja, there was no implementation of laws and policies by state departments (due to negligence and fear of political victimisation) to favour the balanced state of ecological systems, and degradation became a culture.

The scale of land reform affects the environment sustainability with increased possibilities of making mistakes. In Zimbabwe, the FTLRP was expansive, aiming to settle 162 000 families on 5 million hectares of white-owned farmland within four years (Seddon, 2013). Seddon (2013) observed that the programmes lacked transparency, and the newly resettled farmers lacked crucial inputs like seed, water and fertilizer thereby proving to be unsustainable. It is such unsustainability that poses threats to existing natural ecosystems and protected areas.

Dingwall Game Ranch and Chesa Forest in Matabeleland North, Zimbabwe are examples of protected areas that continue to suffer the consequences of the FTLRP. Unprecedented competition for land among humans, wildlife and forests is one of the major results of FTLRP with the potential to deplete the quality and quantity of wildlife and forest resources. Resettlement therefore likely disrupts the natural ecological ecosystems. According to Dickson and Murphy (1998), increasing human populations affect ecosystems through the extinctions due to overuse, as well as the modification of flows of energy or nutrients through changes to

abiotic environmental components of ecosystems. As noted by Anderson and Algren (2011), this does not only affect all other species within the biosphere, but also threatens the support system for all life on earth. Human modification with land management systems has the capacity to affect natural ecosystems.

This therefore can be linked to the situation prevailing within and around Dingwall Game Ranch and Chesa Forest ecosystems (Mani and Bansal 2006) where changes in land management systems have altered the state of these protected areas. According to Dickson and Murphy (1998, p.132), low or poor knowledge as well as low priority for ecosystems result in non-sustainable development.

It is the purpose of this work to analyse and assess the impact of the accelerated agrarian revolution (Fast Track Land Reform) on natural ecological systems by presenting sound and relevant recommendations for the management of forest and wildlife resources in the protected areas that have experienced or are likely to experience human encroachment. Such information remains crucial to any country in the world that may need to undertake a land reform program. Special attention is given to wildlife and forest resources as crucial elements of major ecosystems. Dickson and Murphy (1998, p. 132) present a solid and critical statement on the management of ecosystems when they say that “Frequently, we do not understand the effects of impacts on ecosystems properly, and often we have little idea of the outcome of these impacts. This makes sustainable resource management, upon which the continued functioning of ecosystems depends, very difficult.” The research is guided by the understanding that ecosystems are not isolated from one another. Changes in any one ecosystem bring about a change in the adjacent ones (Mani and Bansal, 2006, p.43). There is a need to understand how the change in the management system of the two areas has influenced the environment. The study also draws upon the concept of political ecology perspective, employing geospatial

technologies and remote sensing as tools to assess the impacts of anthropogenic activities in the selected areas.

1.2 Statement of the problem

The Fast Track Land Reform Programme in Zimbabwe has received mixed reactions from people across the world. Several scholars have reacted to its pros and cons but mainly from the socio-political and socio-economic perspectives. While it is clear that land management changes have direct impact on natural ecological system, there seems to be a glaring lack of interest in tackling the threatening environmental effects of the Fast Track Land Reform Programme from an environmental management point of view. The critics of the haphazard land redistribution only dwell on the marginal issues with immediate gains for rivalry camp perspectives yet the environmental challenge is global and ongoing especially in the light of global warming and climate change. Given the political history and contemporary situation of Zimbabwe, the reality of the Fast Track Land Reform is irreversible. It is only prudent to effectively engage on mitigation dimensions that lead to effective management of co-existence of human population and fragile natural ecological systems. With all the hot arguments for and against the land reform, there has been no effort to determine the extent of human population encroachment into the Protected Areas in order to assess the impact of the Fast Track Land Reform on these Protected Areas.

It is imperative to determine how much the Fast Track Land Reform approach has affected the natural ecological systems especially wildlife and forest resources in Matabeleland. It remains crucial to establish the impact that settlers had on their new areas, how settlers can benefit from the Protected Areas (PAs), and how much their perception of the PAs have the potential of enhancing sustainable management of forest and wildlife resources in the post-Fast Track Land Reform era. This study thus delves into the inner ecological challenges that have been encountered during the Fast Track and post Fast Track Land Reform in order to cultivate the

most needed grounds for adaptation, conservation, management and sustainability of the natural ecological systems in the light of competing needs of political economics and environmental management of game and wildlife resources.

1.3 Justification

Very few studies have been done on human resettlements within or close to Protected Areas in Zimbabwe. Those done have tended to tackle the ecological and socio-economic aspects in isolation. This study will adopt a holistic approach to conservation by maintaining focus on the ecological aspect of the wildlife and forest resources while giving due diligence to the socio-economic and political aspects of conservation. The Dingwall Game Ranch and Chesa Forest increasingly faced human encroachment. Without studies to develop appropriate management strategies that recognise the existence of human settlements in PAs, there is a great possibility that the wildlife and forestry resources will degenerate to little or no ecological and economic value and fail to support livelihoods in areas where rural people can utilise such resources and their products. Consideration of attitudes and perceptions of communities was a vital component in coming up with more effective management strategies in a world where development is no longer considered an antithesis to biodiversity conservation. The study employed participatory approaches which increase acceptability of conservation that has consideration for local communities, including providing the much needed balance between protection and resource provision.

While it is maintained that the land reform overall is irreversible, there is still an opportunity to reverse some of the settlements. Given a sound knowledge and information on the value of wildlife and forest resources, the resettlement of people who occupied PAs is a possibility. It is envisaged that people are resettled on arable areas that suit their social and economic needs without negatively affecting the biodiversity and the vital wildlife resources that are critical in community and national development. The conflict between wildlife and resettled farms has

been going on since the inception of the programme. A sound and area-specific research provides meaningful information for the authorities, policy makers, implementers as well as recipients or beneficiaries of the Fast Track Land Reform Programme.

In general, the rapid and large scale changes in human and biophysical processes, as exemplified by the FTLRP in Zimbabwe, have a capacity to cause collapse of existing social ecological systems and this is a major worry to environmentalists. It is in the light of the above observations that this research is motivated.

1.4 Significance of the study

A lot of studies have been done either to condemn or justify the much debated Fast Track Land Reform Programme in Zimbabwe. All these studies are devoted to the political and social wellbeing of the Zimbabwean population and very little if anything has been written on the impacts on environment and the natural ecological systems. More significantly, researches on the political and social implications of the land reform have been done in many parts of the country but not in Matabeleland. Basically nothing has been written on the fragile ecological systems in the Matabeleland region especially as regards the land reforms yet there is good cause to do so. Matabeleland is found in ecological regions 4 and 5 of Zimbabwe, semi-arid and fragile. Sensitivity to ecological systems in this region can never be over-emphasised. This study finds an opportunity to probe more scholarly work on the protection of wildlife and forest resources in Matabeleland given the new paradigm of land ownership or occupation and management in the contemporary Zimbabwean situation. It is thus expected that this study is important in giving information to various stakeholders like Umguza Rural District Council, the District Lands Office, the newly resettled farmers, Environmental Management Agency (EMA), Dingwall Game Ranch management, Chesa Forest management, Forestry Commission of Zimbabwe, Ministry of Environment, Water and Climate, the Parks and Wildlife Management Authority, various government departments, the public, the academic

community, and several other stakeholders involved in the agrarian evolutions, land use management and natural resources management in Zimbabwe and elsewhere. The findings of this study also give important information to the newly resettled farmers within and around the Protected Areas and the world at large on environmental management strategies especially where human encroachment has been realised. In addition, the information that has been obtained will be shared with other interested scholars on environment and sustainability for verification and improvement.

Zimbabwe is a very rich country in terms of wildlife and forestry, especially Matabeleland in particular. It is important to formulate strategies focused on protecting the wildlife and forestry resources even in the realities of ‘Jambanja’ developments. Any development needs to be managed in order to attain sustainability, a development that satisfies the needs of the present generation without compromising the needs of future generations. The study offers some valuable recommendations that are based on real findings carried out practically in the case study areas.

1.5 Research Objectives

The investigations take a purely scientific and academic approach which is divorced from the land politics of Zimbabwe. The study aims to achieve the following objectives;

- ❖ To determine the extent of human population encroachment into Dingwall Game Ranch and Chesa Forest ecosystems due to the Fast Track Land Reform Programme between 2000 and 2017.
- ❖ To establish the extent to which the Fast Track Land Reform Programme has caused poaching of game and forest resources, and to estimate biodiversity loss, deterioration in both areas.

- ❖ To assess the role of awareness and conceptualization, attitudes and perceptions of settlers on ownership and management of the two Protected Areas.
- ❖ To estimate the economic value and loss caused by the poaching of game and forest resources due to Fast Track Land Reform Programme.
- ❖ Recommend environmental management strategies that will sustain the settlers, wildlife and forest resources.

1.6 Research hypotheses

H₁: Human encroachment in the Protected Areas has occurred due to the Fast Track Land Reform Programme.

H₂: The rate of game and wood poaching levels at Dingwall Game Ranch and Chesa Forest has increased.

H₃: The land management practices at Dingwall and Chesa Ranch have influenced the attitudes and perceptions of settlers on ownership and management of the Protected Areas.

1.7 Conceptual framework

The study is limited to Dingwall Game Ranch and Chesa Forest. Emphasis is on the environmental issues that are threatening the natural ecological systems of these two areas. Special focus was made on the environmental effects between 2000 and 2017 from the accelerated agrarian revolution (Fast Track Land Reform). The study confines itself to the data collected in the years 2015 and 2017. The study explored the weaknesses of the Fast Track Land Reform Programme in so far as the protection and preservation of the natural ecosystems is concerned. Forest degradation, species' decline and loss of wildlife diversity were the major focus points. The Dingwall Game Ranch ecosystem components were assessed and compared with those of the Chesa Forest to get a wider picture of the impact of the unplanned human population encroachment into the specified Protected Areas.

1.8 Assumptions

- ❖ Secondary data relevant to the study will be readily available.
- ❖ Respondents will give truthful answers to questions.
- ❖ The researcher has unlimited access to both study areas.

1.9 Limitations of the Study

Accessibility to some settlements was difficult due to lack of road networks to the homesteads.

While most respondents would be willing to give out information, the challenge was on the possibility of some respondents giving false information.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter explores several schools of thought on Land reform, resettlement, and game and forest ecosystem management. Literature is reviewed with the intention of getting a fuller understanding of what has been written on the above subjects. Critical comments that give a focus to the study are given. The chapter also takes a keen interest in exploring how the Fast Track Land Reform Programme did not cater for sound game and forest ecosystem management. Issues of land use and land ownership changes due to resettlement are also explored.

2.2 Background to the Fast Track Land Reform in Zimbabwe.

The Fast Track Land Reform was undoubtedly a radical response to the existing land distribution inequalities in Zimbabwe since Independence.

RACIAL DISTRIBUTION OF LAND BY SETTLER GOVERNMENT IN 1930

Category	Acres	% of the country
European Areas	49,149,174	51
Native Reserves	21,127,040	22
Unassigned Areas	17,793,300	18.5
Native Purchase Area	7,464,566	7.8
Forestry Areas	590,500	0.6
Undetermined Areas	88,540	0.1
Total	96,213,120	100

Source: Palmer (1977)

According to Goebel (2005), the land reform in Zimbabwe has captured worldwide attention since 2000, after massive land occupations. However, it has received very little scholarly attention. Manby (2002) only acknowledges that the Fast Track land resettlement led to serious human rights' violations and does not refer to its effect on the natural environment. He also acknowledges the necessity of the land reform but questions the procedures that were taken. This study attends to this gap and addresses the environmental effects of the Fast Track Land Reform Programme in Zimbabwe with special reference to the two selected areas.

Agrawal (2010) defines land reform as “the redistribution of rights and interests in land in favour of landless and the poor cultivators”. Hund-Chao (1974) views such a definition as narrow and advocates for a comprehensive programme for the transformation of the entire agricultural economy as he further defines land reform as a “public program that seeks to restructure equitably and rationally a defective land–tenure system by compulsory drastic and rapid means.” This drastic and rapid approach probably motivates the ‘fast track’ to the land question in Zimbabwe. While it is noble to redistribute the land to the landless and the poor, is it the best thing to do such an important exercise hurriedly even at the expense of the most needed natural ecological systems? While Armad (2011, p.51) defines land reform as “the takeover of land or landownership from large landowners, the land being subsequently placed at landless labourers”, he is quick to observe that “Forests are another area of concern as an increasing number of people are claiming forestland by clearing it and planting crops” (Armad, 2011, p.51). Human population encroachment into forests is one of the quick and visible cause for forest degradation. Was there any way the Fast Track Land Reform was going to spare the forest resources?

Cliffe *et al.* (2014) describe Zimbabwe’s Land Reform programme as the ‘accelerated land reform’, and states that it was chaotic. Lyons and Khadiagala (2010) cite limited government resources, high prices, lack of foreign currency and land shortage as some of the major causes

of this scenario. Chaos is another visible feature of the Fast Track Land Reform. This chaos had to be accelerated in order to achieve the political needs of the society. The fragile nature and value of the Protected Areas is never a subject of the land reform programme. It is a puzzle why this was the case when Woube (2005) expresses clearly that the resettlement schemes in most African countries take place in marginal areas most of which are prone to disasters like drought, flood and diseases. Hudson (1976) in Woube (2005) argues that the study of the resettlement process ought to be viewed in association with certain spatial factors such as climate, topography and access to infrastructure, in order to indicate the locations for and accessibility to the resettlement sites. He also argues that well planned resettlement helps to mitigate environmental deterioration. It is part of the factors that have motivated this research to know why the 'jambanja' approach never followed any environmental plan in such a highly literate nation as of Zimbabwe.

Looking at the global scale and in reference to the United Nations, Kacowicz and Lutomski (2007) laments the side effects of poorly planned land reforms when they say "resettlement aftermath need to be reviewed seriously." Cook (1994 p.150) states that: "...since the early 1970s, forest resources have been depleted at a rapid rate, both on privately held and within gazetted forest reserves...This has resulted from a number of causes including unregulated commercial exploitation of timber resources, the growing demand for fuel wood. The proper use and conservation of forestry resources therefore lies in the hands of humanity."

These observations of Cook were made when the World Bank had sponsored some research on resettlements in Africa in general. But as it stands, these words can be mistaken for words spoken against Zimbabwe's Fast Track Land Reform and its aftermath.

On the land reform programme in Zimbabwe Hill *et al.* (2006) say "There were no environmental or social baselines established for monitoring the programme". They emphasise

that: “If sustainability is conceived as the ability to recover from (as well as to cope with) stresses and shocks (be they natural or structural), it is evident that the people of existing resettlement schemes in Zimbabwe have substantial challenges ahead” (Hill *et al.* 2006, p.28).

Jennifer Hill strongly queries the future of the resettlement schemes. She makes this critical observation in the year 2006 when “jambanja” was maturing in Zimbabwe. However, Woube (2005) is very opposed to this concern of Hill (2006) and is convinced that the Fast Track Land Reform Program provided satisfaction and opportunity to talk to former colonial masters. He further argues that there has been a general improvement in the quality of both crop and animal products due to new innovative ideas.

On sustainable management in the game industry, Brocke, Seidel and Recker (2012) say that the adaptive co-management approach, in which institutional arrangements and ecological knowledge are tested and revised in a dynamic, ongoing, self-organized process of learning-by-doing, is necessary. Amnor and Moyo (2008) also add that sustainable management should engage justice and equity in acquiring land so that the natural resources are protected in the process. This argument is in close corroboration with the views of Sundar (2012) who advocates that sustainable management in the game industry and forest ecosystems should engage an adaptive co-management approach in which institutional arrangements and ecological knowledge are tested and revised in a dynamic, ongoing, self-organised process of learning-by-doing. The sustainability of the Agrarian Revolution therefore needs constant monitoring especially to the impacts of the programme on the ecosystems. According to Sundar (2012) conservation of natural resources could either be *in-situ* or *ex-situ*; with the former being a more effective and comprehensive approach as it facilitates conservation of the ecosystem along with the selected species.

Glasson, Therivel and Chadwick (2005) maintain that existing environmentally harmful developments must be managed as best they can to leave the smallest practicable negative impact if not positive. This presents a case for environmental impact assessment, or research especially on protected areas

Holmgren (2002) advocates for permaculture in resettlements. He defines permaculture as “the conscious designed maintenance of agriculturally productive ecosystems which have the diversity, stability and resilience of natural ecosystems.”

According to Blais (2010) the urban sprawl has caused forest degradation for many decades. She argues that urban sprawl goes with many costs like loss of farm land, air pollution, loss of natural open space, and that urban sprawl causes some diseases like childhood asthma and obesity.

Lockwood *et al.* (2006) state that 69% of 12.3 million people in Zimbabwe live in communal areas and depend directly on forests’ woodlands for firewood, construction timber, fruits and fodder. They further state that the open access to forests in these areas results in over-exploitation due to lack of accountability.

The invasion of Dingwall Game Ranch and Chesa Forest (amongst many other properties) has to be understood in the context of political and economic developments in Zimbabwe between 1990 and 2007. During this period, the Government’s political fortunes began to deteriorate, mainly due to declining economic conditions and hardships that accompanied the economic decline. The Government adopted the International Monetary Fund (IMF) sponsored Economic Structural Adjustment Programme (ESAP) in the year 1990. This program had negative effects on the welfare of the majority of Zimbabweans especially the decline in the standard of living. During the same period AIDS was ravaging the country, but the Zimbabweans attributed everything to ESAP (Moyo, 2000). Maravanyika and Maravanyika-Mtimukuru (2011) observe

that over and above the deteriorating standards in the health sector, there was even a marked deterioration in the education sector with poor school attendance, high levels of child labour and child sexual abuse, low nutritional levels, and increased housing shortages. Chikuhwa (2004) presents that there were serious food shortages and several riotous activities took place, especially in urban areas, where hungry people scrambled, stampeded and looted from trucks carrying and delivering food stuff. The majority of people faced starvation.

According to Chikuhwa, (2004) Zimbabwe's involvement in the war in the Democratic Republic of Congo had a huge drain on the country's resources.

The advent of war veterans' demonstrations, triggered by the declining economic climate, contributed immensely to the Zimbabwean situation. It propelled the Government of Zimbabwe to pay huge unbudgeted gratuities worth the equivalent of £150 million in total, to the war veterans. This knocked a huge hole in financial planning and inflicted the first blows to the value of the Zimbabwean dollar (Sithole, 2001). Sithole (2001) also observes that land redistribution was not on the veterans' demands list in 1997. Be that as it may, a lot of discussions on land redistribution were going on across the country (Moyo and Chambati 2013). They posit that the debates, however, "did not look at the future of natural ecological systems and the environmental future of the country" (Moyo and Chambati, 2013). As pressure continued to mount on the Government, a draft constitution that proposed compulsory acquisition of land without compensation was formulated and a referendum was held in February 2000 (Human Rights Watch, 2002). The FTLRP was enhanced by the 2000 referendum which was meant to help the government attain constitutional reform that would help to re-distribute the land to the masses. Unfortunately, people of Zimbabwe disapproved of the referendum by voting. Alao (2007) writes "as a result, from the moment of the electoral defeat, the government brought the land issue more fully into politics." Alao (2007) also says that it was in the same year that war veterans began to occupy farms in a chaotic

and violent manner. During the same time, there was great political division between Zanu (PF) and MDC. The situation and culture were just ripe for ‘Jambanja’. Those who did not support the jambanja invasions or negated this new “patriotic” mindset were labelled as sell-outs (Human Rights Watch, 2002). This scenario basically gave birth to the Fast Track Land Reform Programme.

2.3 The Ecosystem concept and Conflict

Anderson and Algren (2011) define an ecosystem as an integrated system of living organisms (biotic part) and its non-living environment (abiotic part).

Gottle and Sene (1997) highlight the major impacts of the destruction of forest ecosystems as inclusive of destabilized soils more susceptible to landslides, loss of moisture due to deforestation, drought conditions that lead to famine and soil nutrients loss through erosion. The impacts also include decreased food production, possible chronic food shortages, dry conditions combined with loss of vegetation and soil compaction causing desertification, unproductive lands, destruction of biodiversity, loss of traditional cultures, loss of free goods like fuels, food and medicines, dryness accelerating the spread of fires, and destruction of watersheds thus increasing the risk of flooding (Gottle and Sene, 1997).

Mitchell *et al.* (2012) also explain that all the major conflicts in the history of humanity or within all nature are caused by inadequate resources. Miller (2009) defines conflict as “the interaction of interdependent people who perceive opposition of goals, aims and values and who see the other party as potentially interfering with the realization of the goal.” This is explicitly clear in the context of both the Dingwall Game Ranch ecosystem and the Chesa Forest. In these ecosystems there is conflict of goals and evident interference. All the phases of conflict like latent conflict, perceived conflict, felt conflict, manifest conflict and conflict aftermath are being realised in the area under study.

Johnston *et al.* (1994) define conflict as among two or more protagonists. In context, conflict emanates from competition for land and other resources between farmers and wildlife. Such conflicts cannot be effectively examined without looking at the role of the state or the government through its various organs.

Kristjanson (2002) postulate that wildlife and human conflicts have escalated in recent years in areas adjacent to parks because of change in land use and the study pay good attention to expansion and intensification of agriculture as a major cause. This idea is in agreement with Caldecott and Lutz (1996) who say “without proper management, poaching continues unabated and conflict between wildlife and local people outside the reserves have escalated to the crisis point”. This is the case with Dingwall Game Ranch and Chesa Forest ecosystems. Still on conflicts, Das (2013) says that “conflicts arise between the various production sectors or stake holders, of which the major ones are agriculture, livestock, wildlife and urban development.”

Johnston *et al.* (1994) postulate that many conflicts considered by the state are over the use of land. It is therefore in the interest of the state to see how land is used even in the newly resettled areas. It is in actual fact the mandate of the government to see that land is effectively used hence the issue of resettlement. It is not surprising that the use of land as a resource is a global concern of all governments. According to Johnston *et al.* (1994, p.86), the growing global awareness of the threats towards biodiversity has seen a resulting increase in conservation efforts at different spatial scales.

This scholarly view is the cornerstone to this research. Resettlement programmes, while very necessary and inevitable, have brought threat to the environment due to increased exploitation of forest and wildlife resources. This is now a concern for all stakeholders. How we look at conservation is now central.

On the same note, Artiola (2004, p. 357) agrees with Johnston *et al.* (1994) when he says:

“Human beings have greatly disturbed most of the world’s natural ecosystems. Socio-economic pressures, land use patterns, and recently the wide scale removal of natural resources such as forests, have devastated vast tracts of land across the globe”.

Most of the devastation is irreversible. The issues around Dingwall Game Ranch and Chesa Forest are largely environmental. Miller (2009) also adds that environmental problems are caused by rapid population growth and that rapid and wasteful use of resources with too little emphasis on pollution prevention or conservation is of great concern. Miller (2009) also points out that poverty can drive people to use potentially renewable resources unsustainably for short term survival. Poaching is aggravated by low levels of education, food shortages and generally low standards of living. Again, Miller (2009) observes that failure of economic and political systems to encourage earth sustaining forms of economic development, and discourage earth degrading forms of economic growth, is a cause of conflict for land. It has always been human weakness to have an urge to dominate nature for our lives with far too little knowledge about how nature works. There is therefore a greater need for wise use and exploitation of resources. The role of government in environmental management is crucial especially in the newly resettled areas of Zimbabwe.

Most of the published literature does not say much on the nature of the conflicts between arable farming and wildlife. Andrew *et al.* (1996, p.221) observe that “large scale cultivation has led to the loss of many wildlife habitats.” On the causes and effects of conflicts, they say: “In the developing world the need for adequate food for a rapidly expanding population has put enormous pressure on existing productive land under cultivation. This has led to the destruction of the tropical forests and drainage of wetland areas”.

Ngwarai (1988, p.25) defines conservation as: “The wise and careful management of natural and man modified environments so that they may yield sustainable benefit to the present generation while maintaining their potential to meet the needs and aspirations of future generations.” Conservation therefore is everybody’s duty.

Ngwarai (1988, p.20) also says: “The future of natural resources is entirely dependent on man’s activities and it is he who will be held responsible for their destruction. There is a need to protect heritage. We did not inherit it from our ancestors but have borrowed it from our children to come”.

It is therefore our duty to conserve the natural resources. Human activities have largely altered the Earth’s surface, resulting in some observable patterns in the land use and land cover changes over time (Opeyemi, 2006). Blaike and Brookfield (1987) argue that there remain only a few landscapes on the Earth that are still in their natural state.

Population pressure has resulted in unplanned and illegal land use expansions and conversions (Nkala, 2009). Mortberg *et al.* (2007) state that this conversion of large areas of agricultural and forested areas, which hold great stores of biodiversity, into developed land cover has negative effects on the native biodiversity of an area. Mortberg *et al.* (2007) also observe that the land cover changes affect species’ composition, which is, from forest to non-native shrubs, lawns and planted tree species with more impervious surface area and simplified vertical diversity of vegetation.

The land-use or land-cover changes and their impacts are difficult to quantify. However, it is only when these landscape changes are studied from a spatial perspective and appropriate time scale that humans begin to identify and measure the changes that have occurred and predict the

impacts of changes to come (Cuff and Goudies 2009, p.397). Ji *et al.* (2007) echo the same sentiments.

Ferraro *et al.* (2011) argue that protected areas are the dominant approach to protecting biodiversity and the supply of eco-services. The ability of a forest to deliver its functions more efficiently is dependent on its state and status. Gottle and Sene (1997) present that forests are more efficient when in their natural state and in good natural ecological condition or used in a sustainable manner. When a forest's balance is upset then its ability to provide quality ecosystem services is reduced. The capacity of an ecosystem to sustain a specific function depends on the characteristics of its individual dynamics (Gottle and Sene, 1997). According to Lockwood *et al.* (2006), forests are being increasingly affected by human encroachment due to human population increase and the demand for agricultural land. This conversion is threatening forests and wildlife resources and the ultimate services they provide. Forest dynamics are altered leading to a decrease in the quality of eco-services provided. Because forest ecological services are hardly marketable, they generate an illusion that they are not valuable (Pearce, 2001). This gives an incentive to convert land for economic purposes without considering the ecological aspect of these resources.

Accordingly, human modification of natural environment or wilderness into built environment such as fields, pastures and settlements have reduced land under forests (Martin, 2008). The world's forests are experiencing degradation. Land cover and land use changes are caused by different forces acting in both spatial and temporal dimensions making it difficult to come up with remedies that transcend geographical and cultural landscapes. Changes observed across continents have been different, though agricultural expansion has been a universal cause (Martin, 2008).

In Zimbabwe the land issue has been a ‘Pandora’s Box’ as the promise of land was used to solicit support during the liberation struggle in the 1970s. Forest and wildlife management in Zimbabwe takes place within a broader context of historically unequal distribution of land and therefore land shortage, a major issue in the history of the country (Maravanyika and Maravanyika-Mtimukuru, 2011). Colonial policies on land have been highly opposed by many communities, Protected Areas included (Murombedzi, 2003), and efforts to redress these colonial policies did not achieve acclaim with communities until radical measures were undertaken when land was compulsorily invaded under the “controversial” Fast Track Land Reform Programme. The Fast Track Land Reform (and Resettlement) Programme saw a significant number of black farmers being resettled in formerly white-owned farmland which to a large extent had pristine vegetation and natural ecosystems (Matsa and Muringaniza, 2011). This programme was hastily implemented and some individuals decided to resettle themselves without offer letters in areas that were not meant for resettlement (Maravanyika and Maravanyika-Mtimukuru, 2011). Protected Areas thus had settlements by individuals that felt they had a historical claim to the forests leading to increased land-cover and land-use changes. Deforestation is primarily driven by conversion of forests to agricultural uses (Sedjo, 2001). The woody vegetation in Zimbabwe has thus suffered mainly through agricultural expansion and the increase in the human population has meant that more land has been cleared for settlements and to improve food security.

In Zimbabwe, 15,624,000 ha (40.1%) in Zimbabwe are wooded, of which 5.1% (796 824 ha) are classified as primary woodland.

The country loses an average of 327,000 ha or 1.48% of total vegetation cover types per year. In total, between 1990 and 2010, Zimbabwe lost 29.5% of its woody cover about (6,540,000 ha) <http://rainforests.mongabay.com/deforestation/2000/Zimbabwe.htm>. These changes are entwined with the ability of the forests to perform their ecological and economic functions.

Forest ecosystems are highly productive and have the ability to act as biological ‘scrubbers’ by sequestering carbon from the atmosphere (Stavins and Richards, 2005). Non-anthropogenic forest disturbance regimes are a part of forest ecosystems, forests provide for natural regeneration and re-growth which also capture carbon (Sedjo, 2001). Opposed to natural disturbances, settlements permanently disturb the regeneration capacity and resilience of forests. Land cover and land use changes therefore ultimately affect the capacity of forests to provide quality ecosystem and social services.

Forest areas provide natural resources that are critical to many people on earth (Shanley *et al.*, 2011). The increase in the total world human population has increased the demand for natural resources. Protected areas are thus expected to directly contribute to national development and poverty reduction (Naughton-Treves *et al.*, 2006). Protected areas bring tremendous economic, cultural, ecological, spiritual and scientific benefits to society (Janischevski *et al.* 2008). In this regard forests should thus address local communities’ concerns with development and their participation in forest management. PAs have been managed through centralized bureaucracies in ways that totally or largely excluded local communities (Khothari, 2008). This form of management alienated communities and provided the foundation of a hostile relationship between PA managers and communities in and around PAs. PA managers face the dilemma of managing for both conservation of the biodiversity within their jurisdiction and local community interests and resource needs.

Protected areas are charged with improving social welfare, guarding local security and providing benefits across all scales (Naughton-Treves *et al.*, 2006). There is growing awareness of the importance of protected areas to alleviate poverty reduction and to assist in sustainable development. An integration of biodiversity conservation and alleviating poverty reduction is now a pre-requisite for sustainable management of forest resources (Lunn *et al.*, 2013).

It should however be recognised that the effectiveness of protected areas in supporting livelihoods is a difficult goal to measure and achieve (Naughton-Treves *et al.*, 2006). While it is noble to support human welfare, nevertheless there is a need to understand the capabilities of forest areas to deliver significant economic benefits to the rural poor. While the creation of protected areas has undermined local incomes and security particularly in Africa where they are associated with colonial regimes (Murombedzi, 2003), the current populations have more adverse effects on the state of the environment. Child (2004) argues that while financial incentives for conservation are often emphasised as driving forces for conservation, community reliance on fuel wood, medicine and food coupled with population increase and ignorance leads to degradation of those resources. It is with this in mind that conservation should protect the ecological base upon which rural livelihoods are built. Increase in land cover changes will reduce the capacity of forests to provide Non-Timber Forest Products to significantly support livelihoods. In line with sustainability, current use should not affect or sacrifice the capacity for future generations to utilise forest (Murombedzi, 2003) and wildlife resources (Child, 2004).

2.4 Impacts of human population encroachment on management of Protected Areas

Human use of protected areas has a wide range of negative impacts on the environment which need to be assessed, limited and ameliorated. The presence of human settlements within PAs has an effect on the state of the environment. Threats to protected areas often involve complex chains of cause and effect, seldom in isolation, particularly where there is a lack of capacity and strained relations with local communities (Lockwood *et al.*, 2006). With the ever increasing pressure on dry forest and woodlands to meet human development and livelihood demands, vegetation forms are increasingly utilised unsustainably in Africa (Chidumayo and Gumbo, 2010). Forested land is lost to deforestation through the clearing for agricultural land

while other associated impacts like frequent forest fires and subsistence poaching are observed (Thatcher, 2012). The prevalence of subsistence poaching also increases as the number of households within the PA increases. In Mafungabusi forest (Zimbabwe) there were reports of poaching of wildlife as well as rampant tree cutting by the settlers, as they cleared land to make way for their homesteads, fields and gardens (Maravanyika and Maravanyika-Mtimukuru, 2011). Communities in Kivu in the Democratic Republic of Congo, a densely populated region, have migrated into the Ituri forest in search of agricultural land causing massive deforestation (Lockwood *et al.*, 2006). Fires and poaching are sometimes used by settlers as a form of sabotage to the PA as they are frustrated by resource access limitations and victimisation by forest guards.

In areas that are not suitable for crop production, like Gwaai forest (Zimbabwe), the settlers begin to trek to other areas in search of new pieces of land and the invasion of the forest has other downstream impacts, such as siltation of rivers (Maravanyika and Mtimukuru-Maravanyika, 2011). The presence of settlements can cause serious degradation to PAs if no deliberate action is taken to plan and control them.

2.5 Attitudes and perceptions of communities towards Protected Areas

The attitudes of local residents as well as the interactions, level of local participation, and conflicts between people and PAs, have become a concern of PA effectiveness (Ormsby and Kaplin, 2005). Community attitudes and perceptions of PAs have been shown to influence the kinds of interactions people have with PAs and consequently conservation effectiveness. Several studies stress the importance of using local people's perceptions as an input for designing and applying appropriate management plans for sustainable development (Kleftoyanni *et al.*, 2011). It is thus important to understand peoples' attitudes and perceptions towards PAs. The opportunity costs associated with PAs can negatively affect peoples'

attitudes towards the PAs. Costs can range from displacement of local communities to crop damage by wildlife and restricted access to resources and changes in land tenure (Coad *et al.*, 2008). Communities develop ambivalent attitudes or retaliate by sabotaging PAs' activities. Retaliatory action by disenfranchised communities and conflicts with PA managers do not augur well for conservation. The factors that influence attitudes and perceptions towards PAs held by residents living in and around the PAs, include the history of the PAs, the degree of awareness of PAs' existence, types of interactions with PAs, and actual or potential benefits received from the PAs (Ormsby and Kaplin, 2005).

2.6 Historical background of Protected Area management

The Chesa Forest, among others, was identified for protection in 1923 and gazetted in the Land Apportionment Act of 1930. Before it was gazetted, forest resources were managed on a common property basis, where all had access to multiple forest products. Traditional norms and sacred and pragmatic controls were used to regulate resource utilisation. Colonisation introduced 'fortress' conservation as a new approach to conservation. It was an importation of the Yellowstone concept of creating islands of wilderness with minimal human interference (Andrade and Rhodes, 2012). The imposition of colonial conservation regimes led to conscious efforts to obliterate pre-existing land use systems and their regulatory mechanisms (Adams and Mullingah, 2003). Local communities had developed intimate knowledge of their ecosystems and used this knowledge to tailor systems of sustainable resource use and appropriate management systems (Murombedzi, 2003). Colonial regimes destroyed these systems by weakening institutions like chieftainships, under which these systems had evolved. The spiritual basis of some of the controls was also questioned.

According to Kwashirai (2003), in 1920 the Morris Carter Commission set up to investigate land use in Southern Rhodesia, discouraged the removal of Africans in areas that were to be

identified for state protection. The Forest Department, however, disregarded the Commission's recommendations and went ahead to evict Africans and introduced a tenancy system on the remnants of African populations who were left to provide labour to the state agency. The eviction policy was applied in conjunction with strict regulations imposed on tenants. Passes were introduced to regulate movements and permits granted to bestow residential rights as tenants. Punitive measures were put in place to prevent cutting of trees, and access to wildlife resources was prohibited. These actions provided the foundation for a tainted view of the Protected Area system. Due to increased political pressure, the tenancy system was abolished in 1987 (Forestry Commission, unpublished). Meanwhile the Forestry Commission had lost its control over settler activities (Kwashirai, 2003).

Violent removals were attempted with minimal success and were highly insignificant due to political pressures. In 1994 the Forestry Commission pegged stands that were allocated to some of the settlers in a bid to regularize settlement in all the forests. This was, however, not a form of de-gazetting of the area, as Forestry Commission retained ownership rights (Forestry Commission, unpublished).

It should also be noted that the communities have a historically perceived sense of ownership of forest resources. But the protectionist approach to conservation leads to changes in community perceptions from ownership to exclusion. Historical friction between customary and statutory forest tenure has shaped attitudes and perceptions of communities (Sunderlin *et al.*, 2008). These have an influence on community behaviour towards the forests.

2.7 Economic value of Protected Areas

Access to primary resources is important in many rural households (Lee and Neves, 2011). It has been found that costs associated with conservation have negative effects on community attitudes while benefits have positive effects (Walpole and Goodwin, 2001). People are likely

to support protected areas when the benefits gained offset the associated costs. Benefits obtained provide an incentive for communities to be involved in conservation activities. Forest-related incomes are highly diverse including hunting, wildlife, charcoal and fuel wood production, fodder, thatch grass, wild medicines and the production of timber, poles, fruits, and vegetables. Protected area benefits extend to users at different scales, from local people who depend on particular species for their livelihood, to nations that depend on abundant products like timber resources (Brandon and Bruner, 2008).

Studies have served to identify a wide range of real and potential benefits and also highlighted the fact that only a handful of protected areas are truly benefiting poor people (Mansourian *et al.*, 2008). Existing laws often limit or prohibit ownership, access to and use of forest resources by indigenous peoples and local communities (Colchester *et al.*, 2002). In Mafungabusi forest, as in Gwaai forest, local community members are allowed to harvest certain non-timber products from the forest such as broom and thatch grass, mushroom and honey in a sustainable manner but game and timber products are excluded (Maravanyika and Maravanyika-Mtimukuru, 2011). This limits the level of benefits from the protected area and is a source of frustration for rural communities who continue to live in abject poverty while there are resources which they are not able to utilize due to restrictions. The restrictions create financial losses for people who once relied on these resources (Redford and Fearn, 2007). A particularly insidious case of this is when logging operations in forests are favoured, frequently at huge cost to entire communities, but resulting in windfalls for only a few individuals as governments have tended to push for laws that favour large-scale, highly capitalized forest industries, giving priority to sustainable forest management and the generation of state revenues, with much less emphasis on benefits for rural livelihoods (Brandon and Bruner, 2008; Colchester *et al.*, 2002). It is imperative that mechanisms for the equitable sharing of costs and benefits of protected areas are developed. Benefits from PAs can, under the right circumstances with the appropriate

frameworks, generate income for poverty alleviation. Giving land-use rights to communities has proved to be the key to ensuring community benefits (Sitoe and Tchaque, 2008). Strengthening communities' participation in forest management and ensuring benefits accrue to communities contributes to poverty alleviation.

In many cases however, efforts to generate local benefits, however well-intentioned, come nowhere close to offsetting the opportunity costs of protected areas (Scherl and Emerton, 2008). There is also a risk that by over-promoting the role of protected areas in poverty reduction they may suffer from degradation and irreversible damage. Many protected areas have a role to play in reducing certain people's poverty levels, but this role has to be clearly understood, and defined and properly measured if it is to be credible (Mansurian *et al.*, 2008). The problem for PAs as agents of poverty alleviation is that benefits often accrue to a minority of people who in certain instances do not take part in the conservation of the resources. Political elites and the well-connected often benefit at the expense of communities who have the greatest need. Simply relying on ecosystem services will rarely be sufficient to lift substantial numbers of poor people out of poverty (Pearce, 2001). Protected areas alone can therefore not be expected to solve the fundamental conditions that lead to poverty in most countries (Brandon and Bruner, 2008).

2.8 Awareness of Protected Area

Attitudes towards the protected area staff and the perceptions of management practices affect peoples' attitudes towards the protected area (Allendorf *et al.*, 2006). Conflicts with managers due to resource extraction, strict rules on forest resource use and access, harassment by protected area rangers, all generate negative attitudes towards protected areas (Macura *et al.*, 2011). In Abijatta-Sheila Lakes National Park (Ethiopia), residents expressing negative views had experienced poor relations with protected area staff and felt the staff was antagonistic and

disliked local residents (Tessema *et al*, 2007). While in some cases strict prohibitions on resource access inside PAs is appropriate and effective, sometimes it is not (Redford and Fearn, 2007), thus there should be a balance that allows for a healthy relationship between communities and PA managers. Involving local communities in the management of PAs in which they have traditionally lived, and positively engaging them, will address not only an important dimension of poverty but also will provide an effective means of improving PA survival and management.

CHAPTER THREE: METHODS

3.1 Study area

The study is located within the broad spectrum of Environmental Management and in the specific area of the management of natural ecological systems in the light of changing population dynamics and human activities. Dingwall Game Ranch and Chesa Forest are used

as the two case study sites that control the nature and direction of this research. Figure 3.1 is a geo-referenced site map showing the location of Dingwall and Chesa Forest.

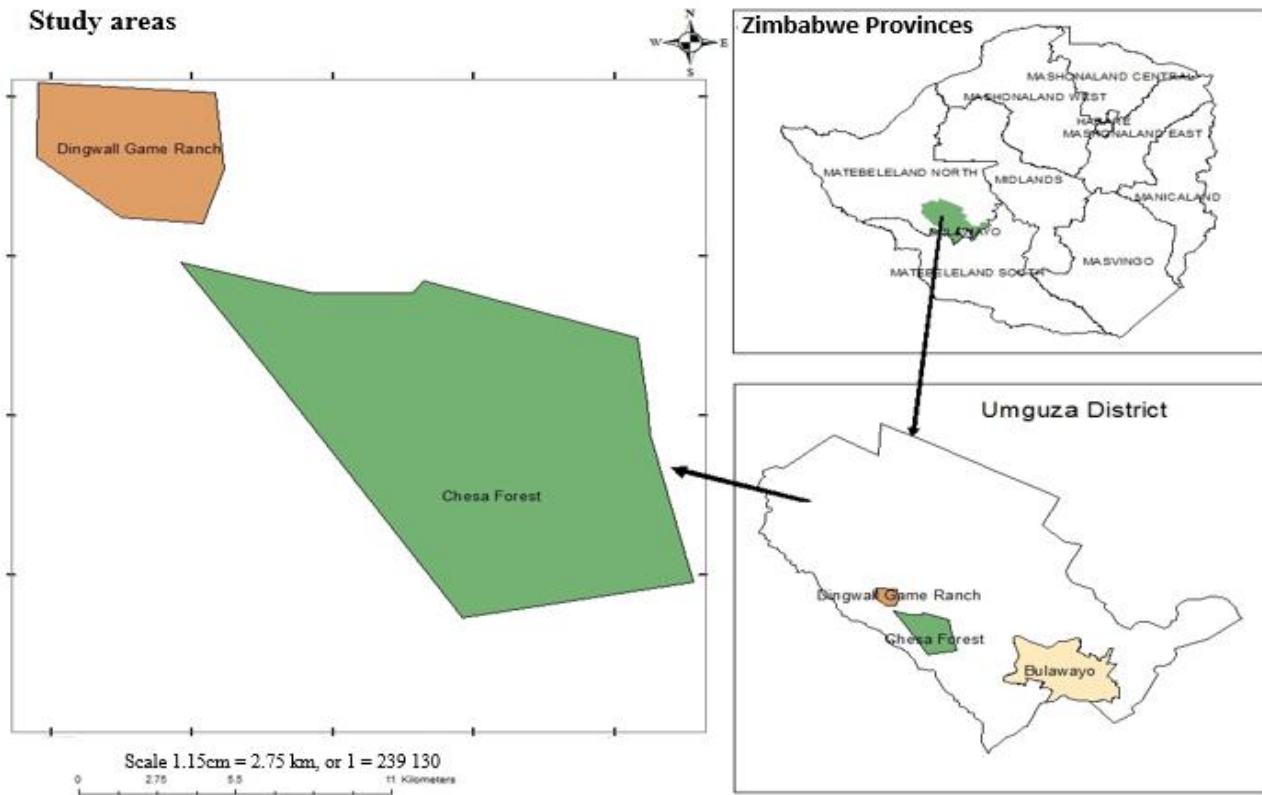


Figure 3.1 A simple digitized and geo-referenced site map showing the location of Dingwall and Chesa Forest.

The study covers two areas in Matabeleland North province, Dingwall Game Ranch and Chesa Forest. Dingwall Game Ranch is located in ward 16 of Umguza District. The ranch is also generally flat (600m to 1000m altitude). It is bounded by Khami River to the north and north west. It is divided into two paddocks separated by the Nyamandlovu/Tsholotsho tarred road. The Inyokeni village is to the west, and the ranch is surrounded by both communal and small scale commercial farmers.

The ranch is predominantly covered by red clay soil with rock outcrops. The soils support *Colophospermum mopane* woodland type which has slightly dispersed grass types

(Nyamapfene, 2007). The grasses include the *Cynodon dactylon* and *Hyparrheniagrasses*. This makes the area suitable for game ranching.

The drainage pattern is such that all streams drain into Khami River to the north. The settlements are lined to the northern parts of the ranch and crop farming is done along the Khami River. The fact that the ranch falls along, and is divided by, the Nyamandlovu/Tsholotsho road exposes the ranch to forest fires that start from travellers. The lush vegetation also increases the fire hazard in the dry seasons and despite well-constructed fireguards, in and around Dingwall, the fire occurrences are generally huge and observations during the study indicated that some trees have become stunted in growth and most are dying due to the hot fires.

Chesa Forest is situated in Umguza District ward 14 approximately 40 kilometers west of Bulawayo. The forest is located in the Nyamandlovu farming area and shares boundaries with Nesby and Stanhope farms to the south, Mandau/Badminton farms to the east, Bantu/Lonsdale farms to the west and Imvani/Compensation farms to the north. Thus, the forest area is also totally surrounded by both communal farmers as well as small scale commercial farmers.

Chesa Forest is generally flat (800m to 1200m altitude) and slopes gently towards Mandau and Chesa vleis which both drain into Khami River. The riverine areas support acacia dominated woodlands which are used for farming by the settlers.

3.2 Research Design

According to Kurmar (2011) a research design is the core foundation to planning, implementing, reviewing and executing the research procedures in a study, and according to Rowley (2014) it is more of a conceptual framework within which a research study will be carried out.

This project used a dual case study design to closely study the transformation of ecosystems due to the Fast Track Land Reform Programme in Zimbabwe. This case study approach specially looks at how the Game Ranch at Dingwall has had its ecosystem being transformed and how the woodland ecosystem of Chesa forest has been affected by the land reforms. The two case studies have been selected in order to examine the phenomena of wildlife and forest respectively and the two sites are representatives of different types of management systems that have been subjected to the Fast Track Land Reform process. Dingwall was selected to specifically study the effects of the Fast Track Land Reform programme on game resources, while Chesa Forest was dedicated to study the effects of the Fast Track Land Reform Programme on forest resources. The thrust was not to necessarily compare the two ecosystems in totality but precisely to establish how the wildlife and forest have been affected by the Programme. This is crucial especially considering that settlers are likely to behave in similar ways. Also it is true that while the research deals with wildlife resources at Dingwall there are similar effects on game even in the forest ecosystem and vice versa. A case study is described by Zainal (2007) as an up-close, in-depth and detailed examination of a subject of study. Shuttle (2008) defines a case study as an in depth study of a particular situation. A case study in most instances selects a small geographical area or a very limited number of individuals as the subjects of the study. Case studies allow a lot of detail to be collected that would not normally be easily obtained by other research designs. The data collected are normally a lot richer and of greater depth than can be found through other experimental designs. However, Sasa (2014) argues that one of the main criticisms of case studies is that the data can not necessarily be generalised to the wider population. This leads to data being collected over longitudinal case studies not always being relevant or particularly useful beyond the target area/group.

The research focused on two specific areas. Selltitz (1981) states that a research design is the practical way in which the research is conducted according to a systematic attempt to generate

evidence to answer the research question. Buckley *et al.*, (2015) echo the same sentiments as they define research design as the strategy to integrate the different components of the research project in a cohesive and coherent way. The research design adopted for this particular study is “mixed methods approach” which uses pluralistic approaches to derive knowledge about a problem (Creswell, 2014, p.11). This is an approach to research that uses a combination of more than one research strategy in a single investigation to balance them so that each counterbalances the margin of error in the other in order to assure completeness of findings or to confirm the results, (Greene *et al.*, 1989). Watson *et al.*, (2008) add that this method “is not an end in itself, and careful and knowledgeable application of this research method provides insightful research outcomes beyond what is possible in the traditional single methods/investigator or data collection approach.” Speziale *et al.*, (2011) highly recommend a mixed methods approach as it often uses quantitative methods combined with qualitative. The mixed methods employed in the present research involved Geographic Information Systems(GIS) and Remote Sensing, Census Survey, Fieldwork (game counts and experimental plots), questionnaire interviews and focus groups.

The mixed methods approach utilised both quantitative and qualitative types of data. Blending the two gives a more holistic approach to the study (Gerrish and Lacey, 2010). Lee (1996) observes that the quantitative approach relies heavily on statistics and figures. Curwin and Slater (2007) add that, “the quantitative approach is about using numbers to help define, describe and resolve a wide range of problems. However, it is more than just doing sums. Numbers need to make sense within the context. It is the context that gives meaning to given numbers.” This alludes to several statistical methods of analysing data that have been employed in this research.

On the other hand, (Schrauf, 2016) describes the qualitative approach as the one “that trades in linguistic symbols.” Neergaard and Ulhøi (2007) postulate that qualitative research is a “multi-

method in focus involving an interpretive, naturalistic approach to its subject matter.” This approach was useful especially in tapping the views, perceptions and attitudes of the respondents during data collection and analysis. Qualitative researchers study things in their natural settings, attempting to make sense or interpret phenomena in terms of the meaning people bring to them. Qualitative research involves the use and collection of a variety of empirical materials, e.g. case study, personal experience, introspection, life story, interview, observational, historical, interactional and visual texts that describe routine and problematic moments and meaning in individuals lives (Denzin and Lincoln, 2011).

This research also adopted a scientific and objective approach to the study of environment and did not dwell much on the political land question in Zimbabwe. If anything political was indeed engaged, it had only to do with policy and how such policy impacts on environmental management and conservation. It is for such reasons that this research employed both quantitative and qualitative research processes in reflecting the importance of mixed methods and scientific research coordination.

Some ethical considerations were also made in this work. Klenke (2016) postulates that “most discussions on research paradigms focus on the tripartite linkages between ontology, epistemology and methodology.” Paliouras *et al.*, (2011) state that “ontology refers to the philosophical discipline which deals with nature and organization of reality.” Contextually, the nature of reality is the Fast Track Land Reform and the related environmental impact associated with it. The approach to land reform had its own philosophy and had its own assumptions. Blaikie and Grix (2010) define ontology as “claims and assumptions that are made about nature or social reality, claims about what exists, what it looks like, what units make it up and how these interact.” With this in mind, it was possible to objectively look at the ontological claims of the resettlement as a social reality that cannot be ignored. The resettlement outcomes are a real interaction with the environment.

The method logically proceeds from epistemology, a process in which we come to know reality. Klenke (2016) summarizes that relationship between ontology, epistemology and methodology when he says “epistemology is intimately related to both ontology and methodology; ontology involves the philosophy of reality, epistemology addresses how we come to know that reality while methodology identifies the particular practices used to attain knowledge of it.” Thus ontological and epistemological assumptions are translated into specific methodological strategies. According to Klenke (2016), axiology refers to the role of values and ethics in research. It is for such reasons that permission was sought from relevant authorities for the research activities, and Ethics Clearance was sought with the Department.

3.3 Theoretical Framework

The theoretical framework of this research is largely guided by the Grounded Theory. Grounded research method is where the researcher uses systematic data collection and analysis pertaining to a particular phenomenon in order to come up with a theory, (Strauss and Corbin, 1990). Various methods of data collection were employed to collect data on how the Fast Track Land Reform Programme has affected game and forest resources at Dingwall and Chesa Forest. A theory that the fast track approach to land reform affects negatively game and forest resources was developed. A grounded theory is one that is discovered, developed, and provisionally verified. In the method, conceptual properties and categories are ‘discovered’ or generated from the data, (Glaser and Strauss 2009: 2). To come to its conclusions, the research built the theory rather than trying to verify or apply it. Grounded theory is an effective methodological choice in three spheres: when there is little or no literature on relevantly similar case, when existing concepts/theories seem inadequate for aspects of the material at hand, and when one wishes to explore the possibility of alternative modes of conceptualizing a case. This was the situation with the Fast Track Land Reform and its effects on game and forest resources. Grounded theory, takes categories and concepts from analysing a data set that grows in the

light of that analysis itself, and it reworks and refines those concepts into more general categories and properties (Glaser 1965; Glaser and Strauss 2009: 101–16). With this, the research was characterised by clear categories and enjoyed a highly contextualised analysis.

3.4 Population and Sampling Data Collection

A population as stated by Best and Kahn (1993) is a group of individuals that have one or more characteristics in common that are of interest to the research. It is the aggregate of all the elements, sharing some common set of characteristics that comprise the universe of the purpose of the research problem. For the purpose of the study, the population consisted of key individual and target groups of settlers within the selected case study areas. The researcher chose to use these two case study areas with the assumption that they show the specific impacts of human population encroachment into protected areas through the FTLRP. A total of 410 respondents from both Dingwall and Chesa Forest were used. They comprised the management, traditional leadership, police and settlers (Table 3.1).

Table 3.1: *Population sizes of the different types of respondents (N=410)*

RESPONDENT	2015	2017	TOTAL
Headman, Officer in Charge, Dingwall Game Ranch Owner, Chesa Forest Manager	5	5	10
Settler Perception Dingwall	100	100	200
Settler Perception Chesa Forest	100	100	200
Total	205	205	410

It was important for the researcher to define the respondent population in a manner that would enable adequate generalisability within the whole population.

Saunders *et al.*, (2012) states that a sampling intensity of between 10% to 20% is representative enough to justify generalisation of the results. In this study a sample of 10 participants is representative enough for generalisation of results to an estimated 1500 settlers in the case study areas (actually 27%).

3.5 Sampling

Sampling is the process of selecting units (e.g., people, organisations) from a population of interest so that by studying the sample we may fairly generalise our results back to the population from which they were chosen. Blank (1984) defines a sample as a subset or portion of the total population. Cooper and Schindler (2006) state that the basic idea behind sampling is that by selecting some of the elements in a population, conclusions can be drawn about the entire population. Terre Blanche (2006) defines sampling as the process of selecting cases to observe. It is a vital step in the research process as it entails making decisions regarding which people, settings, events, processes and behaviours are to be observed. Thus, the methods employed to choose a sample will impact on both the results and their interpretation (Van Rensburg, 2000). The purpose of sampling is to select participants who can deepen the understanding of a particular phenomenon. In the case of this study the phenomenon of interest is impact of the Fast Track Land Reform Programme on Protected Areas. In view of the fact that a qualitative approach is chosen as the most suitable method for this enquiry, a non-probability sampling method was used to select participants for the study in 2015. According to Terre Blanche (2006), this type of sampling refers to any kind of sampling where the selection of elements is not determined by the statistical principle of randomness. Tongco (2007:7) argues that “it is a non-random technique that does not need underlying theories or a set number of informants”. In selecting respondents in 2017, purposive sampling was done in

order to avoid the same participants during the previous survey. In such a case, the judgment of the researcher assumes prime importance in this sampling design (Best and Khan, 1993).

On the other hand, for the quantitative aspects of the research, the samples used waterhole game count method and the forest assessment methods of plot monitoring and remote sensing. These survey methods used the stratified random sampling technique.

3.6 Purposive sampling and stratified random sampling

Purposive sampling, also known as judgmental, selective or subjective sampling, is a type of non-probability sampling technique that was used in this study to select participants for the qualitative study. Non-probability sampling focuses on sampling techniques where the units that are investigated are based on the judgment of the researcher (Saunders et al, 2012).

Purposive sampling represents a group of different non-probability sampling techniques. The sampling was based on the judgement of the researcher when it came to selecting respondents for the case studies and respondents. The criteria for participation selection were based on the fact that potential respondents had the relevant and required information to inform the study.

The main goal of using purposive sampling was to focus on particular characteristics of the population that are of interest, which will best enable the researcher to answer the research questions. Moreover, the researcher used the method because it is one of the most cost-effective and time-effective sampling methods available.

For the quantitative study the researcher adopted the stratified random sampling method. According to Maheshwari (2017), stratified sampling is a probability sampling technique in which the researcher divides the entire population into different subgroups or strata, and then randomly selects the final subjects proportionally from the different strata. The strata are formed based on members' shared attributes or characteristics. The targeted participants are knowledgeable to provide relevant information to the study. The main reason for using the

stratified random sampling method is because it reduces selection bias. Stratifying the entire population before applying random sampling methods helps ensure a sample that accurately reflects the population being studied in terms of the criteria used for stratification (Saunders *et al.* 2012).

Secondary data were gathered by choosing several channels to get a complete overview of the existing theory and research. Primary data in context of this study were collected using field surveys, census method and the questionnaire interviews. Tools used for data collection included questionnaires, interviews, observations, game counts and assessments to collect the qualitative and quantitative data. Questionnaires, were used to collect information on perceptions, conflicts and attitudes between settlers and protected areas management from the two case study areas.

A Census Survey method was used to check human population encroachment into the Protected Areas for both Dingwall and Chesa Forest case studies. The objective was to establish whether or not the human population into or close to the Protected Areas increased as a result of the Fast Track Land Reform Programme. This survey method is defined as the “counting of all individuals belonging to the group of interest within a defined area of survey and when only a proportion are counted” (Henderson and Southwood, 2009:22). Settler Census Surveys were carried out in 2015 and 2017 at Dingwall Game Ranch and in the newly resettled villages around the Ranch by the researcher. The Settler Census Form was used to collect relevant data (see Appendices A and B). Data collected determined the increase of population encroachment into the Protected Area. Results from census surveys carried out in June 2015 and November 2017, together with the data for other years were used to explore the relationship between human population and wildlife numbers on the Ranch. The Census Surveys involved the administration of questionnaire interviews and Focus Group discussions in order to assess the impact of the Fast Track Land Reform Programme on the Dingwall Game Ranch. Results from

the Census surveys were used to check population encroachment and assess perceptions and attitudes of the community towards the Protected Area and the conservation work being done in the Ranch. Collected data were used to check on trends and relationships that exist between human and game populations in the study area in an effort to assess the ‘jambanja’ approach and its effects on the management of game resources.

For Chesa Forest, the Squatter Census was done by the researcher assisted by Mr Mashingaidze of the Forestry Commission. The population was co-operative because it is accustomed to the annual Census Surveys done by the Forestry Commission. This reduced the levels of suspicion. An initial notice to carry out a census was given through the Village Heads. The door to door survey was conducted and the entire Chesa Forest resettlement area was covered. In addition, special interviews with the Headman were done. Focus Group discussions were carried out in 2015 and 2017 and the opinions, perspectives and perceptions were recorded on a group discussions score sheet.

3.7 Questionnaire interviews

The questionnaire is one of the commonly used data collection instruments in research. It is basically a set of questions that are prepared to collect data from the participants of a study. Questionnaires seek the opinions of individuals in a sample or a population on issues directly related to the objectives of the research study (Aina, 2004:348). According to Haralambos and Holborn (2000) the questionnaire consists of a set of structured and unstructured questions designed by researchers to obtain data from the respondents. A questionnaire is simply a printed list of questions, which the respondents are expected to answer. The researcher had a number of questions, which he designed and got answers from the respondents. The questionnaire interview has many advantages (McNabb, 2015). The interviewer is available to seek important

clarifications. It is a flexible data collection tool both qualitatively and quantitatively. Conversely, some respondents may not disclose the actual facts due to fear of being victimised. It involves a process where a researcher solicits information from respondents through verbal interaction (Aina, 2004; Popoola, 2011). In this study, for the purpose of the qualitative data collection, the researcher conducted unstructured In-depth interviews especially with key informants from all the two accounting firms. According to Leedy and Ormrod (2001) in-depth interviews are a useful qualitative data collection technique that can be used for a variety of purposes, including needs assessment, programme refinement, issue identification, and strategic planning.

The questionnaire interviews allow face-to-face interaction and enable the researcher to establish rapport with potential participants and therefore gain their cooperation. They also allow the researcher to clarify ambiguous answers and when appropriate, seek follow-up information

The researcher developed structured interviews for key people at Dingwall Game Ranch and Chesa Forest. For Dingwall Game Ranch, interviews were held with the Ranch Owner, the manager, the Headman and the Officer in Charge of the Zimbabwe Republic Police. At Chesa Forest, interviews were held with the Forest Manager. Issues of forest management and interaction between the settlers and management were key during the interviews.

To get information about game poaching challenges and statistics possibly linked to the resettlement exercise, another specific questionnaire (Appendix H) was designed and a questionnaire based interview was arranged with the Officer in Charge Zimbabwe Republic Police, Nyamandlovu. The ZRP Nyamandlovu services both Dingwall Game Ranch and Chesa Forest.

Perceptions of levels of poaching at Dingwall Game Ranch by the settlers were sought using the Questionnaire method in the years 2015 and 2017. A total of 100 respondents participated in each year. The thrust of the investigation was to confirm the existence of community knowledge about environmental issues, and the questionnaires were distributed to the settlers and were collected through the Village Head. Different respondents from those who participated in 2015 were selected using the purposive sampling technique. The researcher collected some of the questionnaires from the settlers directly from their homesteads. The results were recorded and tabulated. The questionnaire method was also used to establish the reasons for poaching at Dingwall Game Ranch. The major reasons established were tabulated for each year for further analysis.

Assessment of community attitudes towards the game ranch as a Protected Area was also sought using the same instrument for the two years. For the two years of sample populations, settlers were categorised under A1 communal farmers and A2 small-scale commercial farmers. Their views were tabulated accordingly for analysis.

Perceptions of ownership of the Dingwall Game Ranch were also attempted using the same questionnaire. Respondents were required to state whether they had a sense of ownership toward Dingwall Game Ranch or not. One hundred respondents were interviewed in each of 2015 and 2017.

Levels of conflict between settlers and Dingwall Game Ranch were also tested using the Census Survey questionnaire method. The respondents in both years were required to indicate awareness of conflict between Dingwall Game Ranch management and the community. This was to attest the prevalence of the conflict and the community readiness for engagement in the conflict resolution.

The researcher also investigated the forest management plans and land use systems through the questionnaire interview with Chesa Forest Manager. The purpose was to establish how the Forest is being managed in the light of the Fast Track Land Reform Programme. It was crucial to check whether there have been some significant changes in the land use system. The Forest plans were also investigated and the results were tabulated for analysis. Forest focus was attempted using the collected information to determine the future of the Forest.

Attitudes and perceptions of the settled population towards Chesa Forest as a Protected Area were investigated through questionnaires. The respondents were asked about the current forestry management, and the envisioned future of Chesa Forest management and the role that the community could play in the management of the forest. The results are summarised and tabulated. Through the questionnaires in 2015 and 2017, respondents were to express differing views and attitudes towards the forest as a Protected Area.

Perceptions of ownership of the forest by the communities, the importance of Chesa Forest to the Settlers community, non-timber forest products obtained from Chesa Forest, conflicts between communities and the Forestry Commission, levels of conflict between Forest Management, Settlers and Wildlife were also investigated using the questionnaire survey method. The results were tabulated for analysis.

3.8 Game counting at Dingwall

The field work surveys were carried out in order to assess the impact of human encroachment into the Protected Areas. At Dingwall, game count was the major practical fieldwork. At Chesa forest, the major practical fieldwork were the monitoring plots. These methods were further enhanced by the GIS assessment approaches.

There are different methods of game counting depending on the size of the game ranch, targeted animals and available equipment (Green and Bavelier, 2003). Mark and recapture technique is

one of the methods which includes trapping and counting the trapped animals (Bell, 1937). To avoid duplications of counts, trapped animals are painted or assigned a distinct mark (Bell, 1937). Mark and recapture technique is mostly used for hidden animals that are rarely seen in open spaces (Guschanski et al., 2009). Aerial census is another method of game count where a plane is flown over the game ranch and animal population counts will be based on either direct observations or photographs (Jolly, 1969). The aerial census method is used for animals that are big and that don't normally hide (Jolly, 1969). Another method which was used on this study is counting animals on water points or water holes (Grzimek and Grzimek, 1960). This method is normally used to count big animals that visit waterholes and this is done twenty four hours (Grzimek and Grzimek, 1960). Counting of animals in water holes was the method used for this study because it is cheap and it was the best for the targeted animals. Only the number of observed animals that come drink water at designated water holes can be counted.

3.8.1 The waterhole game count method at Dingwall Game Ranch

One of the core interests of this research was to establish how the number of game species has been affected by the Fast Track Land Reform Programme. It was therefore necessary to make estimations of the game species in the ranch, during 2015 and 2017, being the timeframe of this research.

In this study, the researcher used the 24 hour fixed waterhole game count method to estimate the game population. The researcher carried out game counts during the years 2015 and 2017 with the guidance and support of the Ranch authorities and staff. This was not a problem for the ranch because it is their policy to do game count every two years and have a budget for it. The waterhole game counts were done at the designated water points. The first one was done on a full moon on the 2nd of June 2015 and repeated for three days to make a total of four days.

The day was of dry weather and game frequently visited the water points. In 2017, the game count was done on the 4th of November, again on a full moon date and also repeated for the next three days for authenticity and cross checking.

During a waterhole count the participants stayed in hides at the waterholes on the ranch and counted all arriving animals. Each of the six waterholes was manned by two enumerators. They recorded the number of animals that came to their waterhole in each 24-hour day for four days. The figures per waterhole were tabulated and averaged per day to get an estimate of the number of animals that use the given waterhole. The totals from all waterholes were added to get the estimate of the total game per species in the ranch. It is in principle that there is no single game count method that could be fully accurate. Each method has its strengths and weaknesses. Du Plessis and van der Merwe (2014:198) argue that “the idea of waterhole counting is that each animal will at least visit the waterhole once a day to drink. Therefore, all animals can be counted on a particular day”. They are however quick to observe that some animals may not drink water every days and this affects the observed statistics at Dingwall game statistics. In addition, given the small size of the ranch and the proximity of the waterhole to each other, it is possible to have double counting. The strength of the method is that animals rarely drink twice a day. In addition, the herds are basically known by the rangers almost like domesticated animals so it is easier to make informed conclusions on totals enumerated. This type of count was more reliable to make an estimation of the game stock at Dingwall Game Ranch

The game statistics by species over the years were recorded on a game score sheet and the totals were tallied to check numbers and trends per each waterhole. Statistics for the years 2000, 2005, 2010 and 2015 were collected from Dingwall game count records kept at the Ranch after every game count using the questionnaire interviews. These years were only selected from other years just to check on the major trends on game statistics. As a way of showing the trends in numbers of animals counted at each waterhole, the total numbers of game counted at each

waterhole were recorded and are presented on bar graphs. Specific data of the actual species counted per waterhole were also recorded.

Photographs for some of the waterholes were taken and are shown in Fig 3.2. Collected data basically helped to observe the changes in the population of wildlife species over the years since the Fast Track Land Reform. Experienced game rangers aided and participated during the game counts. Through their experience and expertise, it was possible to enumerate and identify game by species, sex and estimated age.

The researcher was thus able to collect data on game animal populations for 5 different years which are 2000, 2005, 2010, 2015 and 2017, of which for the last two years the researcher was personally involved.

During the survey, all waterholes were photographed to shed more light on the concept of a waterhole. Some of the water points are shown in photographs below. All the six waterholes had water during game counts. The build and shape of the other two waterholes whose photographs are not shown in Fig 3.2 below are just like Clabhini.

Clabhini waterhole



Dam waterhole



Tsheni spring

Figure 3.2: Photograph

3.9 Application of Geo for poaching at Dingw



In this study the GIS concepts are used to analyze the human impact on game resources at Dingwall. The major impact of human encroachment is the increased nature and extent of poaching of game species. The method is also used to identify trends and distribution of game within the ranch. GIS has been used as a tool to identify the illegal poaching hotspots and to assess the changes in spatial distribution of wildlife population in Dingwall Game Ranch. Several studies have used Geographic Information Systems (GIS) to analyse the temporal and spatial patterns associated with poaching activity in protected areas (Litvaitis and Tash, 2008).

3.10 Hot spot analysis

There has been an increased interest in using GIS in wildlife conservation as it can analyse animal movement more often and over larger areas than ever before (Haines *et al.*, 2012). Hotspot analysis is one method that has been useful to help mitigate poaching by identifying

patterns of wildlife poaching occurrence (Salem, 2003). Use of GIS technology has tremendously benefited wildlife management, it allows identification of patterns of poaching and produces spatially explicit prediction maps (Haines *et al.*, 2012).

Dingwall Game Ranch's boundary was put in a GIS by first collecting corner coordinates using a Garmin Global Positioning System (GPS) receiver with four-meter accuracy level. The coordinates were put on an excel file and then saved as Comma Delimited text file so that it can be opened in a GIS. This text file was inputted in QGIS and then saved as a shape file. The file showed only points that had been collected, so a point to polygon function in QGIS was used to convert these points into a polygon which shows the boundary of Dingwall Game Ranch. Fig 3.3 below shows Dingwall Game Ranch boundary. The map is then used in the creation of hot spots map.

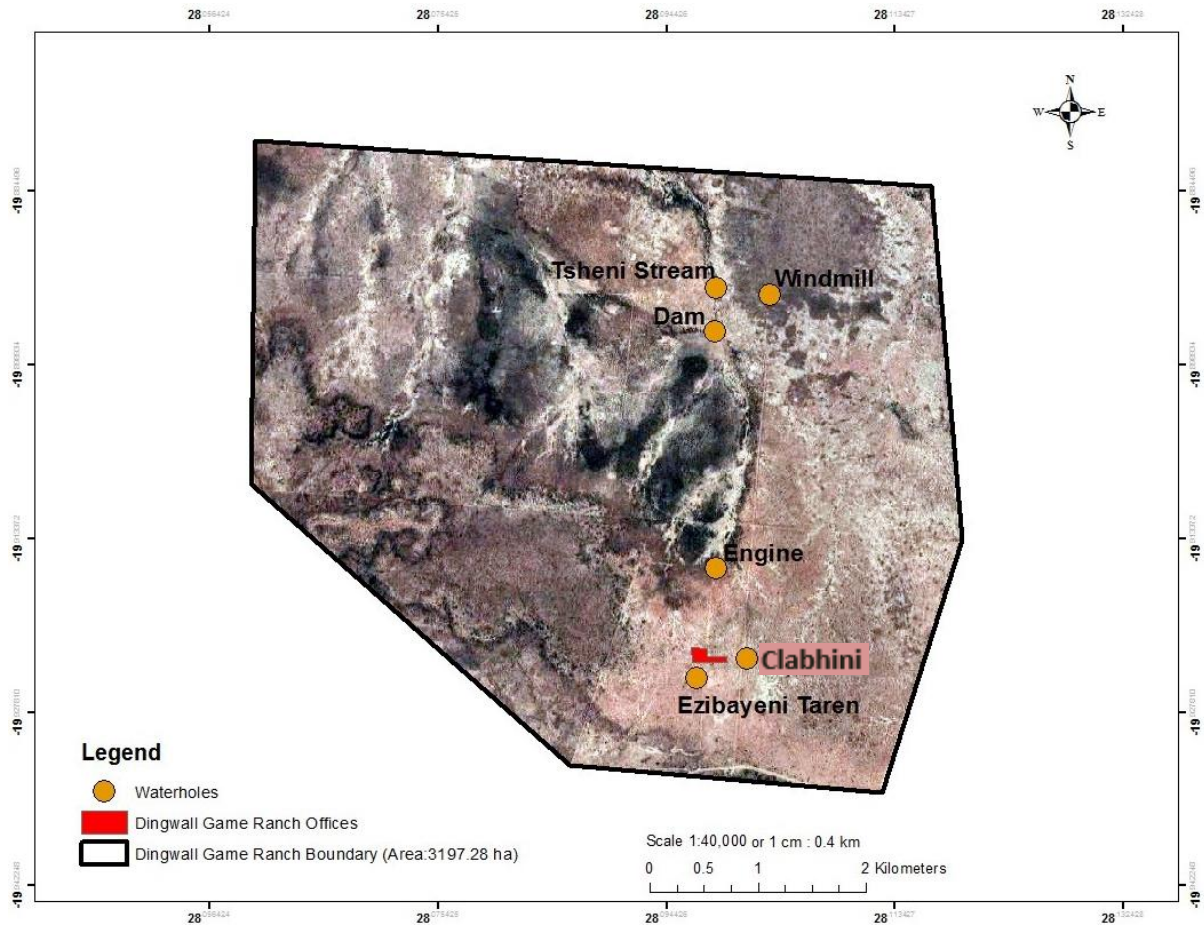


Fig 3.3 Showing Dingwall Game Ranch boundary.

GPS-coded data obtained over the years on poaching was used to create a hot spot analysis map showing areas of high poaching cases. These data are presented on maps showing hot spots for poaching in Dingwall Game Ranch. Hot spot analysis thus greatly assisted to identify areas attracting poachers for management and game patrols. The data were based on collected point data by both the researcher and Dingwall Game Ranch management as well as the data collected from ZRP Nyamandlovu consistently between 2000 and 2017. As a result, the researcher was able to map the number of animals counted at each waterhole using graduated maps with circles proportional to the number of animals counted. All mapping and analysis was done in Quantum Geographic Information System Software (QGIS). This method made it possible to put the case study into the real picture and can be accessed by any research online.

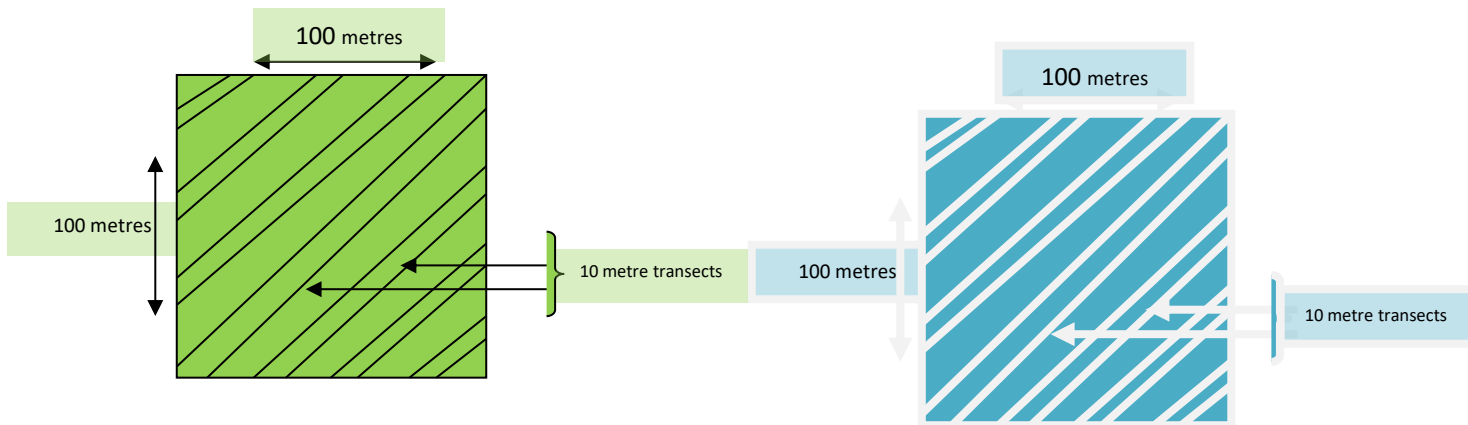
The data that were collected from this exercise is presented on several georeferenced maps of Dingwall Game Ranch.

3.11 Experimental plots to assess deforestation by species due to human encroachment into Chesa Forest

In addition to the census survey to check on human encroachment into the forest land, monitoring plots on human impact on forest resources were used check on the nature and trends of exploitation. The researcher established specific square field plots to measure current vegetation and check tree cutting and biodiversity loss. The plots were 100 metres X 100 metres in dimensions and were marked using wooden corner posts that were marked with white oil paint. Some boundary marks were standing trees that were marked using the white oil paint. Within the plots, transects of 10 metres were established to check deforestation by species of vegetation (Figure 3.4). Stumps and offshoots were observed and results were recorded on a score sheet. The total of all measurements that were collected from the transects within the plots indicated the approximate rate of deforestation per every 100 x 100 metres (1 ha) of forest sampled.

Mr Mashingaidze of the Zimbabwe Forestry Commission (an Inventory and Mensuration Forester), was the resource person on the practical aspect of forest assessment. A pilot survey was done on the ground first. Firstly, some pilot plots were systematically identified and properly demarcated in each and every forest block. This was in preparation for the actual experimental survey. Secondly, during the actual experimental survey, a biodiversity inventory was carried out on each plot. Observations of trees, shrubs, herb layers, canopy cover, grass, soils, deforestation, and litter as part of species biodiversity inventory were made. In line with the aims and objectives of this particular research, losses due to tree cutting by species were recorded in order to account for evidence of forest poaching and degradation by making use of

Appendix G. There was no legal timber logging taking place at any time in the forest and any tree cutting was therefore illegal.



16 transects were used.

Figure 3.4 Structure of plots and 10 m transects that were used for data collection

From each sample plot, attention was given to significant changes like number of stumps, offshoots from regenerating trees, and vegetation. Recording was also done in 2015 and 2017 on the same monitoring plots in order to establish and estimate wood poaching and forest degradation. On this approach, Sutherland (2006, p.13) strongly contends that “One can study only part of the population, through taking samples, for example, through counting the trees in a few one hectare blocks of forest, to estimate the average number of trees per hectare in the whole forest”. The losses on sample plots due to tree cutting were observed and recorded on a score sheet.

A total of 20 square plots (and 100 metre transects) were enumerated and surveyed in the 14250 ha forest. Tree diameters were measured using diameter tapes and recorded on standard enumeration forms (Appendix E).

3.12 Remote Sensing.

Remote sensing is one of the key aspects of the GIS. In this study, remote sensing was used to analyse spatial changes in forest cover in Chesa Forest without being in direct contact with the area. Remote sensing has played the most pivotal role in studies that illustrate and monitor spatial and temporal land cover changes in modern day terrestrial ecology (Bakr *et al.*, 2010; Dewan and Yamaguchi, 2009; Rawat and Kumar, 2015; Yuan *et al.*, 2005). Satellite imagery from remote sensing provides continual historical and precise information about land cover or land use changes of the Earth's surface (El-Kawy *et al.*, 2011). Use of remotely sensed images is cost effective and reduce time spent doing ground surveys (Yuan *et al.*, 2005). Object based image classification can be used to attain different land use land cover types on the acquired image (Blaschke, 2010). Image classification then helps to see the trends that have been occurring throughout a given period (Chen *et al.*, 2006).

Chesa Forest land cover change detection was assessed using classified historical remote sensing images. This enabled the researcher to identify the changes occurring in terms of land cover and land use change before the Land Reform Programme and years after it had been stated.

Object based image classification technique was employed to determine land cover changes in Chesa Forest. Object based image classification is a process that groups similar remotely sensed image pixels into objects. This method is becoming common as it can be used on high-resolution data and it is superior to the traditional classifiers (Darwish *et al.*, 2003). The high resolution 3 band 2017 Google Earth georeferenced image covering the study area was downloaded from Terra Incognita at 20 meters zoom level. Since Terra Incognita does not offer historical satellite images, the researcher saved historical Google satellite images covering the study areas from Google Earth Pro at maximum resolution for the years 1999, 2003, 2007, 2011

and 2014. Image to image georeferencing was performed to the historical Goggle Earth images using the image downloaded from Terra Incognita. Object based classifications were performed using ECognition analysis software. ECognition uses Multiresolution Segmentation (MS) technique that can be used for classification, (Belgiu and Drăguț, 2014). MS starts by considering each pixel as a separate object(Adam *et al.*, 2016). Afterwards, pairs of image objects are merged to form bigger segments based on a local homogeneity criterion which describes the similarity between adjacent image objects (Darwish *et al.*, 2003). Segmentation parameters that were used for analysis are shown in Table 3.2 below.

Table 3.1. Showing segmentation parameters that were used for the analysis.

Image layer weights	Scale	Shape	Compactness
1.1.1	10	0.1	0.5

Segmentation levels were classified into 3 land cover classes (dense forest, cultivated area, and shrubs and grasslands). The classified segments representing each class were exported as vector layers (polygons).

Error Matrix (EM) technique was used as a post processing technique to perform the classification accuracy assessment(Foody, 2002). It is a statistical accuracy assessment technique which reports three accuracy measures (producer’s accuracy, user’s accuracy and the overall accuracy) (Rossiter, 2004). O`nly the overall accuracy (OA) is considered. One hundred random points were generated within the study area for collecting ground truth data. Avenza pdf maps application was used to navigate to the randomly created points in the study area with the classified image as the base map. Calculation of area in hectares covered by each class for the different years was based on the summation of the segments representing each

class using a field calculator function in QGIS. Variation in hectareage in each class was then used to calculate changes in the land cover over the years.

Remote sensing technique was used to detect land cover changes at Chesa Forest. This is a technique of acquiring information about objects but without being in physical contact with them. Satellite images are used in this technique and electromagnetic spectrum works as an intermediate, as interpretation of the absorbed or reflected energy will help in identifying objects. Objects behave differently in different wavelength regions. Some absorb much more within a certain region and reflect energy in another region and this helps differentiate between objects. Google satellite images covering Chesa Forest were downloaded and classified into different classes basing on different behaviour on the electromagnetic spectrum. The classes were dense forest, shrubs and grasslands, and cultivated area. ECognition was used for Object bases image classification. This method was useful in showing how that Chesa Forest was indeed deteriorating in land cover over time.

This study, however, did not attempt to quantify the environmental impacts at species level as these can be influenced by a number of factors like climatic factors, edaphic factors and stochastic events. However, a biodiversity inventory was only carried out to assess forest resources poaching by species. While land cover changes provide useful information on the state of the Chesa Forest ecosystem, there are other anthropogenic effects on the internal dynamics like regeneration that were not examined by this study. The study restricted itself to wildlife and forest resources deterioration like game and timber poaching as well as forest degradation.

3.13 Additional data collection

This is a method that is employed by a researcher in which an individual behaviour or situation is observed and recorded. There are two types of observation: participant observation and non-

participant observation. In this study, the researcher used a non-participant observation, where the researcher was not a member of the group to be observed. Using this technique at Dingwall, snares for poaching were observed and photographed. Also observed were game animal carcasses and poachers caught poaching. The water holes were photographed. At Chesa Forest, types of vegetation, stumps and poached wood were also observed. These observations helped to capture the visible impacts of human encroachment into the Protected Areas.

3.14 Ethical Considerations

Ethics basically refers to a system or set of moral principles. Ethical aspects addressed by the researcher included seeking authority to conduct this research, respect for the respondent's freedom, the right for self-determination, autonomy, volunteerism, confidentiality and avoidance of harm to subjects and respect for person's freedom. The researcher felt that it was important to give weight to the ethical issues.

The purpose of the research was explained to all participants. This helped respondents' willingness to participate and reduced doubt as to the use of the findings of the study.

3.15 Data presentation and analysis.

The study employed a mixed research method, and the researcher analysed qualitative data and quantitative data using different methods. For quantitative data finalised questionnaires were checked for completion and missing information, after which data were captured using the statistical software program Statistical Package for Social Science (SPSS), version 16.0. Chi squared test of independence were performed on questionnaire surveys to tests for associations between attitudes or perceptions with such independent variables as sex, economic status, educational qualifications and age of respondents. Quantitative data were analysed using generalized linear models, with time and space as independent variables, and count data as dependent variables.

CHAPTER FOUR: RESULTS

4.0 Introduction.

The results presented in this chapter are inclusive of the magnitude of human population encroachment into the Protected Areas, poaching trends and levels, game count in Dingwall Game Ranch, opinions and perceptions of settlers, land cover change detection and forest degradation in Chesa Forest. The results are mainly from Census surveys, interviews, game counts, experimental plots and observations as the major sources of data.

4.1 Human Population encroachment into Dingwall and Chesa as a Protected Area due to the Fast Track Land Reform Programme

Date of human population encroachment into Dingwall Game Ranch were collected using the census survey (Appendix A). The number of homesteads and human population were the important variables of data that were collected in 2015 and 2017. The results of these variables are presented in Fig 4.1 below.

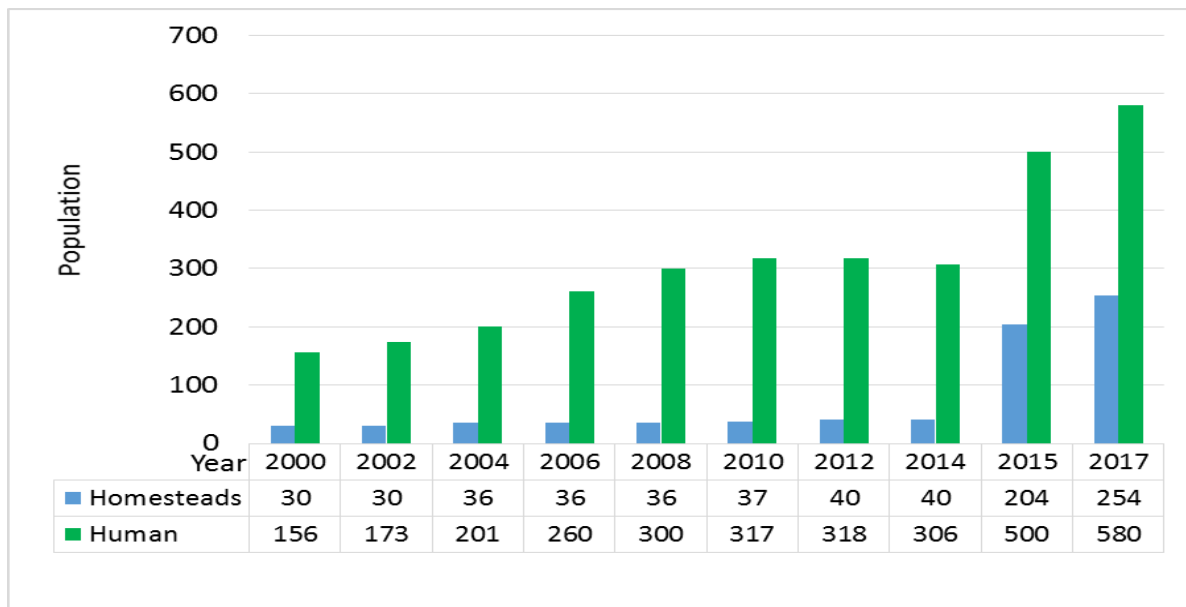


Figure 4.1: Populations of humans and homesteads around Dingwall Game Ranch.

The results show a progressive increase in human population encroachment into the Protected Area. The Headman of the village neighbouring Dingwall Game Ranch provided the data that were collected over the years since the Fast Track Land Reform of 2000 in response to

questions in Appendix A and Appendix B. The data provided information on the size of the fields held by each family, the population and livestock held by individuals since 2000. Numbers of homesteads increased from 30 in year 2000 to 254 in year 2017. Human population increased from 156 in year 2000 to 580 in year 2017. There was therefore a 746.6% increase in the number of homesteads from the year 2000 to 2017; and a 271.8% increase in human population in the same time period.

4.1.2 Human Population encroachment into Chesa Forest

A squatter Census Survey was also conducted at Chesa Forest (Appendix B). The squatter census survey was carried out in order to monitor the threats that the forest faces due to the Fast Track Land Reform Programme. Population encroachment into the forest was a major interest of the research. The summary of the findings is given in Error! Reference source not f

ound..2 below.

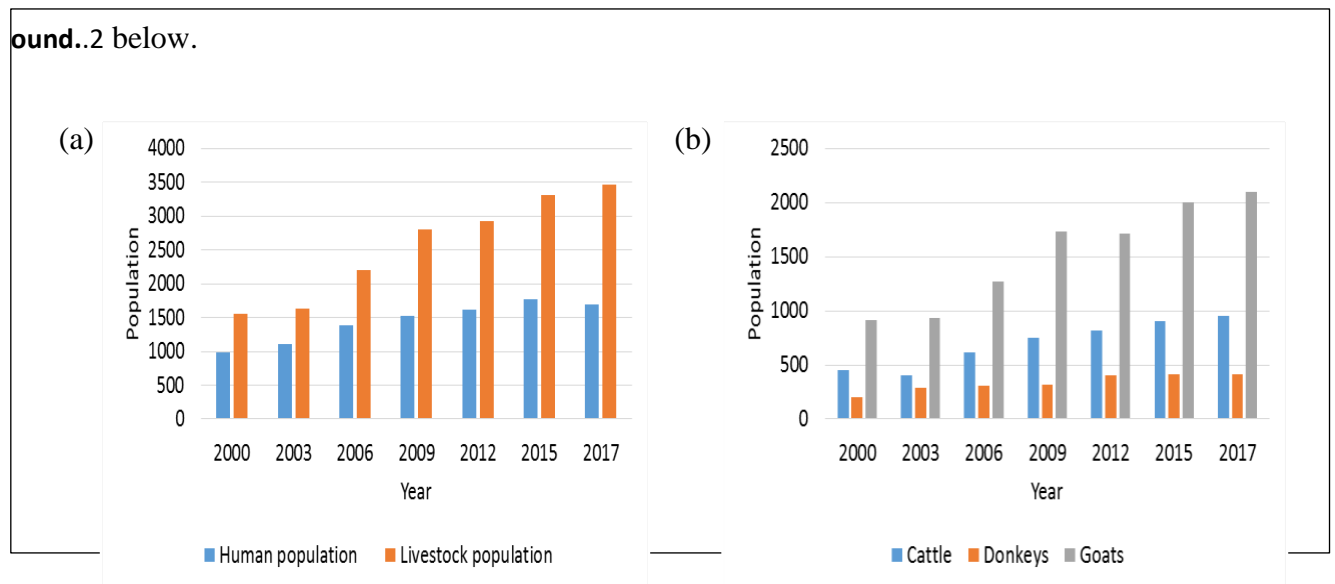


Figure 4.2 Chesa Forest Squatter Census results between 2000 and 2017.

The squatter census results over the given years indicate a steady increase in population statistics both for the human and domestic animal populations.

4.2 Game Counts at Dingwall Game Ranch

The main purpose of the game count was to establish whether there has been any significant change in the number of animals at Dingwall Game Ranch in the years since the Fast Track Land Reform Programme. As part of the game count process, in the years 2015 and 2017, some 24 hour waterhole game counts at each waterhole were carried out. The game records at the Ranch for the years 2000, 2005 and 2010 were also collected. The results are shown in Fig 4.3 below.

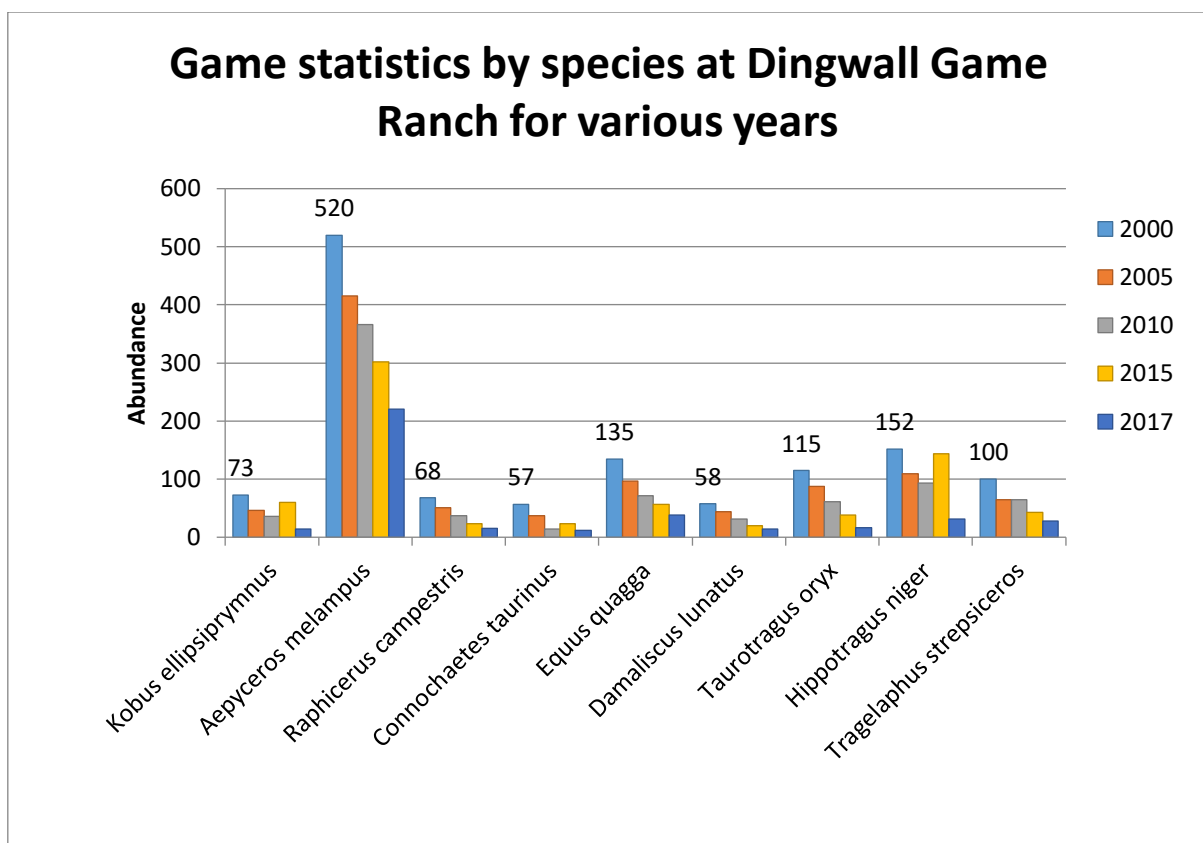


Fig 4.3 Counted and recorded species at Dingwall Game Ranch for various years since 2000.

The collected results show that there were significant differences in the numbers of all species counted over the years (One-way ANOVA, $df = 4$, $p = 0.001$), with all species on a downward trend.

It is observed that the game populations species are dwindling, with *Damaliscus lunatus* (Tsessebe), *Aepyceros melampus* (Impala), *Equus quagga* (Zebra) and *Tragelaphus strepsiceros* (Kudu) showing the greatest decline since 2000. During the game counts, the total numbers of animals visiting each waterhole were captured and recorded on score sheets. The volumes of animals counted at each water point over the years are shown on a bar graph in 4.3 below. Nine species were recorded during the 17-year period and all except *Aepyceros melampus* (impala) are at very low numbers.

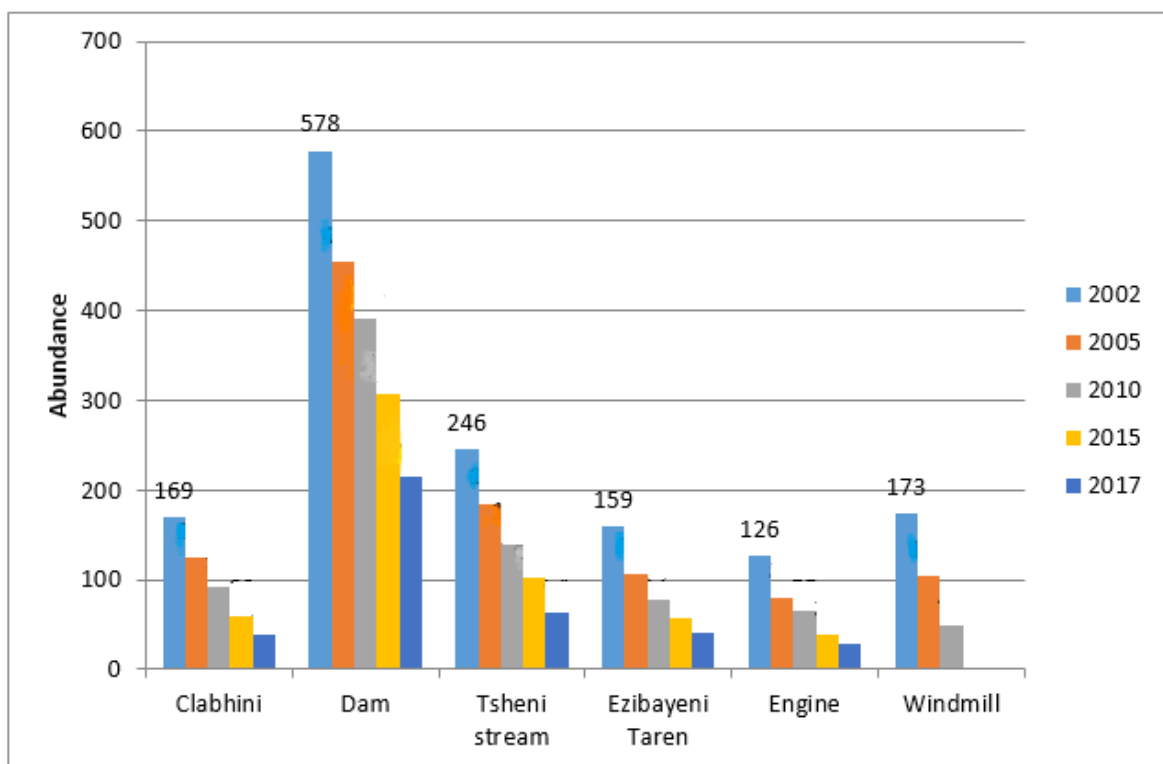


Fig 4.4 Counted and recorded species at Dingwall Game Ranch from 2002 to 2017.

Similar to the trend with species, numbers of animals observed were also in decline across the different habitats and waterholes sampled (One-Way ANOVA, $df = 4$, $p = 0.001$). It was generally observed that all the game populations are dwindling.

4.3 Poaching hotspot analysis at Dingwall Game Ranch

As part of the process of data presentation, a hotspot analysis was performed using point locations of poaching sites. The data were collected from 2002 to 2017. The distribution of these points was then used to create a hotspot map to show areas where high levels of poaching occurred. From the map it can be deduced that poaching hot spots occur in the dense woodland close to the dam water point which also happens to be the water point where the highest number of game counts is recorded each year (see Fig 4.3). **Error! Reference source not found.** 4.5 below shows the distribution of poaching at Dingwall.

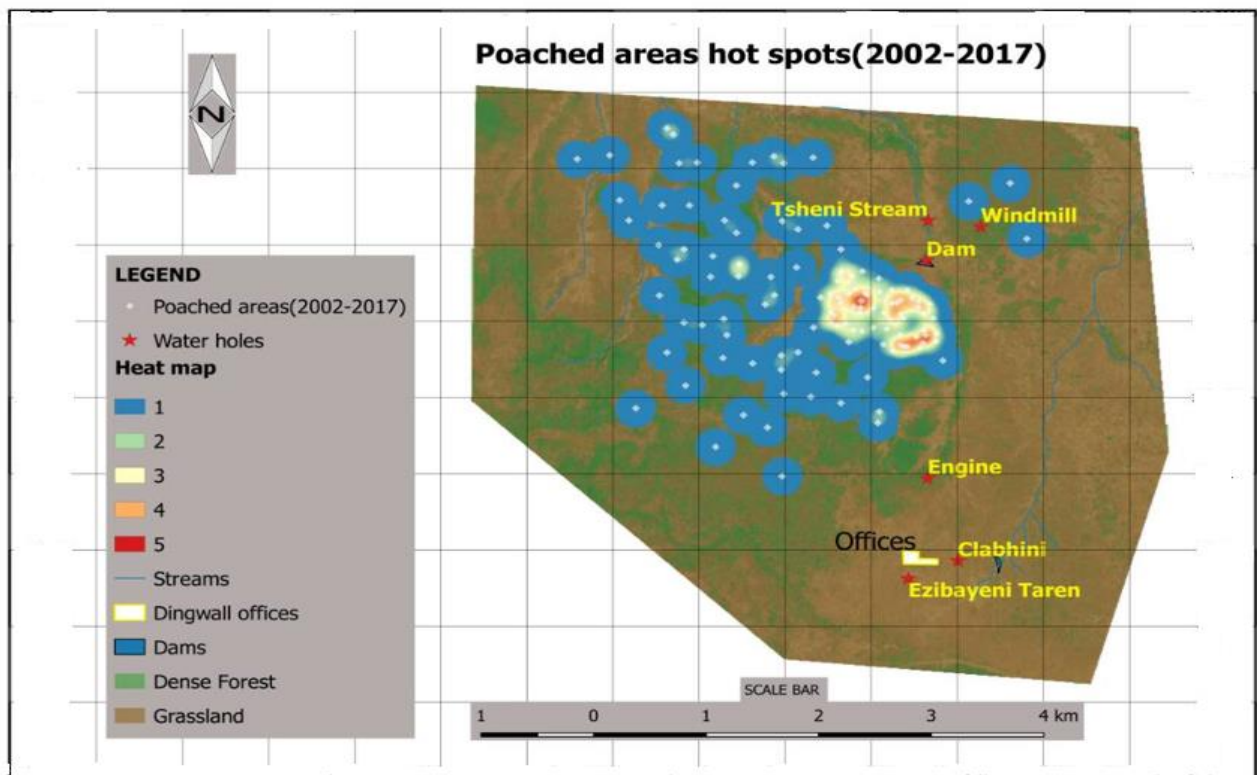


Figure 4.5 Map showing hot spots for poaching in Dingwall Game Ranch

Maps that show the distribution of the identified poaching locations for different years were developed as shown in Fig 4.6 below. Population of animals counted at each water point is proportional to the size of the circle represented at each waterhole (the larger the circle the greater the number of animals counted at each waterhole). The Dam has the highest numbers of animals counted every year followed by Tsheni stream. The total number of animals counted

at the Dam reduced from 578 in 2002 to 220 in 2017 (figure 4.4). At the Windmill the population reduced from 159 to 40 in 2010 and then it was closed in 2015.

Figure 4.6 Maps showing the numbers and distribution of counted animals as well as illegal poaching locations identified in five different years.

4.4 Perceptions of levels of poaching at Dingwall Game Ranch by the settlers

In addition, perceptions on levels of poaching at Dingwall Game Ranch by the settlers were sought using the census method (Appendices A). The results are presented in Table 4.7 below.

Table 4.1 Perception of levels of poaching at Dingwall Game Ranch by the settlers.

Level of poaching	Number 2015	Number 2017
High	70	70
Medium	18	16
Low	12	14
Total number of respondents	100	100

Using the Chi Square test to see if the perceptions on the levels of poaching varied between 2015 and 2017, there were no significant differences in perception between the two tested periods ($\chi^2 = 0.27149$, DF = 2, p-value = 0.87). The majority (70%) of the respondents indicated a high level of awareness of poaching at Dingwall. This does confirm that poaching is an environmental issue in the area and the community has an existing knowledge about it.

4.5 Reasons for poaching at Dingwall Game Ranch

The census surveys (Appendix A) were used to collect data in 2015 and 2017 on reasons for poaching by the settlers. The major reasons established are shown below in Table 4.2.

Table 4.2 showing reasons for poaching at Dingwall Game Ranch

Reasons of poaching	Number 2015	Number 2017
Selling game meat	20	30
Hunting as a skill and gift from the ancestors	18	10

Way of sharing resources	20	10
Food shortages / poverty	22	25
Lack of ‘plough back’ by the ranch owners	20	25
Total number of respondents	100	100

Information given by respondents during the 2015 and 2017 population encroachment surveys, settlers revealed that poverty, need for food and traditional values were some of the major reasons for poaching. Some cited family ancestral spirits responsible for initiating hunting, which the law calls “poaching”.

4.6 Levels of game poaching at Dingwall Game Ranch

Levels of poaching at Dingwall constituted part of the core business of this research. The census survey interviews and game counts were used to collect data. Interviews with Dingwall Management and Zimbabwe Republic Police, Nyamandlovu (Appendix A), were the major sources of poaching statistics. Table 4.3 below shows Game poaching statistical records at Dingwall Game Ranch for the years 2015 and 2017.

Table 4.3 Game poaching statistics at Dingwall Game Ranch obtained during the surveys in 2015 and 2017

ANIMALS POACHED	2015	2017	Reason	Average weight/beast	Average price/kg	Estimated skin price	Estimated economic value of poached game USD*

<i>Tragelaphus strepsiceros</i> (KUDU)	11	30	Meat	220kg	USD 8	USD 350	USD86 510
<i>Hippotragus niger</i> (SABLE)	5	12	Meat	250kg	USD 9	USD350	USD44 200
<i>Taurotragus oryx</i> (ELAND)	10	40	Meat	400kg	USD10	USD 450	USD222 500
<i>Aepyceros melampus</i> IMPALA	17	13	Meat	70kg	USD 10	USD 100	USD24 000
<i>Equus quagga</i> (ZEBRA)	15	5	Meat + Skins	450kg	USD 6	USD 950	USD5 150
TOTAL	58	100					USD450 210

Source: 2015 and 2017 Dingwall Game Ranch Management poaching statistics.

It is clearly observable that poaching statistics increased by between 2015 and 2017 (Unequal variances T-test, DF=5, t statistic = -1.2, p-value = 0.02). The game ranch is thus losing huge sums of potential income from the values of the poached animals.

For the purposes of comparison, poaching statistics were also sought from Nyamandlovu Police Station (Appendix A). This was done through interviews with Inspector Chawarika, the Officer-in-Charge. Inspector Chawarika felt that the penalties for poaching offences were not deterrent enough. An example was of one poacher who was fined \$50 for killing two sables (valued at \$274.00) at Dingwall on the 3rd of May 2015. There were significant differences in the poaching records across the tested years (One-way ANOVA, df =2, MS = 29.87, F = 19.9, p-value = 0.0001). Police records at Z.R.P Nyamandlovu reveal that most poachers come from Mbalibali, near Mathe in Tsholotsho. All villages around Dingwall had poaching cases with Nyamandlovu Police. It was notable that there were discrepancies between poaching statistics at Dingwall and Nyamandlovu Police. According to police records as well as information from the Game Ranch management, poaching crimes are ever increasing. The documented cases are

few at the Nyamandlovu Police Station because of financial constraints at Dingwall Game Ranch. Once rangers catch a poacher, there is need to transport the person and the killed animal as evidence in the Court. Due to financial constraints, most cases are unreported, hence the disparity.

4.7 Community attitudes towards Dingwall Game Ranch as a Protected Area

The attitudes and perceptions of the re-settled population towards Dingwall Game Ranch as a protected area were sought through Census Survey (Appendix A). The respondents were asked to indicate their views under the columns negative, mixed and positive in an effort to establish the communities' perspectives and attitudes. A total of 150 A1 small scale communal farmers and 50 A2 small scale commercial farmers responded to the Census Survey questionnaire and the results are shown in Table 4.4 below.

Table 4.4 showing community attitudes towards the Game Ranch as a Protected Area.

View	A1 communal farmers	A2 small scale commercial farmers
Negative	100	10
Mixed	30	5
Positive	20	35
Total	150	50

The Chi-square test of independence was used to see if attitudes were dependent on the size of the farm the respondents held. Results showed there was ($\chi^2 = 60.78$, DF = 2, p-value = 0.001). Respondents expressed differing views and attitudes towards the ranch as a Protected Area. Overall, the majority (55%) of the respondents indicated a negative view towards the Protected Areas concept. They felt excluded from the natural resources.

Small scale communal farmers (A1) are the poor majority while (A2) small scale commercial farmers are the ‘elite’. There are differences in knowledge and appreciation of issues between these farmers, maybe due to exposure, level of education, and wealth between these two groups of farmers (source: Interviews with Peter Chester, Focus Groups and interviews with Headman Tshailos Moyo (2017).

Table 4.4 shows that 67% of the interviewed A1 communal farmers expressed a negative attitude towards the purpose of the Dingwall Game Ranch, whilst 20% had mixed feeling and 13% supported establishment of the game ranch. The A2 small scale farmers were more supportive to the cause of the establishment of the Game Ranch. 70% expressing positive attitude whilst only 20% expressed negative attitude whilst 10 % had mixed feelings.

4.8 Perceptions of ownership of the Dingwall Game Ranch

Perceptions of ownership of Dingwall Game Ranch were investigated using the Census Survey (Appendix A). The results are presented in Table 4.5 below.

During the surveys, the sense of ownership of the game ranch by the settlers was tested. Respondents were interviewed to assess whether they had a sense of ownership toward Dingwall Game Ranch. The interviews were carried out in 2015 and 2017 and different respondents were selected using purposive sampling. A total 200 respondents were asked who they thought owned the game ranch. 100 respondents were interviewed in 2015 and 100 in 2017. The results are presented in table 4.5 below.

Table 4. 5 Perceptions of ownership of the Dingwall Game Ranch.

Answers given by the respondents	Number of respondents	Number of respondents
	2015	2017
Government	30	25

Both community and government	5	10
Private	60	50
Community ownership	5	15

In both years, the majority of the respondents' held that the ranch was privately owned, however the perception of the respondents was more accurate in 2015, 60 % of the respondents holding that the game ranch was privately owned whilst in 2017, 50 % held that belief. The percentage of respondents who thought that the game ranch was owned by the government was 30 % in 2015 and 25 % in 2017. These results show that the community surrounding Dingwall are under the impression that the game ranch does not belong to the community and therefore may not benefit them in any way. However, on a more positive note the percentage of respondents who thinks that the ranch is community based is increasing from 5 % in 2015 to 15 % in 2017.

4.9 Levels of conflict between settlers and Dingwall Game Ranch

Levels of conflict between settlers and Dingwall Game Ranch were also tested using the Census Survey questionnaire method, (Appendix A.4). The results are shown in table 4.6 below.

Table 4.6 Perceptions on levels of conflict between settlers and Dingwall Game Ranch

Level of conflict	Number of respondents in 2015	Number of respondents in 2017
High	69	70
Medium	20	20
Low	11	10

Total number of respondents	100	100
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The majority of the respondents in both years indicated a high awareness of conflict between Dingwall Game Ranch management and the community. This may be an indication of the prevalence of the conflict and the community readiness for engagement in the conflict resolution.

4.10 The Fast Track Land Reform and Forest degradation at Chesa Forest

4.10.1 Experimental Plots Results

Experimental plots of 100m x 100m were demarcated and losses due to tree cutting were observed and recorded in the years 2015 and 2017 (Appendix G). The researcher made a deforestation inventory on each demarcated plot. The major business was to enumerate species lost through poaching within the forest within the period under review. The results were recorded on the enumeration data sheet.

Table 4.10 shows that from the enumeration exercise it was established that *Baikiaea plurijuga*, *Combretum imberbe*, *Combretum zeyheri* and *Colophospermum mopane* were the major species poached at Chesa Forest. These have high quality energy and a total of US\$12 016.55 was lost as a result. The enumeration results also show that timber poaching was mainly done on trees that had not reached harvestable sizes (of at least 31cm diameter at breast level), i.e. on tree that were still growing and in the regeneration process. This gives a clue on forest degradation. Subsequent interviews with the Chesa Forest Manager also revealed that the Forestry Commission guards do not frequently and effectively patrol the forest to curb degradation.

Table 4.7 Observed losses due to tree cutting / poaching Chesa forest, 2015 and 2017.

Species	DBH Range	Stump / height volumes lost (enumerated) 2015	Stump / height volumes lost (enumerated) 2017	Percentage increase	Value (US\$)
<i>Baikiaea plurijuga</i>	20-24cm	150m ³	200m ³	33%	2900.55
<i>Combretum imberbe</i>	15-19cm	40m ³	80m ³	100%	994.5
<i>Combretum zeyheri</i>	20-24cm	190m ³	210m ³	10.52%	3314.9
<i>Colophospermum mopane</i>	20-24cm	280m ³	300m ³	7.14%	4806.6
Total		660m³	790m³		12 016.55

Value = volume * \$30 / cord

Source: Experimental Plot Survey, A.M. Ncube and C. Mashingaidze, 2015 and 2017.

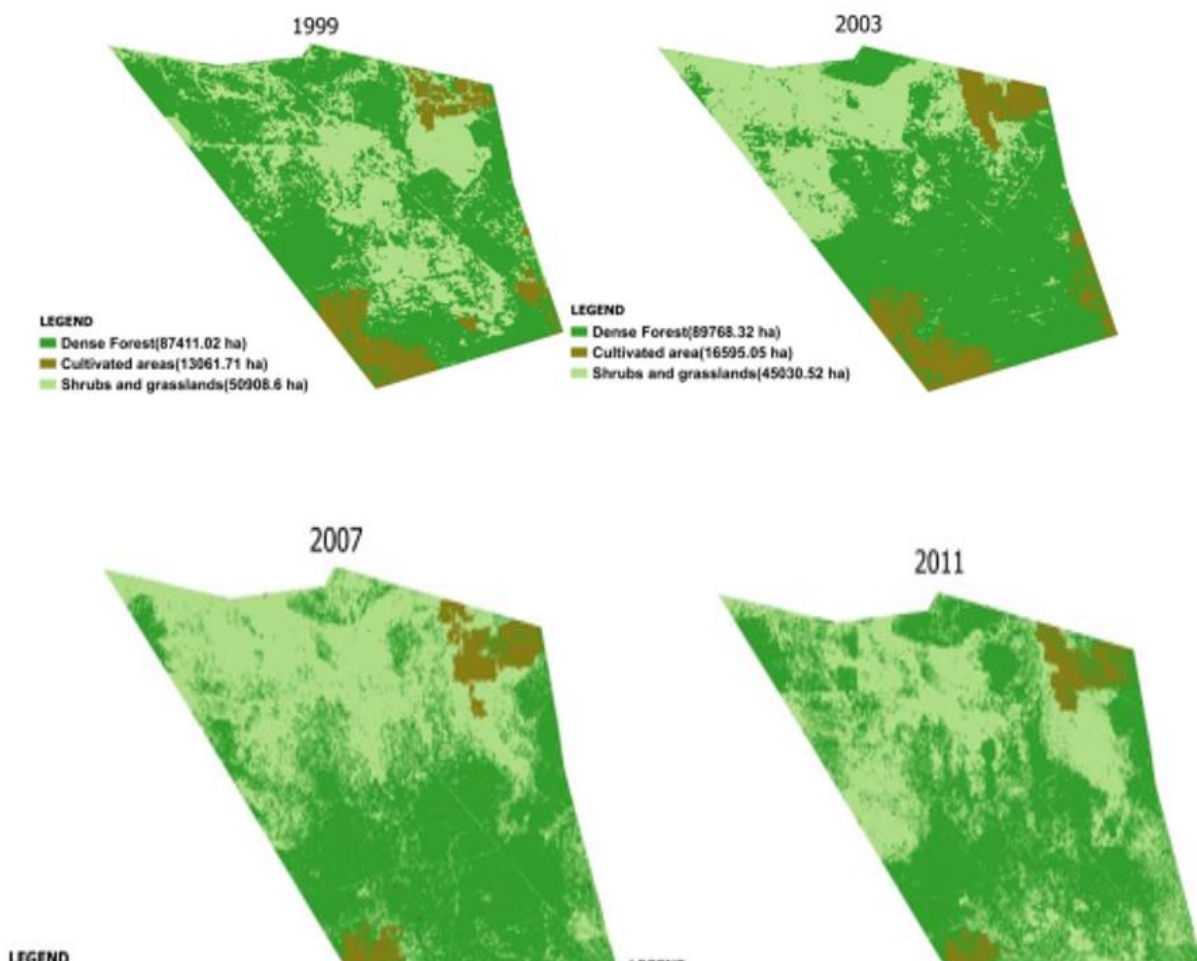
4.11 Economic uses of Tree Species at Chesa Forest

Zimbabwean forests (woodlands) have different tree species depending on location and climatic conditions (Miles *et al.*, 2006). The most common ones that were observed by the researcher included African teak or Mukusi (*Baikiaea aplurijuga*) which is common in western Zimbabwe. African teak tree is cut by people for different uses which include stripping its bark to treat eyes, stomach aches, syphilis and toothaches (Steenkamp, 2003). Mukusi very has hard wood which is resistant to rot and termites and it is used to make furniture for this reason and also as firewood (Sseremba *et al.*, 2011). Seeds for mukusi are also used as beads in strings (Affre *et al.*, 2004). Leadwood or Mostwiri (*Combretum imberbe*) is another common tree species found in Chesa forest used for firewood, also its bark boiled in water is used for tanning, and can also be used to treat bilharzias (McGaw *et al.*, 2001). The third tree species found in Chesa Forest is Bush willow (*Combretum zeyheri*) and it is a bush with a rounded crown (McGaw *et al.*, 2001). Bush willow is used as food, firewood and as a source of material used to make baskets (Emanuel *et al.*, 2005). The fourth common tree species is Mupane

(*Colophospermum mopane*) which has oily seeds and is used for charcoal and braai wood (Okello *et al.*, 2001). Its small branches can also be used as tooth brushes (Aumeeruddy *et al.*, 2017).

4.12 Land cover change detection using remote sensing

Remote sensing technique was used to detect land cover changes at Chesa Forest. This is a technique of acquiring information about objects but without being in physical contact with them. Satellite images are used in this technique and electromagnetic spectrum works as an intermediate as interpretation of the absorbed or reflected energy will help in identifying objects. Objects behave differently in different wavelength regions. Some absorb much within a certain region and reflect energy in another region and this helps differentiate between objects. Google satellite images covering Chesa Forest were downloaded and classified into different classes basing on different behaviour on the electromagnetic spectrum. The classes were dense woodland, shrubs and grasslands, and cultivated area. Ecognition was used for object-based image classification. The land cover results are presented in Fig 4.7 below.



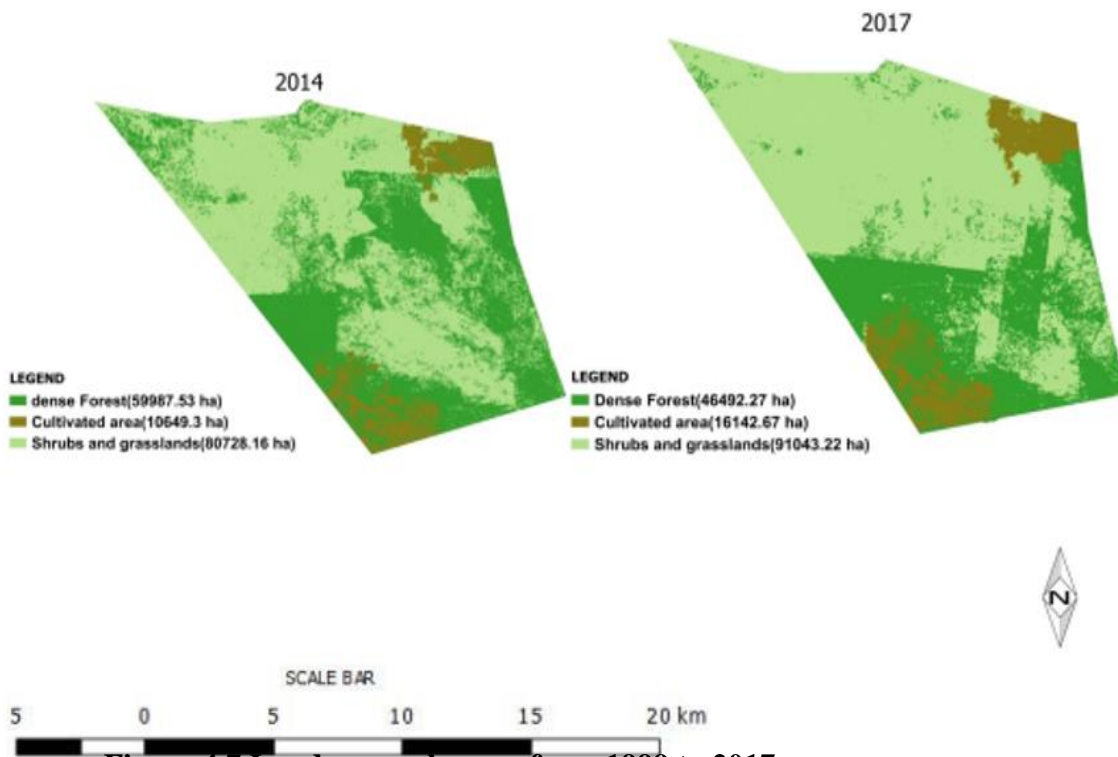


Figure 4.7 Land cover changes from 1999 to 2017.

Forest cover was reduced from 87 411 hectares in the year 1999 to 46 492 hectares in the year 2017, with an overall loss of 47%. Shrubs and grasslands increased from 50 909 hectares in the year 1999 to 91043 hectares in the year 2017 with a gain of 40135 hectares. Cultivated area increased from 13062 hectares in the year 1999 to 16 143ha in the year 2017 with a gain of 3081 hectares.

There is a negative relationship between dense woodlands cover and shrubs and grassland cover (fig. 4.7). The area covered by cultivated area is relatively steady with less variation ranging from between 10 000ha and 20 000ha over the years. These varied changes over an 18-year period are shown in Fig 4.8 below.

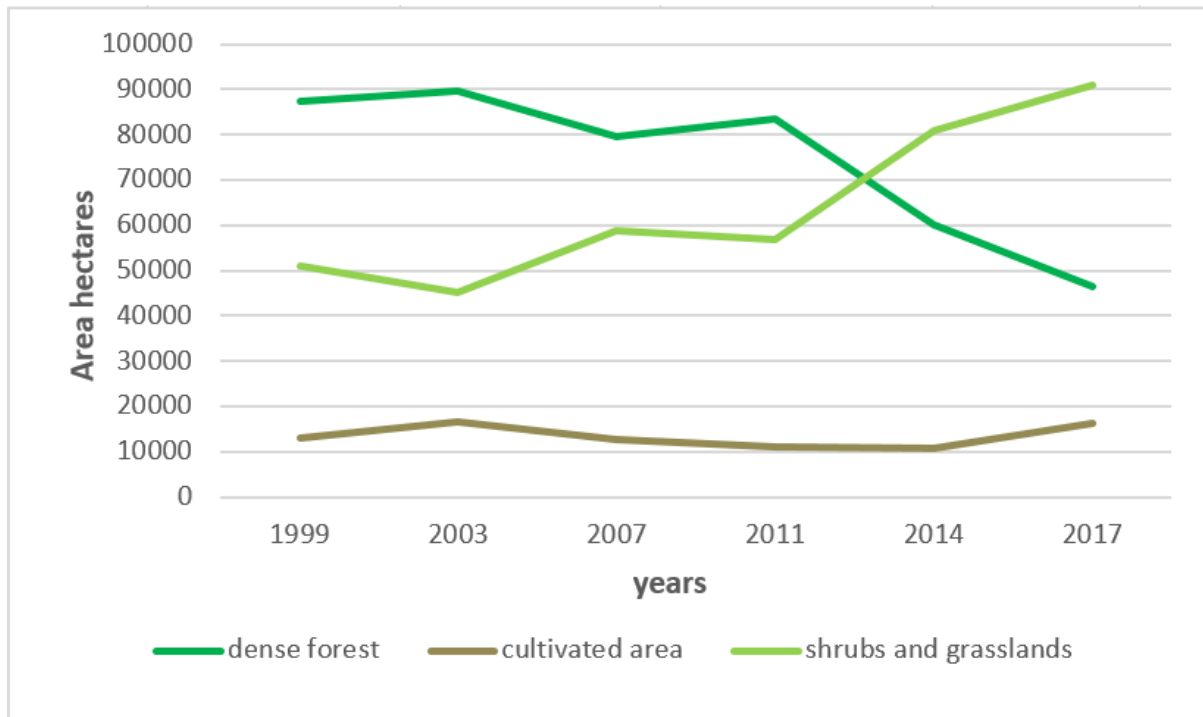


Figure 4.8 Land cover changes in the three land classes over the years.

The overall accuracy of the classification is 82%. The producer and user accuracy for each individual class show a high degree of accuracy: for the class shrubs and grassland the producer accuracy is 85% and the user's is 88%; for the dense forest category, the producer's accuracy is 75% and the user's accuracy is 78%; for the category cultivated area the producer's accuracy is 85% and the user's accuracy is 69%.

4.13 Error Matrix

An error matrix is a table layout that allows visualization of the performance of an algorithm (Torres-Moreno, 2014). It is frequently employed to assess the thematic accuracy of a land cover map, Høhle (2015). The rows of the matrix represent the occurrence in a predicted class

while the columns denote the instances in an actual class (Omatu *et al.*, 2012). It is a contingency table with two dimensions characterizing the actual and predicted values. The different land cover classes are identical in both dimensions and each combination of dimension varies in the error matrix. With a confusion matrix it is easy to see if the land classification algorithm confused and mislabelled two different classes. Below is the error matrix that was used in the classification of vegetation images at Chesa Forest.

Table 4.8 Showing Error matrix for the three covers

		Reference Data			
		Grassland and shrubs	Dense Woodlands	Cultivated area	Total
	Grassland and shrubs	50	5	2	57
Classified data	Dense Forest	6	21	0	27
	Cultivated area	3	2	11	16
	Total	59	28	13	100
	Producer's accuracy	85	75	85	
	Users accuracy	88	78	69	
	Overall Accuracy	82			

4.14 Land use systems and Management Plans at Chesa Forest

The researcher investigated the Chesa Forest management plans and land use systems through interview with the manager (Appendix G). The collected data are shown in Table 4.11 below.

Table 4.9 showing Land Use at Chesa Forest (2000-2017) as per Management records.

Year	Land use system (by ha) for:				Totals
	Squatters	Research plots & plantations	Bush & logging	Admin/roads/residential	

2000	760	200	13190	100	14250
2005	980	200	12970	100	14250
2015	1560	275	12215	100	14250
2017	1700	300	12150	100	14250

Source: Forest Management Plans (Forestry Commission)

The data show an ever-increasing squatter area and a decreasing bush and logging area. In 2017, there were 1500 ha from 14 250 ha that were used as fields only, and 200 hectares are used for residential purposes. Therefore 1700 ha out of the forest's 14 250 ha are taken up and used for residential and field purposes by the squatters. Land lost to squatter settlements thus can be statistically estimated to be:

$$= \frac{1700-760 \text{ ha}}{17 \text{ yrs}} \text{ or } \frac{940 \text{ ha}}{17 \text{ yrs}}$$

$$= 55.3 \text{ ha/year lost to squatter settlement in Chesa Forest.}$$

4.15 Human population

$$= \frac{1690-981 \text{ people}}{17 \text{ yrs}} = \frac{709 \text{ people}}{17 \text{ yrs}}$$

$$= 41.7 \text{ extra persons per year}$$

These are either through new homesteads or through births. In either way, the new people needed land and access to the forest.

4.16 Forest loss

$$\frac{13\,190-12\,150 \text{ ha}}{17 \text{ yr}} = \frac{1040}{17 \text{ yr}} = 61.2 \text{ ha/yr as woodland lost due to cultivation, fires, tree cutting,}$$

construction, firewood, etc.

Therefore $\frac{12150 \text{ ha}}{61.2 \text{ ha/yr}} = 198.5 \text{ yrs}$ (hypothetical) meaning that there are 175 years to wipe out

the forest into a resettlement rural reserve if nothing good is done to manage the forest.

The Chesa Forest Management, in response to question 2 of Appendix G on land use system plans, gave a detailed answer on several land use system plans in existence at Chesa. The results are presented in Fig 4.9 below.

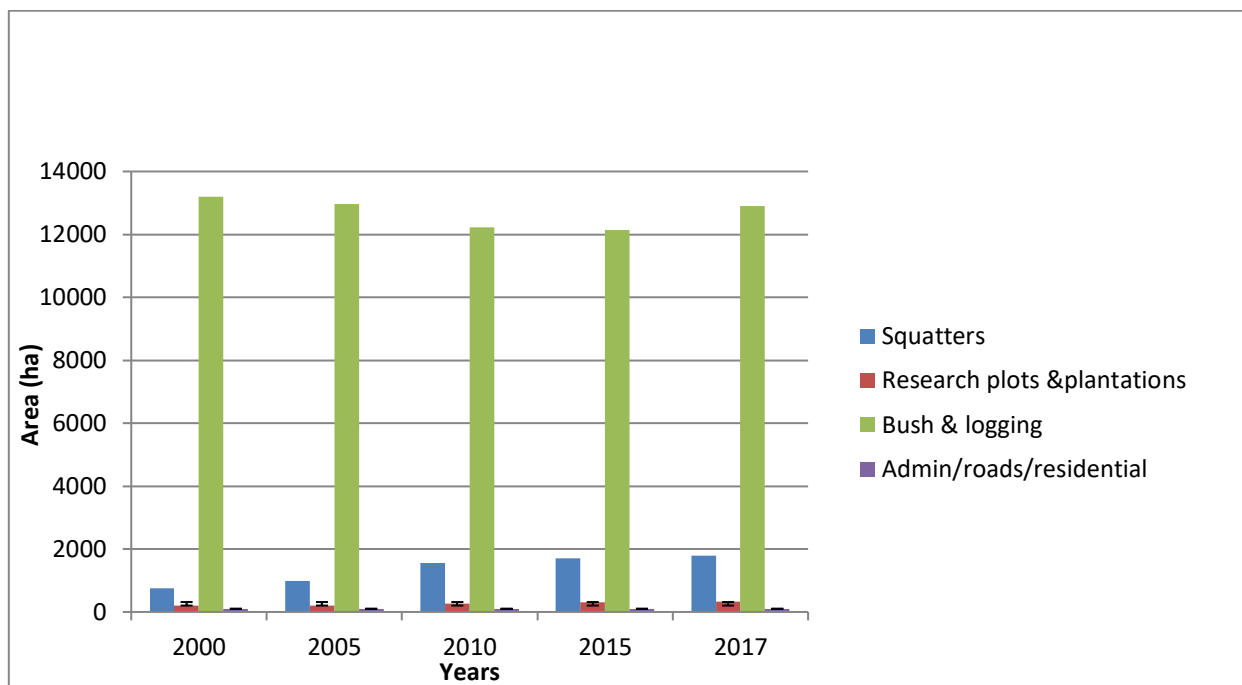


Fig 4.9 Land use system at Chesa Forest; Source Chesa Forest Management.

There is good correlation between data collected through Remote Sensing, Census surveys, Focus Groups, Interviews, Experimental Plot quadrats, and data collected from the Chesa Forest Management. There is agreement on major observations like increase in population encroachment, deforestation and changes in land use systems.

4.17 Community attitudes towards Chesa Forest as a Protected Area

Attitudes and perceptions of the settler population towards Chesa Forest as a Protected Area were investigated through the census survey method (Appendices). The respondents were

asked about the current forestry management, and the envisioned future of Chesa Forest management and the role that the community could play in the management of the forest. The results are summarised in Table 4.10 below.

Table 4.10 Community attitudes towards the forest as a Protected Area.

View	A1 2015 respondents	A2 2015 respondents	A1 2017 respondents	A2 2017 respondents
Negative	130 (87%)	20 (40%)	110 (73%)	5 (10%)
Mixed	15 (10%)	20 (40%)	10 (7%)	5 (10%)
Positive	5 (3%)	10 (20%)	30 (20%)	40 (80%)
Total	150 (100%)	50 (100%)	150 (100%)	50 (100%)

Source – Data collected from questionnaires and interviews in 2015 and 2017.

Respondents expressed differing views and attitudes towards the forest as a Protected Area. The majority of the population had a negative attitude towards the forest as they generally felt excluded from free use. The high levels of conflict are due to limited interaction between the Forestry Commission and the resettled community as well as the low levels of knowledge of the Forestry Commission by the settlers. A2 holders had some knowledge gained from meetings to address development projects by organs of the Commercial Farmers’ Union (mainly composed of white farmers and middle class blacks) and hence with better knowledge about the potential conflicts.

75% of the respondents felt that it was important for the forest to continue as a protected area, 10% wanted modification but not a total change in land use while another 15% felt that the Forestry Commission was managing the forest very well.

When probed on the future of the forest, the A1 settlers requested for more involvement compared to A2 settlers. The A2 settlers queried the settlers’ ability to contribute to effective management without compromising the entire forest resources. Very few respondents

mentioned relocation as a method of Chesa Forest conservation. They cited relocation costs and lack of compensation as major deterrents.

4.18 Perceptions of ownership of the forest by the communities.

Respondents were asked whom they thought owned the forest (Appendix F). The results are presented in Table 4.13 below.

Table 4.11 showing opinions of various respondents on forest ownership

Who owns the forest?	Number of respondents 2015	Number of respondents 2017
Government	100 (50%)	80 (40%)
Both community and Government	50 (25%)	60 (30%)
Forestry Commission	45 (22.5%)	45 (22.5%)
Community ownership	5 (2.5%)	15 (7.5%)
Total	200 (100%)	200 (100%)

The majority of the respondents perceived the forest as owned by the government. The minority perceived a community ownership which indicates potential reasons for negligent use of forest resources. This also explains why the majority of the people maintain that the forest is very important and yet poaching is prevalent.

4.19 The importance of Chesa Forest to the Settlers community

The importance of Chesa Forest to the Settlers at Chesa were investigated using the Census Survey method (Appendix F). The results are presented in Table 4.14 below.

Table 4.12 showing the importance of Chesa Forest to the Settlers community.

Response	Number of respondents 2015	Number of respondents 2017
Very important	80	83
Important	20	17
Not important	0	0
Total number of respondents	100	100

The respondents indicated a clear knowledge of the importance of the forest to the settlers.

4.20 Non-Timber forest Products obtained from Chesa Forest

Non Timber forest Products obtained from Chesa Forest were investigated using questionnaire interviews during the Census Surveys in 2015 and 2017(Appendix).The results are shown in Table 4.15 below.

Table 4.13 showing Non Timber forest Products obtained from Chesa Forest

Response	Number 2015	Number 2017
Construction	200	200
Firewood	200	200
Thatch grass	190	150
Grazing land	180	200
Mushroom	100	90
Wild fruits	80	100

Honey	60	65
Employment	10	15
Wood carving	5	10
Hunting	4	5

Source: Questionnaire interviews 2015 and 2017.

There were no significant differences between 2015 and 2017 harvested non-timber forest products (T-Test, t Stat = -0.016, t Critical two-tail = 0.99). The demand for non-timber forest products is consistent in the two years that is 2015 and 2017.

Very few respondents mentioned hunting and wood carving as accessed resources. These are controlled and regulated by law and access is thus illegal. This made disclosure difficult despite guaranteed confidentiality, so these answers could well have been under-counted.

4.21 Conflicts between communities and the Forestry Commission

Through census survey method (Appendices F and I), there was evidence of human wildlife conflict. Wildlife destroys crops in the fields of the resettled farmers, and the resettled farmers respond by poaching.

Main crops destroyed: maize and groundnuts and the destructive animals are *Tragelaphus strepsiceros* (kudu), *Phacochoerus africanus* (warthogs), *Numidame leagris* (guinea fowls) and *Chlorocebuspygerythrus* (vervet monkeys).

Also as a response to destruction of crops by wildlife, resettled farmers have established crop protection measures. Crop protection measures that the respondents indicated they used were as follows:

- Guard by day 17%
- Snare 10%
- P.A. control 1%
- No protection 2%

- Guard – day/night 70%

4.22 Levels of conflict between Forest Management, Settlers and Wildlife.

Indication of levels of conflict between Forest Management, Settlers and Wildlife was sought using a Census Survey method (Appendix F). The results are tabulated in table 4.16 below.

Table4.14 Indicating levels of conflict between Forest Management, Settlers and Wildlife

Level of conflict	Number 2015	Number 2017
High	150	140
Medium	30	30
Low	20	30
Total	200	200

To test if there is an association between time (in years) and the levels of conflict with the Forestry Commission, I a Chi-square test of independence was used. There was no association between years and perceptions on the levels of conflict ($\chi^2 = 2.344$, DF = 2, p-value = 0.3).

Conflict between Chesa Forest Management, Settlers and Wildlife has been in existence for long with no changes over time. There is need to have this conflict resolved for environmental management purposes and sustainable development. As time goes on, one expects an increase in the conflict between the residents and the Forestry Commission. Residents will keep on interfering with the environment breaking the regulations from the Forestry Commission which are meant to protect the environment.

CHAPTER FIVE: DISCUSSION

5.1 Human population encroachment into Dingwall due to the Fast Track Land Reform Programme

The Fast Track Land reform Programme saw human population encroachment into Dingwall Game Ranch. The number of homesteads increased in the Ranch from 30 homesteads in year 2000 to 254 homesteads in 2017. This impacted negatively on the land available for game ranching. Human population also increased from 156 in year 2000 to 580 in 2017. There was thus a progressive increase in human population encroachment into the Protected Area, due to the Fast Track Land Reform Programme, and the sustainability of the Dingwall Game Ranch ecosystem was highly compromised. The findings are consistent with the views of several scholars. Mani and Bansal (2006) have presented that the scale of agricultural expansion and intensification raises concerns about the state of the agro-ecosystems. The encroachment into Dingwall Ranch raises similar concerns as argued by Ferraro *et al.*, (2011) that encroachment into protected areas reduces their productive capacity. The encroachment was unavoidable as there was high demand for land and also that the expansion of land under cultivation became the next possible solution under the prevailing political and economic conditions during the FastTrack Land Reform era in Zimbabwe, (Gandiwa *et al.*, 2011). Population encroachment also saw some competition for land use between human beings and wildlife. Chidumayo and Gumbo (2010) made similar observations in 2010. Human population encroachment thus affected Protected Areas and the natural ecosystems, also substantiated by Lane (2001). Similar observations were made by Amonor and Moyo (2011) who concluded that agricultural reforms in Africa normally change the society's land management system. The situation prevailing within and around Dingwall Game Ranch ecosystems is just but similar.

The encroachment into Dingwall Game Ranch was due to the demand for land thus saw indigenous farmers being resettled within and even too close to the game ranch as the Fast Track Land Reform Programme (FTLRP) was very expansive. Similar conclusions were made by Seddon (2013). Human population encroachment into Dingwall disrupted the natural ecological ecosystems of the Protected Area. The findings are confirmed by Dickson and Murphy (1998), who concluded that “The large human population affects ecosystems through elimination of species, modification of flows of energy or nutrients or by change to abiotic environmental component of ecosystems.” Anderson and Algren (2011) further note that this does not only affect all other species within the biosphere, but also threatens the support system for all life on earth.

Human population encroachment was rapid, uncontrolled and lacked any transparency and sensitivity to environmental management. The findings are similar to those of Seddon (2013, p. 26) who concluded that the ‘fast track’ programme lacked transparency and with the farmers lacking the required infrastructural inputs (seed, water, fertiliser), it has proved “unsustainable”. Human population encroachment into the ranch thus caused unsustainability that posed threats to existing natural ecosystems of the protected area. While the observations and findings are based on the case study of Dingwall Game Ranch, similar observations undoubtedly obtain across the country where similar circumstances have been realised.

5.2 Game Statistics at Dingwall Game Ranch since the Fast Track Land Reform ProgrammeS.

The Fast Track Land Reform Program saw a decreasing trend on the number of game species at Dingwall Game Ranch. There were significant differences in the numbers of all species counted over the years, with all species on a downward trend. The game population species continued dwindling, with *Damaliscus lunatus*(Tsessebe), *Aepyceros melampus* (Impala), *Equus quagga* (Zebra) and *Tragelaphus strepsiceros* (Kudu) showing the greatest decline since

2000. The decline is heavily attributed to the increased poaching due to high levels of poverty and illiteracy among the newly resettled farmers during the Fast Track Land Reform Programme (Appendix A number 6). The numbers of animals visiting each water point in the different years the game count was held was also on a rapid decrease. Windmill waterhole was closed in 2015 when cyanide poisoning was carried out by poachers; hence no records are available for the two later years. This waterhole was closed as a result of poachers targeting this water point frequently compared to the other water points. Geographically, this waterhole is located furthest from Dingwall Homestead but closest to the resettled farmers in the north and east. The Fast Track Land Reform Programme thus had huge impact on game statistics at Dingwall. The subsequent increase in poaching and the dwindling of game species shows that the land reform programme never considered biodiversity and its relevance.

5.3 The analysis of game poaching at Dingwall Game Ranch, its causes and effects

Increased game poaching is one of the clear features that have characterized the effects of the Fast Track Land Reform Programme. The poaching levels were very high during the period under review and these continued to increase with time and intensification of the Fast Track Programme. Arrests of poachers were another common finding of this research. Game poaching and poaching arrests are not peculiar to the settlers at Dingwall Game Ranch, but may be the same with many other communities in the rest of the country. In a related study (Gandiwa *et al.*, 2011; Gandiwa *et al.*, 2013) it can be reasoned that an increase in illegal hunting of wildlife in Zimbabwe is due to increased poverty and or less penalties for those caught in the act of poaching. It is the same case for this study there are basically no police patrols or patrols by the rangers from Parks and Wildlife Authority. The thrust of the matter here is that due to the fast track nature of the resettlement program, the settlers were located close to the ranch which is a centre of biodiversity for the surrounding population. The settlers therefore will continue to access illegally the game resources if no conservation policies are

adhered to. Population increase around the protected areas means an increase in unsustainable harvest of game resources, for example through illegal trapping or shooting of game. The research findings confirm findings by Scoones *et al.*, (2010, p.174) that:

‘Following land reform opportunities for hunting opened up. Reducing wild animal populations were an important precursor to any type of agriculture, so snares and traps were set in large numbers.’

Scoones *et al.* (2010) further acknowledge that natural resources are a vital source of livelihood particularly for the poor and the marginalised.

It is of concern that some of the illegal poachers have resorted to starting veld fires in Dingwall Game Ranch to trap animals. They drive animals towards a particular direction, preparing for easy killing of the game. Veld fires provide clear ground for dogs to be able to chase animals. However, the veld fires also destroy biodiversity and destroy property. The poachers make veld fires to trap animals. The fire that was allegedly started by poachers in 2015 burnt down more than US\$500 000 worth of hunters’ lodge at Ding wall (Source: Peter Chester Interview 2015). Peter Chester is the owner of Dingwall Game Ranch. The photograph below shows the Hunters’ Lodge in its burnt state.



Fig 4.9 Showing Dingwall Game lodge that was destroyed by fire in 2015

Gandiwa *et al.*, (2011) also cite veldt fires as synonymous with population encroachment into Gonarezhou National Park also due to the Fast Track Land Reform Programme. In general, the poaching methods used are destructive and do not encourage environmental sustainability in the long run leading to ecosystem biodiversity loss.

Hot spot analysis enabled the study to identify areas favoured by poachers. High levels of poaching are concentrated close to the dam inside the wooded area. This area is more fitting as animals come regularly to drink water, the game count results show that most animals favour the dam compared to other water point sources, hence poaching occurrences are concentrated in the forest close to the dam. The results are consistent with other studies done in Kenya (Maingi *et al.*, 2012;) and in Zimbabwe (Sibanda *et al.*, 2016) . The majority of poaching activities were found to occur in areas with high vegetation and close to waterholes. Evidence of snares and traps with animal carcasses were located inside the forest suggesting that animals drinking water at the dams are pushed towards the direction of the forest where they are caught in the traps. Game caught by snares is part of the evidence. Wire snares are mostly used. The two animals were caught by wire snares in a thick bush near the Dam and Tsheni waterhole.



The Impala on the left is being rescued by a ranger during a patrol. On the right, the young Zebra is totally stripped of meat. The vultures have eaten the rest of the meat.

The poachers need clear ground for their dogs to chase the wild animals. They also use snares to catch wild animals. The two photographs below show the most ideal poaching sites at Dingwall near the Dam waterhole. In the south is a thick bush land forest and the southern area goes down towards the Dam. In between the Dam and the bush is a clear and level ground that can be muddy if wet. Dogs can easily pounce on helpless game within this area. This is a good poaching zone for poachers. They also put wire snares in the bush and intimidate animals that have come to the Dam. When animals are intimidated, they naturally run towards thick bushes for hiding (as shown in the third picture). This is the very time they get into snares easily.



Fig 4.10 showing bushy areas around Dam waterhole.

The snares are put in-between trees along common paths as shown by the arrow on the above photograph. The major assignment for the Rangers is to remove the wire snares daily in the Ranch to curb the rampant poaching. Some of the retrieved snares at Dingwall are shown below



Fig 4.11 showing wire snares that have been recovered from around the Ranch.

5.4 Perceptions of levels of poaching at Dingwall Game Ranch by the settlers.

Perceptions on levels of poaching by settlers at Dingwall Game Ranch were critical in this research. The majority of the respondents indicated a high level of awareness of poaching at Dingwall. This confirms that poaching is a real problem that has escalated in the area due to the Fast Track Land Reform Programme. The community demonstrated an existing knowledge about this challenge. The respondents had several reasons to justify poaching. In the majority of cases poverty and failure to ‘plough back’ to the community by the ranch dominated the responses. Information given by respondents during the 2015 and 2017 population encroachment census surveys, settlers revealed that poverty, need for food and traditional values were some of the major reasons for poaching. Some cited family ancestral spirits responsible for initiating hunting, which the law calls “poaching”.

5.5 Settler perceptions on ownership of Dingwall Game Ranch and game poaching

Perceptions on ownership and related effects were also investigated during this research. Respondents expressed differing views and attitudes towards the ranch as a Protected Area. The majority of the respondents indicated a negative view towards the Protected Areas concept. They felt excluded from the natural resources.

At 5% level, there was evidence to suggest that the residents' attitude towards the game ranch was influenced by the type of communal farmers. Small scale communal farmers (A1) are the poor majority while (A2) small scale commercial farmers are the 'elite'. There are differences in knowledge and appreciation of issues between these farmers, maybe due to exposure, level of education and wealth between these two groups of farmers.

67% of the interviewed A1 communal farmers expressed a negative attitude towards the purpose of the Dingwall Game Ranch whilst 20% had mixed feeling and 13% supported establishment of the game ranch. The A2 small scale farmers were more supportive to the cause of the establishment of the Game Ranch. 70% expressing positive attitude whilst 20% expressed negative attitude whilst 10 % had mixed feelings.

The research also tested the sense of ownership of the game ranch by the Settlers.

The majority of the respondents' held that the ranch was privately owned, however the perception of the respondents was more accurate in 2015, 60 % of the respondents holding that the game ranch was privately owned whilst in 2017,50% held that belief. The percentage of respondents who thought that the game ranch was owned by the government was 30 % in 2015 and 25% in 2017. These results show that the community surrounding Dingwall are under the impression that the game ranch does not belong to the community and therefore may not benefit them in any way. However, on a more positive note the percentage of respondents who thinks that the ranch is community based is increasing from 5 % in 2015 to 15 % in 2017.

5.6 Levels of conflict between settlers and Dingwall Game Ranch

Levels of conflict between settlers and Dingwall Game Ranch were also tested using the Census Survey questionnaire method, (Appendix A.4). The majority of the respondents in both years indicated a high awareness of conflict between Dingwall Game Ranch management and the community. This may be an indication of the prevalence of the conflict and the community

readiness for engagement in the conflict resolution. There was an independence in the perceptions of conflict levels and time (years of data collection), $\chi^2 = 0.05$, DF = 2, p-value = 0.97). The fact that the majority of the respondents during the research indicated a high awareness of conflict between Dingwall Game Ranch management and the community, the prevalence of the conflict shows the very need to work towards harmonization and sound psychological preparation for the management of resources.

5.7 Economic losses on game resources due to the Fast Track Land Reform Programme

The research findings reveal that the poaching statistics increased significantly between 2015 and 2017 (Unequal variances T-test, DF=5, t statistic = -1.2, p-value = 0.02), and the Game Ranch thus lost an estimated total of USD450 210.00 economic value through poaching.

There were significant differences in the poaching records across the tested years (One-way ANOVA, DF=2, MS = 29.87, F = 19.9, p-value = 0.0001). Police records at Z.R.P Nyamandlovu reveal that most poachers come from Mbalibali, near Mathe in Tsholotsho. All villages around Dingwall had poaching cases with Nyamandlovu Police. It was notable that there were discrepancies between poaching statistics at Dingwall and Nyamandlovu Police. According to police records as well as information from the Game Ranch management, poaching crimes are ever increasing. The documented cases are few at the Nyamandlovu Police Station because of financial constraints at Dingwall Game Ranch. Once rangers catch a poacher, there is need to transport the person and the killed animal as evidence in the Court. Due to financial constraints, most cases are unreported, hence the disparity. The Fast Track Land Reform was thus a big loss as far as the economic value of game resources is concerned. Agricultural productivity decreased and so was the economic contribution of game resources towards human development.

5.8 Human population encroachment into Chesa Forest due to the Fast Track Land Reform Programme

Research findings at Chesa Forest revealed a rapid and constant increase in human population encroachment into Chesa Forest posing threats to the forest ecosystem. Human population increased by 700% from 1000 to 1700 between 2000 and 2017. The encroachment is attributed to Fast Track Land Reform Programme. The forest dynamics and viability are thus at stake due to the Land Reforms. The population already in existence in the forest is bound to grow. There are now new laws that have been put forward by the resettling authority to protect the forest. In the given scenario one may need to know whether the forest has a future or not. The sustainable management of Chesa Forest has been out to a challenge as a result of Fast Track Land Reform Program.

The findings are in agreement with Mani and Bansal (2006) who observed that there is also a human encroachment problem into forest reserves in Matabeleland. Chenje (1998) also observes that Matabeleland contains most of Zimbabwe's forest reserves. According to Lee and Neves (2011), forest and wildlife resources are key towards poverty reduction in rural areas. Matabeleland North province in Zimbabwe is one rural area that is prone to poverty but with a huge wildlife and forest resources base.

Dickson and Murphy (1998, p.132) also argue that "Poor knowledge as well as low priority for ecosystems integrity remain barren to sustainable development". There is therefore a greater need for research on Matabeleland North's ecology for sustainable development.

In the post Fast Track era, Mukamuri *et al.* (2009, p.130) observe that the fast track land reform caused conflicts which spilled over to environmental degradation between commercial farmers and the newly resettled farmers. Muyengwa (in Mukamuri *et al.* (2009, p.13) observes that there was excessive sale of fire wood and the subsequent destruction of forest resources. He further asserts that "They are now valuing money more than trees. They behave as if they are

passing through”. Most farmers were uncertain about the land tenure and ownership arrangements which instead motivated destructive behaviour on their part (Mukamuri *et al.*, 2009, p.13). This obviously shows how much the forest and wildlife resources were exposed to destruction. The same economic hardships that faced the newly resettled farmers are still in existence. It is by no surprise that Colchester, *et al.*, (2002,) advocated for a comprehensive study to determine the impact of the fast track land reform in Zimbabwe. The findings of this study confirm this notion.

Human population encroachment into the protected areas was observed to be an ever growing at Dingwall and Chesa Forest. More and more settlers were being allocated land every year. In a similar study, Scoones *et al.* (2010, p.24) observed that “large targets for land acquisition were set and were then significantly exceeded as land invasions continued. There was no order at all, and in the midst of such disorder, who had time to make consideration for the value and sustenance of the natural ecological systems”. In addition, Chaumba *et al.* (2003) observed that there was significant amount of retrospective planning of resettlements during the Fast Track Land Reform in Zimbabwe. The present research established similar findings. There was massive environmental degradation. This is also confirmed by Scoones *et al.* (2010, p.176) strongly contends that the fact that “land reform has resulted in massive environmental destruction can be challenged, how to ensure sustainable use remains an issue.”

There is no sound adherence to resource management rules within the resettled communities. The new settler communities have been formed on new land, and therefore resource management rules have to be strengthened and established. Similar observations have been raised by Blaike and Brookfield (1987) who agree with Scoones *et al.* (2010) that in the past, traditional approaches to resource management such as the protection of sacred groves or wetlands have been important, but however, resources remain highly wasted on the newly resettled areas. The research establishes that there is a need for the emergence of effective

resource management during the post-resettlement era, especially within and around Protected Areas. Dingwall Game Ranch and Chesa Forest are examples of Protected Areas that continue to suffer the consequences of the Fast Track Land Reform Program.

There was a lot of disorder during the Fast Track Land Reform. According to Scoones *et al.* (2010) the Jambanja period has come to define the Zimbabwean land reform process as this was a time when chaos reigned. Chaumba *et al.* (2003,p.533)assert that:

‘Jambanja came to refer to all the illicit activities on these farms that rapidly became normalized, this included closing farm roads, cutting down trees, poaching, cattle theft and mutilation, starting fires, attacking game guards, demanding meat and mealie meal from white farmers, looting property and sugar cane.’

The big question to ask is whether this ‘jambanja’ approach and the atmosphere it created was good for environmental management or not. Scoones *et al.*, (2010) emphasize that the Jambanja era threw the nation into environmental chaos. Chaumba *et al.*, (2003) and Schoones *et al.* (2010) are in agreement that during the Jambanja (confusion or nonsense), there was no implementation of laws and policies by state departments (due to negligence and fear of political victimization) to favour the balanced state of ecological systems, and it became a culture. Most respondent in this research revealed that population pressure resulted in unplanned and illegal land use expansions and conversions. This agrees with findings by Nkala, (2009).

The Fast Track Land Reform Programme resulted in land-use or land-cover changes within the protected areas. Cuff and Goudies 2009). Ji *et al.* (2007) echo the same sentiments.

While Ferraro *et al.* (2011) argue that protected areas are the dominant approach to protecting biodiversity and the supply of eco-services, the Fast Track Land Reform has proved to be the opposite. The ability of a forest to deliver its functions more efficiently is dependent on its state. Gottle and Sene (1997) present that forests are more efficient when in their natural state and under good natural ecological condition or used in a sustainable manner. When a forest's balance is upset then its ability to provide quality ecosystem services is reduced. The capacity of an ecosystem to sustain a specific function depends on the characteristics of its individual dynamics (Gottle and Sene, 1997). According to Lockwood *et al.* (2006), forests are being increasingly affected by human encroachment due to human population increase and the demand for agricultural land. The Fast Track Land Reform has actually done the worst damage to the forest resources. Remote sensing also provided information data on changes in land cover hectare from 1999 to 2017. Results reveal that there was a decline in forest cover and increase in grassland and shrubs. This can only be attributed to high level of deforestation. Contreras-Hermosilla (2000) states agricultural intensification as one major cause of deforestation. Forest cover decline seem to affect the gazetted forest at Chesa and other forests in Zimbabwe. In a study by Mapedza *et al.* (2003) in Mafungabusi forest, they discovered that forest cover was declining in the surrounding area of the forest. This study was done in the early phase of the land reform program in Zimbabwe. Hor *et al.* (2014) revealed loss of forest cover as an impact of agricultural expansion in Ratanakiri Province, Cambodia.

The research established that Forest cover at Chesa was reduced from 87411 hectares in the year 1999 to 46492ha in the year 2017 with an overall loss of 40919ha. Shrubs and grasslands increased from 50909ha in the year 1999 to 91043ha in the year 2017 with a gain of 40135ha. Cultivated area increased from 13062ha in the year 1999 to 16143ha in the year 2017 with a gain of 3081ha. There was therefore a negative relationship between dense forest cover and shrubs and grassland land use. There was an increase in grasslands and shrubs as the area

covered by dense forest decreases. The area covered by cultivated area steadily increased with less variation ranging from between 10 000ha and 20 000ha over the years. The dense forest was being reduced and replaced by shrubs due to a continuous increase of both human and animal populations within the forest since the FTLRP began. As children grow up they establish their own families, especially adjacent to their parents' homesteads. Due to the fast track land reform, some new allocations occur every year; people come in from other areas for resettlement. Consequently, more land is cleared for both homestead construction and fields. As human population increases so does the livestock. There are no efforts to calculate the carrying capacity to check overgrazing and to cater for the slow regeneration of the forest. The forest is thus exposed to great deteriorations a result of human encroachment associated with high demand for agricultural land. Chesa Forest has Kalahari sands which are infertile and thus characterized by high incidences of crop failure, or declining crop yields which cause more land to be cleared. The same condition also fosters unsustainable farming practices like shifting cultivation which are more destructive to the Chesa Forest ecosystem. The FTLRP thus has led to increase in human settlement at Chesa Forest. The program continues to be done hastily with people settling illegally. It is a critical observation that there is need to revise the tenure regimes in order to protect the protected areas like Chesa Forest.

In a similar study Chaumba *et al.* (2003) also concluded that poaching is prevalent in the newly resettled areas due to the need for survival. It was established that there is an increase in unsustainable harvest of various biological resources within the forest. These are in demand for furniture making or for energy. The stumps in the experimental plots gave a clue that timber poaching was mainly done on trees that had not reached harvestable sizes (of at least 31cm diameter at breast level), those that were still growing and in the regeneration process. This has a serious impact on the future of the forest. Non-selective timber poaching negatively impacts on the future livelihood of the settlers. The campaign for forest resource protection should

therefore not only focus on settlers in the forest but have a holistic approach even to the surrounding communities. For the settlers, more focus can be towards finding common ground or reducing the destructive harvest methods. The high poaching levels cannot be attributed to settlers alone and hence an indication of a need to pay attention on conservation practices outside the protected area system.

5.9 Economic losses on forest resources due to the Fast Track Land Reform Program

The research also established that *Baikiaea plurijuga*, *Combretum imberbe*, *Combretum zeyheri* and *Colophospermum mopane* were the major species poached at Chesa Forest. Findings reveal a close link between population encroachment due to the Fast Track Land Reform Program and wood poaching at Chesa Forest. *Baikiaea plurijuga*, *Combretum imberbe*, *Combretum zeyheri* and *Coleospermum mopane* are the most targeted species by wood poachers at Chesa Forest. These have high quality energy and a total of US\$12016.55 was lost as a result. The enumeration results also show that timber poaching was mainly done on trees that had not reached harvestable sizes (of at least 31cm diameter at breast level), those that were still growing and in the regeneration process. This gives a clue on forest degradation. Subsequent interviews with the Chesa Forest Manager also revealed that the Forestry Commission guards do not frequently and effectively patrol the forest to curb degradation.

Experimental plots of 100m x 100m were demarcated and losses due to tree cutting were observed and recorded the years 2015 and 2017, (Appendix G). The researcher made a deforestation inventory on each demarcated plot monitored the plots. The major business was to enumerate species lost through poaching within the forest within the period under review. The results were recorded on the enumeration data sheet- tree/stump measurements.

The research also established an ever-increasing squatter population and a decreasing bush logging. According to the data presented, there are 1500 ha from 14250ha that are used as fields

only; 200 hectares are used for residential purposes. Therefore 1700 hectares out of the forest's 14250 hectares are taken up and used for residential and fields' purposes. Land lost to squatter settlements thus can be statistically estimated to be:

$$= \frac{1700-760 \text{ ha}}{17 \text{ yrs}} \text{ OR } \frac{940 \text{ ha}}{17 \text{ yrs}}$$

= 62.7 ha/year lost to squatter settlement in Chesa Forest. There is thus a marked and clear deterioration of the forest directly linked to the Fast Track Land Reform Program.

The forests in Zimbabwe are generally of high economic value and comprise different tree species depending on location, and climatic conditions (Miles et al., 2006). The most common ones that were observed by the researcher study include African teak or Mukusi (*Baikiaea plurijuga*) which is common in Southern Africa. African teak tree is cut by people for different uses which include its bark decorations to treat eyes, stomach aches, syphilis and toothaches (Steenkamp, 2003). Mukusi has hard wood which is resistant to rot and termites and it is used to make furniture for this reason and also as firewood (Sseremba et al., 2011). Seeds for mukusi are also used as beads in strings (Affre *et al.*, 2004). Leadwood or Mostwiri (*Combretum imberbe*) is another common tree species found in Chesa forest used for firewood, also its bark boiled in water is used for tanning, and can also be used to treat bilharzias (McGaw et al., 2001). The third tree species found in Chesa Forest is Bush willow (*Combretum zeyheri*) and it is a bush with a rounded crown (McGaw *et al.*, 2001). Bush willow is used as food, firewood and as a source of material used to make baskets (Emanuel et al., 2005). The fourth tree species is Mupane (*Colophospermum mopane*) which has oily seeds and is used for charcoal and braai wood (Okello *et al.*, 2001). Its small branches can also be used as tooth brushes (Aumeeruddy *et al.*, 2017).

5.10 Community attitudes towards Chesa Forest as a Protected Area

Attitudes and perceptions of settled population towards Chesa Forest as a Protected Area were investigated through the census survey method. (Appendix A). The respondents were asked about the current forestry management, and the envisioned future of Chesa Forest management and the role that the community could play in the management of the forest.

The research established that the majority of the population has a negative attitude towards the forest as they generally feel excluded from free use. There were evidently high levels of conflict between the Forest Management and settlers due to limited interaction between the Forestry Commission and the resettled community as well as the low levels of knowledge of the Forestry Commission by the settlers. A2 holders had some knowledge gained from meetings to address development projects by organs of the Commercial Farmers' Union (mainly composed of white farmers and elite blacks) and hence with better knowledge about the potential conflicts.

75% of the respondents felt that it was important for the forest to continue as a protected area, 10% wanted modification but not a total change in land use while another 15% felt that the Forestry Commission was managing the forest very well.

When probed on the future of the forest, the A1 settlers requested for more involvement compared to A2 settlers. The A2 settlers queried the settlers' ability to contribute to effective management without compromising the entire forest resources. Very few respondents mentioned relocation as a method of Chesa Forest conservation. They cited relocation costs and lack of compensation as major deterrents. 5.3 Attitudes and perception towards protected areas by poachers

Attitudes and perceptions towards the management practices affect peoples' attitudes towards the protected area (Allendorf *et al.*, 2006). This is substantiated by Macura *et al.*, (2011). During the focus group discussions in both Dingwall Game Ranch and Chesa Forest there was

an alarming number of respondents with negative attitudes towards the purpose of these PAs. There is no immediate benefit or any foreseeable benefit of the game ranch to the surrounding community. Similarly, a study in Abijatta-shella Lakes National Park in Ethiopia, residents expressing negative views had experienced poor relations with protected area staff and felt the staff was antagonistic and disliked local residents (Tessema *et al.*, 2010). This leads to the perception that these protected areas are privately owned by the ranch management and the Forestry Commission as shown by responses from the focus group discussions and questionnaires. This indicates that communities are important stakeholders in the management of these protected areas. They often get into conflicts with the management of these protected areas over use of the resources. Conflicts with managers due to resource extraction, strict rules on forest resource use and access, harassment by protected area rangers, all generate negative attitudes towards protected areas (Macura *et al.*, 2011). While in some cases strict prohibitions on resource access inside PAs is appropriate and effective, sometimes it is not (Redford and Fearn, 2007), thus there should be a balance that allows for a healthy relationship between communities and PA managers.

The community has limited access to resources, especially where they are expected to get permission to hunt within their homesteads. This is likely to result in conflict between the settlers and managers on resource extraction. They alleged harassment by the rangers and management. Although the management at the Dingwall Game Ranch denied this, the settlers strongly felt that they were segregatory, as they allowed the rich and the whites to hunt, whilst denying the local blacks.

Explicit action plans that address the interests of all stakeholders through consultation can improve attitudes and ultimately have a positive impact towards improving effective conservation. The perception of the game ranch by the settlers is important as it influences their attitudes towards the whole system. Kleftoyanni *et al.* (2011) argue that the local people's

perception is an input for designing management plans for sustainable utilization and development of local resources.

The settlers, to a very large extent, had a negative perception of the PA. In Chesa Forest 3% of the respondents from the focus group discussions believed that they were stakeholders in the forest management and also that they benefit from the proper management of the forest. If the communities do not perceive ownership of the forest, then it is under serious developmental threat. However, the respondents also acknowledged the importance of forests with 60 percent in 2015 accepting that the forests are important. The number went down to 55 % in 2017 indicating that there is a reason behind less people not acknowledging the importance of forest products. One possible reason could be that the community no longer sees the benefits of the products.

Such negativity means that the settlers will not invest in conserving what they do not own or see as important at all, hence leading to degradation of these protected areas. Given also that there are no perceived benefits obtained by the peripheral settlers, it is more than difficult to build synergies with these settlers to participate in wildlife management and forest conservation since there is no clear incentive to justify their participation. The only benefits are but to poach. The protected area does not fully benefit the poor, instead it is a source of frustration to the settlers who live in poverty in an area full of resources. The majority of the respondents perceived the forest as owned by the government. The minority perceived a community ownership which indicates potential reasons for negligent use of forest resources. This also explains why the majority of the people maintain that the forest is very important and yet poaching is prevalent.

According to the findings of the research, there were no significant differences between 2015 and 2017 harvested non-timber forest products. The demand for non-timber forest products is

consistent in the two years that is 2015 and 2017. There is great demand for non-timber products by the newly resettled farmers. Of good interest is the very few respondents during the research who mentioned hunting and wood carving as accessed resources. These are controlled and regulated by law and access is thus illegal. This made disclosure difficult despite guaranteed confidentiality, so these answers could well have been under-estimated.

5.11 Conflicts between wildlife and Settlers and Settlers and the Forestry Management.

The research revealed that there was evidence of human wildlife conflict. Wildlife destroys crops in the fields of the resettled farmers, and the resettled farmers respond by poaching.

Main crops destroyed: maize and groundnuts and the destructive animals are kudu, warthogs, guinea fowls and vervet monkeys. Also as a response to destruction of crops by wildlife, resettled farmers have established crop protection measures like guard by day and snares mainly.

The research also tested if there was an association between time (in years) and the levels of conflict with the Forestry Management using a Chi-square test of independence. The null hypothesis was that there was no association between time and perception on the level of conflict. The research established no association between time and perceptions on the levels of conflict ($\chi^2 = 2.344$, DF = 2, p-value = 0.3), giving evidence to suggest that there was no association between time and conflicts. Conflict between Chesa Forest Management, Settlers and Wildlife thus has been in existence for long with no changes over time. There is need to have this conflict resolved for environmental management purposes and sustainable development. As time goes on, one expects an increase in the conflict between the residents and the Forest Commission. Residents will keep on interfering with the environment breaking the regulations from the Forestry Commission which are meant to protect the environment.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

In short, the researcher holds the position that land reform was necessary but the fast track approach ignored crucial principles that matter most in environmental management and conservation.

The Fast Track Land Reform Programme affected negatively the natural ecological system of Dingwall Game Ranch and Chesa Forest. The programme was hastily carried out (in terms of environmental management) and less attention was given to the natural ecosystems, their value and their future. Expansion of population and settlements increase, twinned with low agricultural production among the settlers, has caused a severe threat to these Protected Areas. High levels of poaching at Dingwall Game Ranch and Chesa Forest coupled with habitat destruction as well as unsustainable agriculture practice will eventually drive species to local extinction. While the settlers are the principal poachers in the protected areas, the poachers also come from outside and far away and the effects need to be addressed. The attitudes and perceptions of the settlers towards the Protected Areas were mostly based on the costs and benefits as well as access to the natural resources. While there is the Constitution of Zimbabwe, Environmental Management Act, Forestry Commission, Parks and Wildlife Management Authority, Environmental Management Agency (EMA), Umguza Rural District Council, CAMPFIRE and traditional and political leadership, as well as the 'Church', during the study and research none of the above demonstrated serious and keen interest to conserve biodiversity at Dingwall Game Ranch and Chesa Forest. The study recommends a collective effort from both the Government and the resettled populations to protect game and forest resources.

Dingwall is mainly treated as a private safari ranch, making the Parks and Wildlife Authority stand at a distance as far as game conservation is concerned. At the same time Chesa Forest is treated as a 'baby' of the Forestry Commission. There is no evidence of any collective effort by all stakeholders towards protecting and conserving these valuable resources. The high levels of conflict between settlers and Protected Areas fail all efforts to provide critical and necessary

foundations for smooth and cordial relations that are conducive and beneficial for effective environmental conservation and management. While the Fast Track Land Reform Programme was a political move to solve pressure on the land and the ever-dwindling economic levels in Zimbabwe, ecosystems and their values were not given their due economic and scientific attention. The magnitude of economic loss due to the effects of the Fast Track Land Reform cannot be over-emphasised.

There is a growing concern of biodiversity loss and continued exposure of the fragile and resettled Protected Areas to the unavoidable present effects of global warming and climate change.

6.2 Recommendations

The issues that involve resettlement and land tenure system should not be neglected by both the government and communities as past events. The effect of the fast track land reform can be addressed through the formulation of policies that are clear and concise and in line with environmental management. The existing legislation on environmental issues must be taken seriously, strengthened and implemented. Land use planning techniques to curb the ever-expanding area affected by human encroachment, through the fast track approach to land reform, must be employed.

6.2.1 Dingwall Game Ranch

At Dingwall Game Ranch, there is urgent need to educate the settlers on the value of wildlife and the benefits that they can enjoy if game is protected and commercially harvested. There is also great need to establish and increase the benefits from the game for the settlers as a way of providing incentives for the community to actively participate in game management and conservation. This can be done through shooting game and giving out game meat for community functions like Independence Day celebrations or other national or important

community gatherings. The ranch can also do well by supporting the education of the less privileged; especially those children who fail even to attend primary school education.

Mechanisms that enforce remittance of a particular percentage of the game ranch proceeds to community projects should be in place. This is justified since the settlers have an opportunity cost due to the fact that they have no access to game yet they deal with wildlife on a daily basis. A kind of a trust fund thus can be handy for the community's social and economic development. This will enable the settlers to see tangible benefits of protecting game. The whole approach should be backed up by high level of positive interaction between the game ranch and settlers, supported by education campaigns and awareness workshops.

Regular game counts need to be done and the information should be availed to the settlers as well. This will help to protect the almost extinct species. In addition, the game ranch fence must be intact always so that the game is kept within the fence

Zimbabwe Republic Police revealed that as the law enforcement organ, they conducted educational campaigns on poaching through kraal heads in the villages and other public meetings. Magistrates also educate villagers on anti-poaching before or after court sessions. Villagers are taught to report or remove snares. The Dingwall rangers patrol the ranch, remove snares, trace the poachers and report to the police. The police revealed that they had transport challenges. They cannot be on the spot immediately after the report due to lack of transport. The other major setback was that once the poachers were remanded out of prison, they disappeared, and targeted other potential hunting places. The game rangers do not have the ammunition to defend themselves when attacked by poachers. The poachers from Mbalibali use axes and spears. The rangers fear for their lives, rendering wildlife more vulnerable.

It is however important to note that the ranch has a capacity limitation. The benefits should be provided within its capabilities without further causing ecological damages. The protected area cannot be expected to solve all the community problems.

The poaching hotspots identified can be used as a starting point by the game ranch management to begin implementing measures that ensure local-community support for conservation. Furthermore, these hotspots are necessary to beef-up anti-poaching activities. There is a need for Zimbabwe to legislate new anti-poaching laws that are a much more effective deterrence to poaching than currently exist.

6.2.2. Chesa Forest

Chesa Forest as a protected area will continue to have deteriorating biodiversity unless the settlers are provided with other livelihood options. There needs to be a provision of other sources of energy like electricity, biogas or coal and even solar energy to curb the destruction of forests for firewood. Such provisions should extend to the peripheral areas since firewood poaching attracts poachers from as far away as Bulawayo. The primary cause of loss of biodiversity in the forest is the destruction of habitats resulting from human population activities, so other livelihood options might control the situation.

Strategic planning and effective implementation of policy, towards protecting the protected areas, especially policies that incorporate human needs as well as forest resource conservation, need to be given first priority by both government and Forestry Commission. These will be beneficial towards biodiversity conservation.

Practical benefits from forest resources by the locals need to be provided by the Forestry Commission in order to cultivate positive attitudes towards the forest as a protected area.

Buying timber at low prices by the locals can be a good example or being given easy access in time of need, as well as being given first priority for employment in the forest. This fosters the sense of ownership and responsibility.

Ploughing back to the community by the Forestry Commission is highly recommended. The forest or timber resources should be used to develop schools and clinics for the population settled next to the forest. Through the forest resources the Forestry Commission should support the environmentally friendly community projects, like drilling of boreholes or environmental education campaigns. The environmental education campaigns should aim at increasing the knowledge of the settlers in resource value and conservation, and through interaction there should be an effort to blend indigenous and scientific knowledge as a strategy to combat biodiversity loss.

Environmentally friendly farming methods like zero tillage and agro-forestry need to be employed by settlers in order to attain food security without compromising biodiversity and its conservation. Included should be low impact projects like beekeeping, mushroom growing and rearing small livestock in order to provide the most needed income. Such activities are highly recommended as a good option given high incidences of crop failure due to infertile Kalahari sands in the area. These environmentally friendly methods will maintain the biodiversity and go a long way in conserving the entire forest.

Community involvement and support in environmental management strategies is highly recommended. Environmental management committees need to be formed so as to become an interface between the settler population and the Forestry Commission. Such committees will provide a platform to address settler grievances and conflict resolution. A friendly and lateral communication and interaction will be established thus providing an enabling environment for forest conservation

The Forestry Commission and Chesa Forest management need to take environmental education seriously especially fire combating and management since the area is prone to fires. The settlers need adequate knowledge on the use of fires especially when clearing their fields. Poor fire management has in the past caused massive destruction of biodiversity.

- For both Dingwall Game Ranch and Chesa Forest ecosystems, a multi-infrastructural approach which includes the government, private sector and non-government organizations to combat biodiversity loss in the light of increasing encroachment into protected areas is critical. The government should create the necessary environment that will enable private companies and non-governmental organizations to take roles in conserving biodiversity as well as providing necessary funding towards conservation strategy. Such a framework that provides co-existence of institutions and affords collective efforts to manage the environment is critical for future conservation of natural ecological systems. Such a corporate approach provides the capacity to provide livelihoods for the settlers without causing threats to the environment. A better opportunity is given for ploughing back to enhance co-operation towards environmental management.
- In both ecosystems more patrols and road blocks should be implemented. Respondents should be arrested for settling without authority. Corruption by law enforcement agents should be curbed through the Anti-Corruption Commission of Zimbabwe. Participatory natural resource management, sustainable livelihoods and development, settlers' poverty alleviation and attention to land tenure, are strongly recommended for the ecosystem management of the two specified ecological systems.
- Sustainability can be achieved through employment creation, capacity building, building partnerships and upholding to appropriate policies. These will go a long way towards attaining sound management and conservation of the natural ecological system.

- Stiffer and deterrent penalties for poaching or negligence towards forest resources should be preferred upon the offenders.
- The findings of the research strongly detest the fast track approach to land reform but advocates for a transition towards a systematic and well informed land tenure system that will conserve the environment, with a clear conscience that the world is but a global village.
- The land tenure system should be sensitive to environmental issues; environmental deterioration has serious threats to life for both present and future generations.
- The government of Zimbabwe should allocate more resources (both human and capital) to the sound management of the environment including follow-ups and the implementation of all proposed strategies and legislation especially in game and forest protected areas.

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APPENDICES

= Appendix A

PROTECTED AREA POPULATION ENCROACHMENT CENSUS FORM (YEAR 20....)

Sheet No.....

PROTECTED AREA: **DINGWALL** GAME RANCH

WARD: _____ VILLAGE: _____ VILLAGE

HEAD: _____ MONTH: _____ YEAR: _____ ENUMERATOR:

1 Fill in the appropriate

No	Household name	District of origin	Year in forest	No. of fields	Size (ha)	Children (numbers)		School pupils		Other relatives		Cattle	Donkeys	Goats	Sheep	Pigs	Dogs	Total	
						Boys	Girls	Boys	Girls	M	F								

2 Indicate attitude towards the Dingwall Game Ranch Management in appropriate boxes.

View	A1 communal farmers	A2 small scale commercial farmers
------	---------------------	-----------------------------------

Negative		
Mixed		
Positive		
Total	150	50

3 Indicate your perception of ownership of Dingwall Game Ranch

Answers given by the respondent.	YEAR 2015	YEAR 2017
Government		
Both community and government		
Private		
Community ownership		

4 Indicate levels of conflict with the Community and Dingwall Game Ranch

Level of conflict	Number 2015	Number 2017
High		
Medium		
Low		
Total		

5 Indicate level of poaching at Dingwall Game Ranch

Level of conflict	Number 2015	Number 2017

High		
Medium		
Low		
Total		

6 Indicate reasons for poaching at Dingwall Game Ranch

Reasons for poaching	Number 2015	Number 2017
Selling game meat		
Hunting as a skill and gift from the ancestors		
Way of sharing resources		
Food shortages / poverty		
Lack of plough back by the ranch owners		
Other		
Total		

Appendix B

PROTECTED AREA POPULATION ENCROACHMENT CENSUS FORM (YEAR 20....)

Sheet No.....

PROTECTED AREA: CHESA FOREST WARD _____ VILLAGE _____

VILLAGE HEAD _____ MONTH _____ YEAR _____ ENUMERATOR _____

1 Fill in the appropriate

No	Household name	District of origin	Year in forest	No. of fields	Size (ha)	Children (numbers)		School pupils		Other		Cattle	Donkeys	Goats	Sheep	Pigs	Dogs	Total
						Boys	Girls	Boys	Girls	M	F							

2 Indicate attitude towards the Chesa Forest Management in appropriate boxes.

View	A1 communal farmers	A2 small scale commercial farmers
Negative		
Mixed		

Positive		
Total		

3 Indicate your perception of ownership of Chesa Forest.

Answers given by the respondent.	YEAR 2015	YEAR 2017
Government		
Both community and government		
Private		
Community ownership		

4 Indicate importance of the forest to the settlers community

Response	Number of respondents 2015	Number of respondents 2017
Very important		
Important		
Not important		

5 Indicate non timber forest products obtained fom Chesa forest

Response	Number of respondents 2015	Number of respondents 2017
Construction		

Firewood		
Thatch grass		
Grazing land		
Mushroom		
Wild fruits		
Honey		
Employment		
Wood carving		
Hunting		

6 Indicate levels of conflict between the Settlers and Chesa Forest

Level of conflict	Number of respondents 2015	Number of respondents 2017
High		
Medium		
Low		
Total		

Appendix C

Interview guide for Headman Tshailos Moyo

Date.....

Time.....

1. Give a brief background of the Fast Track Land Reform Program in Zimbabwe
2. Why do you think the fast track land reform program was necessary?
3. Did the Fast Track Land Reform Program take into consideration wildlife and forest resource conservation?
4. Is there any conflict between wildlife and new resettlement farmers in your area?
5. Do you have any statistics concerning the number of homesteads, size of fields, human population, and number of cattle, goats, donkeys and dogs from the people that have been resettled within your chieftainship?
6. Where do you get the statistics?
7. What role does the headman and the chief play in the resettlement program?
8. Comment on the levels of poaching and ranch degradation in your area.

Appendix D

QUESTIONNAIRE FOR PETER CHESTER THE DINGWALL RANCH OWNER

Date.....

Time.....

1. Dingwall Ranch is a) Private property
 - b) Public property
 - c) Other (specify)
2. How long has the ranch been operational?
3. How much land was initially given for game ranching?
4. After the resettlement, how much land was left for ranching?
5. Has the reduction of land available for ranching affected negatively the operations of Dingwall Ranch?
6. Is poaching a problem in this ranch? If yes, give details on what has been poached.
7. Have poaching levels increased since the recent resettlement of adjoining farms? If yes, give details.
8. Have you had any problems with the people resettled nearby? If so give details.
9. Have you had any meetings with the resettled farmers? If so, what was the agenda?
10. Kindly supply statistics on the damages that were incurred by a veld fire in 2012.
11. Do you employ people from resettled farms? Give details.
12. Have animals from this ranch destroyed crops on newly resettled farms? If so, give details.
13. How do you think the resettled farmers and the ranch can best co-exist?
14. Kindly supply available statistics on previous game counts.

APPENDIX E

A QUESTIONNAIRE FOR THE ZRP NYAMANDLOVU

Date..... Time..... Occupation.....

1. Are there any reports of poaching from Dingwall Ranch?

Yes No.....

2. If yes what has been poached?

3. How do you respond to the problem of poaching?

4. State whether the level of poaching has

(a) decreased []

(b) increased []

(c) remain constant []

in the last fifteen years.

5. Where do most poachers come from?

6. What role does the ZRP play in protecting the

a) Wildlife

b) Forests

7. What are the penalties for poaching

8. Kindly supply statistics on poaching cases if any.

Appendix F

Interview with Forestry Commission Manager

Date.....

Time.....

1. Kindly supply squatter census results for Chesa Forest population from the year 2000 to 2015

CHESA FOREST SQUATTER CENSUS RESULTS WARD 14

YEAR 2000, 2003, 2006, 2009,2012, 2014 and 2015

Year	Homesteads	Sizes of field (Ha)	Human Population	Cattle	Donkeys	Goats	Sheep	Pigs	Dogs
2000									
2003									
2006									
2009									
2012									
2014									
2015									
2016									
2017									

- 2 Kindly supply forest management plans and land use system in Chesa Forest from year 2000 to 2015

Source: forest management plans (Forestry Commission)

Year	Land use system (by ha) for:			
	Squatters	Research plots & plantations	Bush & logging	Admin/roads/residential
2000				
2005				
2010				
2015				
2017				
Total				

- 3 In summary state the major causes of forest degradation in this area
- 4 Would you link the levels of deforestation with the Fast Track Land Reform Program?

Explain your answer.

- 5 Comment on the conflicts that exist between Chesa Forest management and the newly resettled farmers.
- 6 How does a local community benefit from the forest resources in Chesa Forest.
- 7 State the various strategies employed by this department to resolve the conflict between forestry and arable farming.

Appendix G

ENUMERATION DATA SHEET- TREE/STUMP MEASUREMENTS

Forest: CHESA FOREST RESERVE

Enumerators:/...../..... date:/...../.....

Plot Number & strip number	DBH Range	Baikiaea	Combretum	Pterocarpus angolensis	Mopane	Combretum zexheri	Brachystegia spiciformis	Commiphora	Others	Totals (stumps and
	Less 10cm									
	10-14cm									
	15-19cm									
	20-24cm									
	25- 29cm									
	30- 34cm									
	35-39cm									
	40-44cm									
	45-49cm									
	50-54cm									
	55-60cm									
	60-64cm									

	65-69cm									
	70-74cm									
	75-79cm									

Volume estimate is: $[\pi * (\text{stump diameter} - 2)^2 * \text{length}] / 4$ (in m³)

$\pi = 22/7$; tape factor is 2cm & convert diameter from centimeters to meters