INDIGENOUS FORESTS LEVEL OF DEFORESTATION, FOREST DEPENDENCY AND FACTORS DETERMINING WILLINGNESS TO PARTICIPATE IN INDIGENOUS FOREST CONSERVATION: EVIDENCE FROM RESETTLED FARMERS OF SHAMVA, ZIMBABWE

BY

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DECLARATION

I, (Renias Vavarirayi Chivheya) hereby declare that this thesis; “Indigenous forests level of deforestation, forest dependency and factors determining willingness to participate in indigenous forest conservation: evidence from resettled farmers of Shamva, Zimbabwe” is the result of my own original work and that other scholars’ works referred to here have been duly acknowledged. I also declare that this thesis is original and has not been submitted elsewhere for a degree.

ABSTRACT

This study first explored the rate of forest deforestation in Shamva resettlement areas. It then identified and estimated the extent to which these resettled farmers depend on forest for their livelihoods. Evaluation of farmer perceptions on management issues and willingness to participate in indigenous forest conservation and the socio-economic and institutional factors which affect their willingness to participate were also done. Finally the study sought to identify incentives for forests conservation.

The study was conducted in Shamva district in Mashonaland Central province. And the respondents were stratified into three groups: A1, A2 and Old resettlement models. The three models differ on how they were implemented and supported which might render them to have different deforestation rates, livelihood strategies and forest dependency. A total of 247 respondents were surveyed, consisting of 98 A1 farmers, 50 A2 farmers and 99 Old resettled farmers. The data was collected using GIS and remote sensing, structured questionnaire interviews and direct observation. The data was analysed using descriptive analysis, KAP analytic framework and binary logistic regression analysis.

The land cover/changes results revealed that both deforestation and afforestation are taking place in Shamva resettlement. Woodland and bushland were decreasing, croplands were also decreasing. However woodland dense and grasslands were increasing. Deforestation was found to be as a result of the resettled farmers' livelihood strategies which were found to be diverse and agriculture being dominant in all models. All the farmers depended on the forest but at varying levels of 19% for Old and 14% forA1 and 0.02% for A2 resettle farmers. 84% of the interviewed farmers however, indicated that they are willing to conserve forest with A1 farmers being the highest followed by A2 86% and lastly Old resettled farmers at 76.8%. Results of the binary regression model revealed that the significant factors which explain willingness to participate in indigenous forest conservation are age, marital status, education, gender, institution, culture and belief, employment and household size. The highest preferred incentive was the provision of free seedlings and the lowest was out grower scheme. The study recommends that GIS and remote sensing should be used to monitor deforestation, off farm projects be encouraged, exotic and indigenous trees be promoted and forest conservation education be promoted in resettlement areas

DEDICATION

I dedicate this study to:

My dear wife, Sholister Chivheya, for her support and encouragement during the entire period of my studies.

My loving parents who natured me up to this level.

My sons, Vunganai and Vavarirai and daughter Vongai who sacrificed their time and relinguished my attention during my studies.

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Thank you all. May the Almighty Bless You All.

LIST OF ABBREVIATIONS

AGRITEX	Agricultural Technical and Extension
AREX	Agriculture Research and Extension
ASEAN	Association of Eastern and Southern Asian Nations.
AU	African Union
CAMPFIR	Communal Areas Management for Indigenous Resources
CBHRM	Community Based Human Resource Management
CEN-SAD	Community of Sahel-Saharan State3s
CIFOR	Centre for International Forest Resource
COMESA	Common Market for Eastern and Southern Africa
DFID	Department for International Development
EAC	East African Community
ECCAE	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EMA	Environmental Management Agency
ENVI	Excelis Visual Information Solutions
EU	European Union
FAO	Food and Agricultural Organisation
FTLR	Fast Track Land Reform
GDP	Gross Domestic Produce
GIS	Geographical Information System
GIZ	Gesellschaft for Intematiionale Zusammenarbelt
KAP	Knowledge Attitude and Practice
NGO	Non-Governmental Organisation
RDC	Rural District Council

REDD^{+}	Reduced Emissions from Deforestation and Forest Degradation
SADC	Southern African Development Community
SPSS	Statistical Package for Social Sciences
TIFF	Tagged Image File Format
UNDP	United Nations Development Programme
UNFC	United Nations Framework Convention on Climate Change
UN	United Nations
USAID	United States Agency International Development
WRI	World Resource Institute
Zanu PF	Zimbabwe African National Union (Patriotic Front)
ZESA	Zimbabwe Electrical Supply Authority
ZIM-ASSET	Zimbabwe Agenda for Sustainable Socio-Economic Transformation
ZimStat	Zimbabwe Statistics
ZimVac	Zimbabwe Vulnerability Assessment Centre
ZNA	Zimbabwe National Army
ZRP	Zimbabwe Republic Police

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CHAPTER 1

INTRODUCTION

1.1 Background to the study

Human society and the global economy are inextricably linked to forests (FAO, 1999; Sati, 2006; World Resource Institute, 2013). More than one billion people worldwide depend on forests for their livelihoods (USAID, 2007; World Resource Institute, 2013). However, little is known about the rates and process of deforestation in many countries (Tanaka and Nishii, 1997).

Administrative organisations at an international, regional, sub-regional and national level have made tremendous effort to raise awareness and reduce deforestation. This has resulted in the United Nations (UN) recognising the level and impact of deforestation on livelihoods leading to a stimulation of debate and support for environment management through conferences, protocols, conventions and programs which include initiatives such as the Rio convention 1992, Kyoto protocol 1997, Global Forest Resource Assessment 2010 and the second Earth Summit 2012. Programs that augment such initiatives include the International year of the forest, Million Tree initiative, World Forest Congress and REED+ (UNFCC, 2014).

Regional organisations such as the European Union (EU) Association of Southern Eastern Asian Nations (ASEAN) and African Union (AU) have also joined the chorus by providing political and technical support for forest conservation initiatives. Whereas EU has also put in place conventions such as the Lomé Convention, Vienna Convention, Lisbon Convention and Natural 2000 Network and these advocate for forest conservation. These conventions gave birth to programs such as European Union biodiversity strategy, ASEAN member stated convened the Forest Asia Summit on sustainable landscape Green Growth in Asia. The AU has had an African Convention on Conservation of native and natural resources and a Comprehensive African Agricultural Development plan. Some of the AU programs in place are the Congo Basin Conservation plan on forest, Climate for development in Africa and the Green wall for the Sahara and Sahel initiative (African Union Handbook, 2014).

Observations have also been made that the Sub-regional economic organisations in Africa such as Common Market for Eastern and Southern Africa (COMESA), Community of Sahel-Saharan States (CEN-SAD), East African Community (EAC), Economic Community of Central African States (ECCAS), Economic Community of West African States (ECOWAS) and Southern African Development Community (SADC) also assist in coordinating the interest of both the UN and AU by including conservation of natural resources and forests in their strategic plans. SADC protocol on Forest (2002) is an initiative aimed at promoting the development of a sustainable management and utilisation of all types of forests and trees, control of trade in forest products and achieve effective protection of forests. SADCC+REDD^{+} program and the SADC-GIZ Project are some of the examples of programs under SADC.

Zimbabwe has not been spared of this calamity. We hypothesise that deforestation in Zimbabwe has been exacerbated by the land reform program. After 1980, subject to addressing the imbalance in land access while alleviating population pressure in the communal areas with the hope of extending and improving the base for productive agriculture , the government adopted the land reform program premised on land acquisition and equitable land distribution (Moyo, 2004; Mushunje, 2005) This resulted in several programs being initiated in partnership and alliance with organisations like Environmental Management Agency (EMA), Non-Governmental Organisations (NGOs) and Forest Commission. These programs have given birth to the Fire Awareness Program and the Tree Planting projects and REDD+ biodiversity initiative in Kariba.

Whilst there is an increase in recognition of forest resource at all levels, most of the forests continue to be seriously threatened and in extreme cases are disappearing at a disturbing rate resulting in the conversion of forest area into a collection of mature forest fragments (Rudely and Roper, 1997).

After the land reform program, there was transfer of ownership of agricultural portions of prime land to the black smallholder resettled farmers (Utete, 2003; Moyo, 2004; Mushunje, 2005). Ecologists, environmentalists and wildlife experts state that deforestation, indiscriminate and overharvesting of forests, rapid encroachment of human settlements into national park due to land reform all have had serious implications on the country's forest and its conservation (Tsiko, 2010). This

necessitated punitive measures to control deforestation in the country by instituting laws that mitigate the process.

In 1992, the Ministry of Environment and Tourism initiated a process of environmental law reform. The reforms were also necessary in the light of the Rio Earth Summit at where Zimbabwe participated in 1992 and in response to the effects of the land reform. The process culminated in the formulation and modification of several acts including the passage of the Environmental Management Act no 13 of 2002 chapter 20:27 subsection 3 of the Forest Act of 1954, Traditional Leaders Act of 1998, Natural resource Act of 1941, The Communal Land Act of 1882, Rural Councils Act of 1988, Communal Land Forest Products Act of 1928 and National Parks and Wildlife Management Act of 1975.The Environmental Management Act which amongst other issues stated that:

'…… *an order may be issued in respect of one or more of the following matters-(i) prohibiting or limiting the cutting, felling or destruction of or injury to any vegetation whatsoever…….'*

This was meant to protect the environment while allowing people to use it to meet their needs. The Forest Commission also modified the Forest Act of 1954.

The Forest Commission, being the state agent responsible for regulating forest utilisation including indigenous forests in Zimbabwe under the Forest Act of 1954 Part IV Section 56 subsection 1 and 2 which also stated that the:

'*minister may give orders restricting cutting or removal of indigenous timber and that notice made in terms of subsection (1) shall not apply to the cutting or removal of indigenous timber and where the indigenous timber is being cut and stamped in the course of preparing land for cultivation, tree planting or improved grazing, the construction of fireguard, road building or other developments or the extraction of gravel, sand, stone or other materials'*

Whilst the above citation given by the Forest Act above may appear to have given room to justifiable deforestation, the Traditional Act 25 of 1998 Part II of section 5 stated:

'*that a chief shall be responsible within his areas for (l) ensuring that land and its natural resources are used and exploited in terms of the law and , in particular,*

controlling (iii) the indiscriminate destruction of flora and fauna and (iv) general degradation of land and its natural resources in his area.'

The Acts were designed to ensure that land and its natural resources are used and exploited in terms of the law and in particular controlling indiscriminate destruction of forests.

Besides the foregone Acts, a number of forest management programs and policies meant to develop environmental management strategies to reduce deforestation, land degradation, veld fires and restore biodiversity in Zimbabwe have been initiated. However, because of the continued forest cover loss besides the management programs in place, policy makers are still grappling with the following questions :(i) What is the best forest conservation strategy? and (ii) How can a new agrarian structure be supported and a vibrant forest conservation technique be developed? Yet, such discussions were often taking place in a vacuum, with limited data on the deforestation status of specific areas, forest dependency of specific areas, perceptions and attitudes of settlers and why they are not willing to participate. This necessitates a need for qualitative and quantitative analysis of forest issues across different models of land reform.

1.2 Statement of the Problem

About 327000 hectares of forest is cleared every year in Zimbabwe (FAO, 2010). Statistics indicate that agricultural land has increased from 13 010 000 hectares in 1990 to 15 060 000 hectares in 2000 to 15 274 000 hectares in 2010. Arable land has also increased from 289 000 000 hectares in 1990 to 358 000 000 hectares in 2000 to 425 535 000 hectares in 2010. Forest area is however decreasing from 22 234 000 hectares in 1990 to 18 894 000 hectares in 2000 to 15 474 000 hectares in 2010 (World Bank, 2010). As such it becomes relevant to determine the land use /land cover changes to establish whether the forest cover changes could be attributed to agriculture activities, firewood, construction activities or increase in population.

An agricultural activity such as tobacco farming through collection of firewood for tobacco curing is a major contributor of deforestation in resettlement areas (Forestry commission, 2013). It is estimated that 1.38 million cubic metres of wood is required

to cure 127million kilograms of tobacco (AGRITEX, 2013). Agriculture experts further state that a single hectare produces about 1400 kilograms of tobacco which requires seven tonnes of firewood for curing. Moreover, the area under tobacco production continues to increase exponentially from 47 691 hectares in 2009 to 88623 hectares in 2013 (AGRITEX, 2013). Meanwhile, according to Forestry Commission, Zimbabwe is estimated to have lost 15% of its tree cover in the past 15 years (1998 – 2013) due to tobacco farming with experts saying at the current rate, the sobering thought is that the country risks being a desert in 35 years or to be precise it is estimated that by 2016 the major tobacco areas will have no trees (Forest Commission, 2013. This means that an increase in hectare for tobacco, increased number of tobacco farmers as well as lack of alternative energy source for curing tobacco will have the use of firewood continue to increase proportionally if drastic mitigation measures are not implemented.

Besides tobacco production, the 2012 census results are indicators of challenges ahead as an increase of communal farmers and increase of population in the resettlement areas may impact negatively on indigenous forests when more lands are opened for agricultural activities, settlements, construction activities, and more families that use firewood as a source of energy.

Whilst all institutions managing indigenous forests such as traditional chiefs, councillors, Environmental Management Agency(EMA),Agriculture, Technical and Extension AGRITEX),Zimbabwe Republic Police (ZRP), Forest Commission and non-governmental organisations are represented in Zimbabwe resettlement areas, deforestation continues unabated. Ostrom (1999), highlights that failure to achieve sustainable natural resource utilisation has been attributed to the continued focus on management without consideration of the institutional framework within management. Arnold (1999), also stated that rural communities had traditional institutions such as Chiefs, Headmen and Spirit Mediums that guarantee protection of natural resources. Consequently the emergence the resettlement program, it is argued led to the destruction of local institutions and transformed the then existing system of common property resource management which operated on the basis of collective management resource, into open access resource, thereby exposing the resources to deforestation.

Whilst extensive research on forest-poverty links are emerging in developing countries (Cavendish, 2000; Fisher *et al*., 2001; Masozera, 2002; Angelsen and Wunder *et al*., 2004; Kabubo-Mariara and Gachoki, 2008) no systematic study for resettled farmers of Zimbabwe has been carried out. Also the management of common pool resources has been well studied in developing countries but there is a dearth of such studies that have been carried out for resettled farmers of Zimbabwe. Studies in Zimbabwe's resettlement areas have focused on gender issues and forest, land tenure and forests, productivity and livelihoods (Wekweto, 1997; Nhira, 1992; Clarke, 1994; Choto, 1996; Ncube, 1996; Nemarundwe, 2000; Matose, 2006; Manzungu, 2003; Wermer, 2010; Scoones, 1998; Turner, 2012: Child, 2013; Cousins, 2013 and Alber, 2013). No specific studies have been carried out to document the differential nature of the farming model A1, A2 and Old resettlement areas of Shamva district on issues concerning dependency on forest, household welfare, willingness to participate in conservation. This study seeks to address this gap.

Several studies on conservation of indigenous forests have acknowledged the significance of local parameters in formulation of natural resource conservation strategies (Osborne, 1999; Panta, 2009; Om Prakash, 2003; Rosemarie and Knierim, 2006; Dominique, 2008). However, policies, plans and programs take local issues from an international, continental, national perspective and not provincial, and District or village level. Observations have been made that the Agricultural Extension workers and policy-makers do not take into consideration the different socio-economic and institutional factors at provincial and district level and worse still in the resettlement areas. Hence, it goes without saying that failure to recognise this as legitimate may result in increased deforestation, increased dependency on forest, negative perceptions on forests and subsequently unwillingness to participate in conservation of indigenous forests. In light of this, the research study seeks to achieve the following objectives:

1.3 Research Objectives

The main objective

The broad objective of the study was to determine the level of deforestation, forest dependency and factors which determine willingness to participate in natural indigenous forests by resettled farmers of Shamva District, Zimbabwe.

Specific objectives

Basing on the broad objective, the specific objectives of this study were therefore:

1. To assess the rate of deforestation in resettlement areas of Shamva District.

2. To determine the resettled farmers' level of dependency on natural indigenous forest in Zimbabwe's Shamva District.

3. To evaluate socio-economic and institutional factors which influence resettled farmers' willingness to participate in natural indigenous forest conservation programs.

4. To deduce incentives with the potential to influence farmers to participate in conservation programs.

In light of the above specific objectives the research seeks to answer the following questions:

1.4 Research Questions

1. What is the rate of deforestation in the resettlement areas of Zimbabwe's Shamva District?

2. What is the level of dependency of resettled farmers on natural indigenous forest in Shamva District?

3. Which socio and institutional factors influence Shamva District resettlement farmers' willingness to participate in natural forest conservation programs?

4. What incentives will influence resettled farmers to participate in indigenous conservation programs?

1.5 Justification

This study may assist in the formulation of evidence based strategies and policies for conservation of indigenous forests and trees at local level. An assessment and monitoring of deforestation at global, national and local level is important in the management process. It assists monitoring effectiveness of forest management and the changes that are brought by deforestation (Schweik, 1998; Nagendra *et al*., 2005).This is because the specific geographical, ecological, cultural, socio-economic and political contexts in which conservation strategies are implemented make it difficult

to have general view of the results. Therefore a thorough understanding of the resettled farmers and the forests is essential for successful implementation of conservation strategies. Forest conservation techniques valued at the local level are essential for effective, sustainable and replicable solutions (Wilson and Hart, 2000; Herzon and Mikk, 2006; Siebert *et al*., 2006; UNDP, 2010).

After the Land reform program, Zimbabwe experienced deforestation and degradation of the resettled areas (Forest Commission, 2002). However, statistics available appear to be too generalised as it focuses on national level. This study will therefore provide local level estimates of deforestation enabling the study to provide a basis for future management of forest programs in resettlement areas of Zimbabwe with similar conditions. The results will assist government develop legislation that allow institutions manage indigenous forests sustainably at micro-level.

Wilson and Hart (2000) and Herzon and Mikk (2006) and other various authorities state that community based conservation approaches provide an effective framework to conserve biodiversity and to improve livelihoods of local people. However there is no consensus on the success of this approach in many African countries (Masozera, 2002).This is because strategies were designed to fit a specific environment and context and then be replicated elsewhere under different conditions and context. Masozera (2002), suggest that assessment of community based conservation programs from various stakeholders' perspectives be done before they are implemented is an effective management prerequisite. This study attempts to address this view by evaluating the performance of forest conservation programs and the extent of participation by resettled farmers so that appropriate recommendations can be made on policy formulation. The Zimbabwe Agenda for Sustainable Socio-economic Transformation (Zim-Asset), 2013 to 2018 policy document Article 2.23 mentions the need to develop environmental management strategies to reduce deforestation, land degradation, veld fires and biodiversity. This study will augment government efforts to reduce deforestation by assisting government agents with recommendations on sustainable environmental management strategies.

In addition recommendation from this study will therefore play a vital role in the conservation of indigenous forests thereby assisting resettled households to secure livelihoods, food security, water, health, enhance resilience to climate change,

conserve threatened species and other habitat and increase carbon storage and

sequestration. This study aims to provide a future management model of forests in Shamva resettlement area and similar areas in Zimbabwe and worldwide. The aim of the conceptual framework on Figure 1.1 above is to bring together existing findings and reveals, both in terms of content and conceptual approach the points where they overlap, mutually inform one another and where there are gaps in literature (Siebert *et al.*, 2008). This framework analyses content and conceptual approach of each objective and finally summarising with the aim of placing the thesis into context.

1.6 Conceptual framework

In this study the resource use theory provided by Firey (1960), was used as a framework to guide the conceptual statement in Figure 1.1 above. Firey (1960), takes recognition of three value factors namely ecological, economic and cultural that interact with each other and play a role in determining local perception towards a resource. The ecological factors in the framework consists of livelihoods for forest dependency whilst economic factors include household characteristics such as gender ,education, farm size, market distance, tobacco farming, farm income, number of cattle and cultural variables are institutional variables which comprise cultural values, spiritual values and forest norms.

As such Figure 1.1 below is a conceptual framework developed to analyse the effects of rate of deforestation, forest dependency and socio-economic and institutional factors on the willingness to participate in natural forest conservation. Following Firey (1960), this conceptual framework consists of three models that are interrelated: rate of deforestation, dependency and socio-economic and institutional factors. Rate of deforestation is determined by forest dependency and forest dependency is determined by household's socio-economic and institutional factors. Forest dependency influence attitudes towards forest conservation and attitudes determine willingness to participate in forest conservation. Institutions regulate access to forest and formulate management policies and strategies

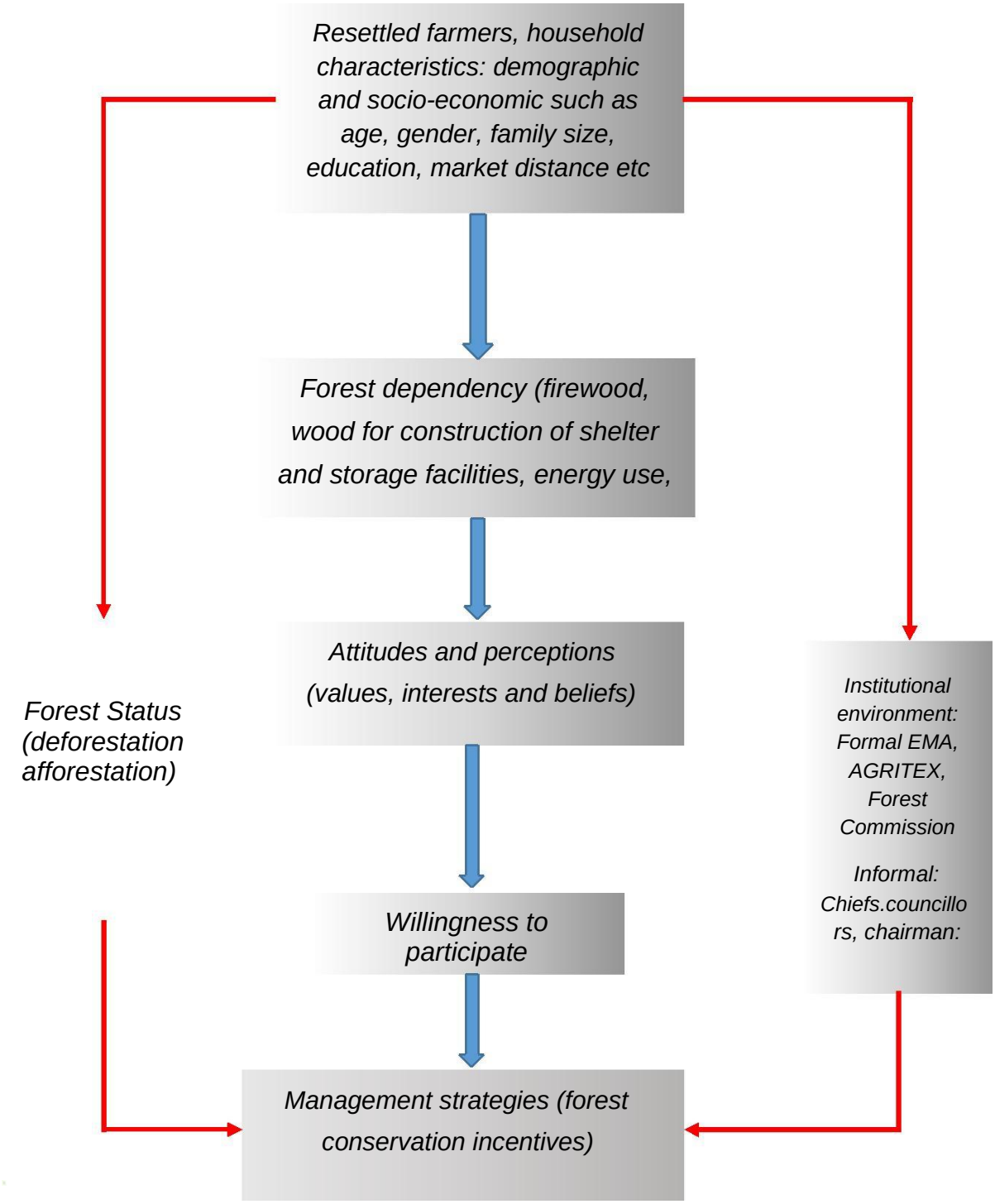


Figure 1.1 Conceptual Framework explaining deforestation, household dependency, perceptions, institutional and socio-economic factors.

In discussing each model in Figure 1.1 above, we come up with the following:

Identifying the rate of forest deforestation at different spatial and temporal scales could provide useful information for planning and sustainable management of forest (Panta *et al*., 2008). In light of this, GIS and remote sensing provides a unique opportunity to assess and monitor deforestation, degradation and fragmentation of natural forests (FAO, 2007).The status of the forests determines the perceptions and attitudes of households towards forest dependency.

Perceptions and attitudes are standards of behaviour based on shared beliefs about how individuals should act and are constituted when members in a group, in this case, farmers have perceptions of how other members in the group think, believe, know and act on forests (Hedge and Enters, 2000). Age of the farmer, farm size, education, off farm employment opportunities, household size, farm income have been found to influence dependency of household on forest (Takasaki *et al*., 2001, Hedge and Enters, 2000; Gunatilake, 1998).

The perception of the farmer depends on how the farmer perceives the context in which he/she operates. The contextual factors include agric–environmental schemes, economics, extension, farm history, technology and social norms. The farmer has a certain perception on natural indigenous forest use. Infield (1988) found that benefits from the forest and better education resulted in a more positive attitude in Natal, South Africa. Heinen (1993), points out that literacy and rights to collect products lead to positive attitude. Nepal and Weber (1995), found that land holding size has a positive effect on attitude towards forest. Gillingham and lee (1999) found age, gender and wealth to influence attitude. These results were supported by other researchers from all over the world (Cavendish, 2003; Fiallo and Jacobson, 1995). However restrictions for grazing and collection of firewood were shown to have a negative impact on forest conservation in Nepal (Fiallo and Jacobson 1995). Environmental change interacts with other processes of change and biophysical, social, economics, institutional and technological conditions. This dynamic influence outcome, including conflict and cooperation (Campbell *et al*., 2001).Therefore institutions are of great importance to reducing conflict and improving cooperation.

Institutions can be contextualized as clusters of right, rules and decision making procedures occurring at all levels of social organisations and with an emphasis on

environmental and resource regimes. The role institutions play causes and confronts environmental change. In order for us to achieve a well-planned decision making processes there must be a reliance on the consensus rules. Issues of governance are critical factor which requires to be tackled. Failure to tackle issues of governance leads to human insecurity and ineffective management of environmental programs (Contreras, 1999).

Therefore common biodiversity conservation programs that are well managed support sustainable forests and members of the community are also supportive of the programs.

1.7 Organisation of the thesis

The remainder of the thesis is as follows:

Chapter two presents a review of literature on other studies done by other scholars on rates of deforestation, level of dependency, willingness to participate and factors which determine the willingness to participate in forest conservation and incentives for forest conservation. The chapter also presents an overview of the influence of state policies during colonisation, at independence and after independence on conservation of indigenous forests. This chapter is important because it presents the basis for comparison with research findings. Chapter three provides clarification and familiarisation of the study area. It describes the location of the study area, the topography, climate, the demographic data of the District, and the socio-economic summary of Shamva District. The explanation of the study area also highlights why Shamva was chosen. In addition, the chapter describes the methodology of the study. It focuses on sampling procedure, data collection and data analysis. Details of the analysis per individual objective are given in the subsequent chapters 4, 5, 6 and 7.

In Chapter four land use/land cover changes in Shamva A1, A2 and Old resettlement programs were explored using remote sensing and GIS. The pattern of land use distribution and the annual rate of change per land use type per resettlement model were analysed.

Chapter five analyses the livelihood strategies of households in Shamva resettlement area and their level of dependency on forest resources. The chapter presents a

detailed analysis of livelihood strategies, livelihood income, forest dependency, energy used in the area and perceptions of local on forest management.

Chapter six is two thronged. The first part uses the KAP analytical framework to explore the extent of willingness to conserve indigenous forests by A1, A2 and Old resettled households of Shamva District. This section acts as a proxy to the next section by being the dependent variable in the next part.

The second part is a presentation of the socio- economic and institutional factors that influence the level of willingness of the households to participate in indigenous forest conservation. Explanation was sought on the effect of the following socio economic and institutional independent variables: age, gender, education, employment status, marital status, religion, education, cattle, tobacco growing, coal use, paraffin use, solar use, penalties, forest distance, household size, market distance, AGRITEX, EMA, media, private companies, NGOs, community leaders, forest commission on willingness to participate on conservation programs.

Chapter seven explores the various incentives which can be used to motivate farmers into knowing conservation of indigenous forests, developing a positive attitude towards conservation of forests and practicing forest conservation techniques. A descriptive analysis was used to evaluate which incentive is most suitable and least suitable for each resettlement program.

Finally, Chapter eight combines the results, conclusions and policy recommendations of the previous chapters. The chapter crystallises the extent of land use /land cover changes, the reasoning and underlining forces behind deforestation and incentives which can stimulate a practical, implementable and sustainable forest management program in Shamva A1, A2 and Old resettlement models. Figure 1.2 below outlines of the project.

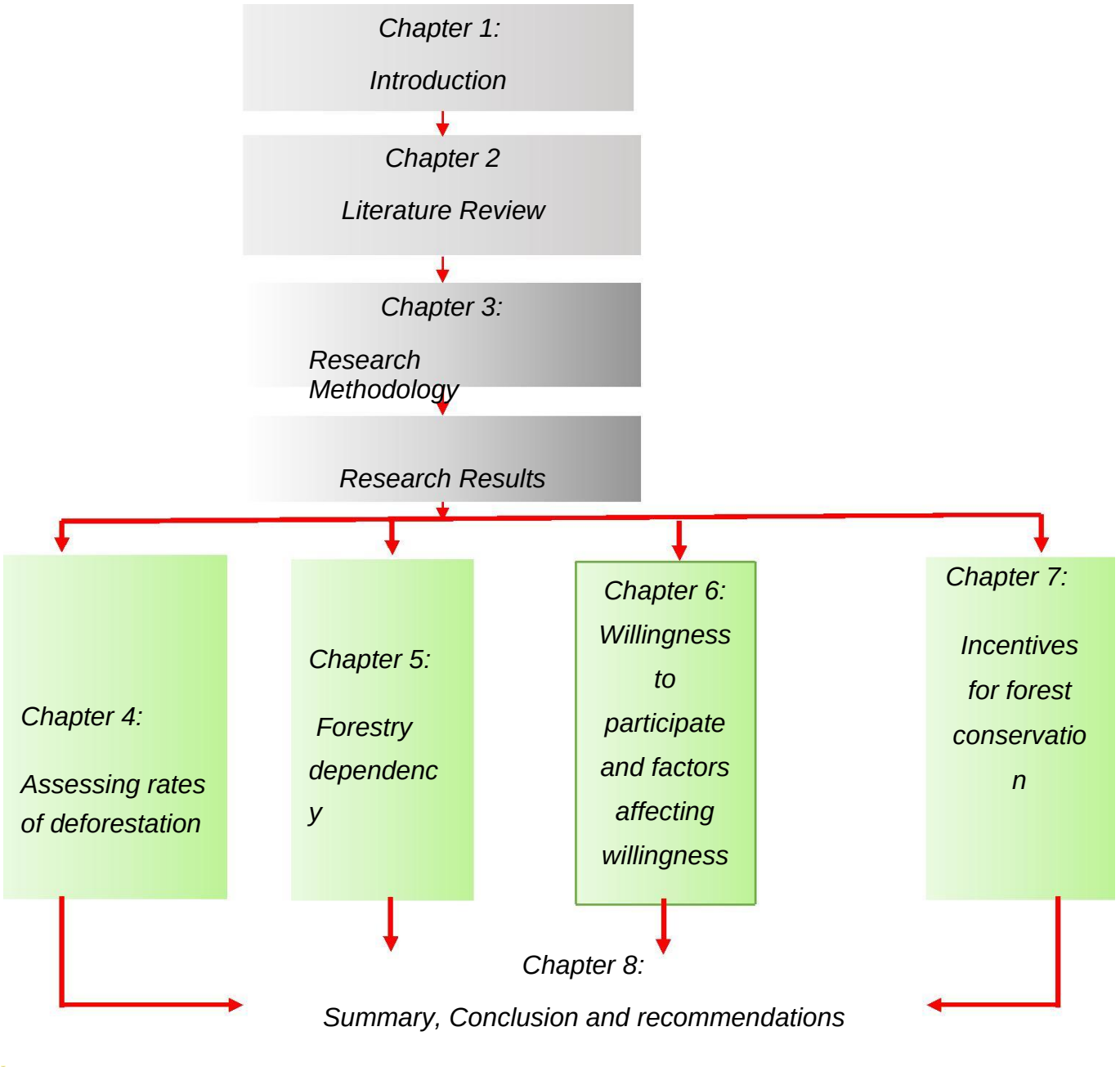


Figure 1.2 Structure of the thesis

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter gives a comprehensive outline of theoretical and empirical literature analysis of the socioeconomic and institutional perspective of indigenous forest deforestation and linking it with recent technology of Geographical Information System (GIS) and remote sensing. The review focused on current literature on practices of GIS and remote sensing that include the growing practice of integrating socioeconomic and institutional data in determining rates of deforestation globally, regionally and in Zimbabwe. The socioeconomic and institutional data involved the review on livelihood strategies and dependency on forest, factors that determine willingness to participation in forest conservation and finally incentives for motivating households in forest conservation. The chapter ends by giving an account of the land question in Zimbabwe, examining the land policies and their impact to the indigenous forests.

2.2 GIS and remote sensing: A Forest conservation Perspective

This review will focus on the historical perspectives of GIS and Remote sensing technique in assessing rate of deforestation and highlight on the importance of its use in forest change detection. It will also provide imperial literature on GIS and remote sensing globally, regionally and in Zimbabwe.

2.2.1 Definition of deforestation, GIS and remote sensing

FAO (2007) defines deforestation as the conversion of forest to another land use or the long term reduction of tree canopy cover below 10% threshold. The United Research Institute for Social Development (UNRISD) defines deforestation as not only the conversion to non- forest but also degradation that reduces forest quality – density and structure of trees, the ecological services supplied, the biomass of plants and animals the species and genetic diversity.

Both definitions refer to deforestation as changes in land cover and land use. Land cover measurements use percentage of cover to determine deforestation whilst land use measures deforestation by change in land use (FAO, 2007). Land cover /land use changes can be measured using GIS and remote sensing.

A geographic information system (GIS) is a computer-based tool for mapping and analysing feature events on earth. GIS technology integrates common database operations, such as query and statistical analysis, with maps. GIS manages location-based information and provides tools for display and analysis of various statistics, including population characteristics, economic development opportunities, and vegetation types (Bekker *et al.*, 2009).

Remote sensing is the art and science of making measurements of the earth using sensors on airplanes or satellites. These sensors collect data in the form of images and provide specialized capabilities for manipulating, analysing, and visualizing those images. Remote sensed imagery is integrated within GIS (Panta *et al.*, 2009).

2.2.2 History and importance of GIS and Remote sensing

Surveying and mapping were the first geospatial data acquisition techniques in detecting forest change. Photogrammetry evolved as a sub discipline of surveying and mapping thus offering an extension to ground based methods (Bakker *et al*., 2009). However, the degree of quantification with this technique which relied only on qualitative appraisal of successive sets of photography was inadequate (Elliott and Campbell, 2002).

As a result, Landsat-1 1972 became the first remote sensing used to classify land use and land cover (Arvind *et al*., 2006). According to Tejaswi (2007), remote sensing provides a unique opportunity to asses and monitor deforestation, degradation and fragmentation for a number of reasons. Firstly, remote sensing can work at multiple scales ranging from few meters to several kilometres. This will include a detailed study at local level to global forest resources assessment. Secondly, remotely sensed data can be acquired repeatedly (e.g. daily, monthly) this helps in the monitoring of forest resources in a regular basis. Thirdly, these measurements can be made in near real time basis which is quite useful for monitoring events such as forest fire. Fourthly, remote sensing data has synoptic coverage and information can be acquired in places

where accessibility is an issue. Fifthly, remote sensing uses wavelengths that is not visible to human eye. Thus, remote sensing is the most effective means of assessing and monitoring forest resources. It is important to understand that remote sensing does not replace field survey but again provides complimentary information.

GIS connects a database to spatial data. In this way it facilitates analyses of spatial relationships which otherwise is not possible in traditional database analysis. It allows the combination of independent thematic map information to generate new thematic information (Musa, 2004; Tejaswi, 2007). Some of the advantages of the utilisation of GIS, which makes it an ideal tool for mapping and analysing of phenomenon that cover large areas are: extraction of single themes from general purpose ways are sometimes expensive using manual records, large and complex data sets can be both compactly stored and rapidly retrieved with high accuracy, the storage format data handling methods are uniform and it is easy to update information in digital format (Panta, 2008).

2.2.3 Imperial literature on GIS and remote sensing and forest management

Remote sensing technology is a potentially useful mapping tool for providing a spatial synoptic view of changes in forest condition, type and cover over time worldwide (Rogan *et al.*, 2002; Schweik and Green, 1999). Remote sensing and GIS has been efficiently and widely used in forest monitoring (Joshi, 2006; Coppin and Bauer, 1994; Rogan *et al.*, 2002), watershed management (Pahari *et al.*, 1996), forest fire management (Kachmar and Sanchez-Azofeifa, 2006), forest policy evaluation (Nagendra *et al*., 2005), ecological modelling (Tuelle, 1989), inter-disciplinary study of tropical forests (Trigg *et al.*, 2006). Following is extant literature of some of the uses of remote sensing and GIS in forest management:

Shosheng and Kutiel (1994) investigated the advantages of remote sensing technique in providing a regional description of deforestation cover. The results of their research were used to produce few vegetation cover maps that provided new information on special and temporal distribution of vegetation in this area and allowed quantitative assessment of vegetation cover.

Arvind and Nathawat (2005) carried out a study on land use land cover mapping of climate and physiographic conditions in chosen districts which resulted in the

development of different land use land cover in those districts an evaluation of digital analysis of satellite data which indicates that majority of areas in those districts are used for functional purposes. Therefore, the fore gone studies indicate that GIS is an important tool that can help to avoid extinction of forests in Africa as well. .

On the one hand, satellite imagery is particularly a vital tool for African environment in which historical land use/land cover change records are either not available or outdated. (Luneta and Elvidge, 1999). In Kenya, Geographical Information Systems, remote sensing and mapping have been widely used under the Mount Kenya East Pilot Project (MKEPP) as tools for natural resource management and for monitoring the project's progress.

In Nigeria, land use/land cover changes have been determined using remote sensing and GIS. The changes which were observed include loss of forests due to expansion of agricultural land and settlements and increased land degradation (Eva *et al*., 2006).Ghana is not immune to the above, a study by Vescovi, *et al*, (2002) detected the human induced land cover changes in Ghana applying principal components and vector analysis techniques to provide information on the change type and intensities.

A study by Mambo and Archer (2007), used remote sensing and GIS in Buhera Save catchment area of Zimbabwe and detected high siltation susceptibility along the major rivers and their tributaries in northern and southern parts of the district due to expansion of agriculture activities by small holder farmers in these areas. Some areas of high susceptibility in the northern parts were also along the major highway suggesting either firewood trading or deforestation for curio business.Where as an earlier study done in Zimbabwe, Murwira (2003), assessed natural resource distribution using remote sensing and GIS.

Similarly, Matsa and Muringaniza (2011), in their recent study, used GIS and remote sensing and observed that the major factors for land use/land cover changes in Shurugwi District were Zimbabwe' s fast-track land reform program and related economic activities as well as mining and gold panning activities. There is a convergence of literature some researchers in Zimbabwe who have analysed land use /land cover changes in Old resettlement areas (Elliott and Campbell, 2008) and some the A1 resettlement model Matsa and Muringaniza (2011) and Grundy *et al*., (1993), but none has analysed on A2 resettlement or a comparison of the three models (A1,

A2 and Old resettlement) of Zimbabwe's resettlement programs. This has resulted in scanty literature in this area of study.

Given this assertion, Shamva district is experiencing developmental activities such as infrastructural development, mining, construction of settlements, agriculture development and other anthropogenic activities (Musemwa and Mushunje, 2011). These activities have resulted in increased land consumption, forest consumption; land modifications and alterations of the status of the land use and land cover over time. Unfortunately, this scenario has been on going without a detailed account to determine, monitor and evaluate the condition of these activities.

To remedy this anomaly, it has been proposed by researchers that an assessment and monitoring of deforestation at global, national and local level is important in the planning process. Its reasons being that it may assist monitoring effectiveness of forest management and the changes that are brought by anthropogenic activities by the new farmers (Schweik, 1998; Nagendra, 2005).This is because the specific geographical, ecological, cultural, socio-economic and political contexts in which conservation strategies are implemented make it difficult to have general view of the results. Therefore, a thorough understanding of the resettled farmers and the forests is essential for successful implementation of conservation strategies. Forest conservation techniques that are valued at the local level are essential for effective, sustainable and replicable solutions (Wilson and Hart 2000; Herzon and Mikk, 2006 Siebert and Knierim 2006; UNDP, 2010). It therefore becomes imperative to review the household characteristics, the livelihood strategies, income and outcome, dependency Section (3.3) in order to understand the primary mechanisms and driving factors of land use/land cover changes (Panta *et al*., 2009).

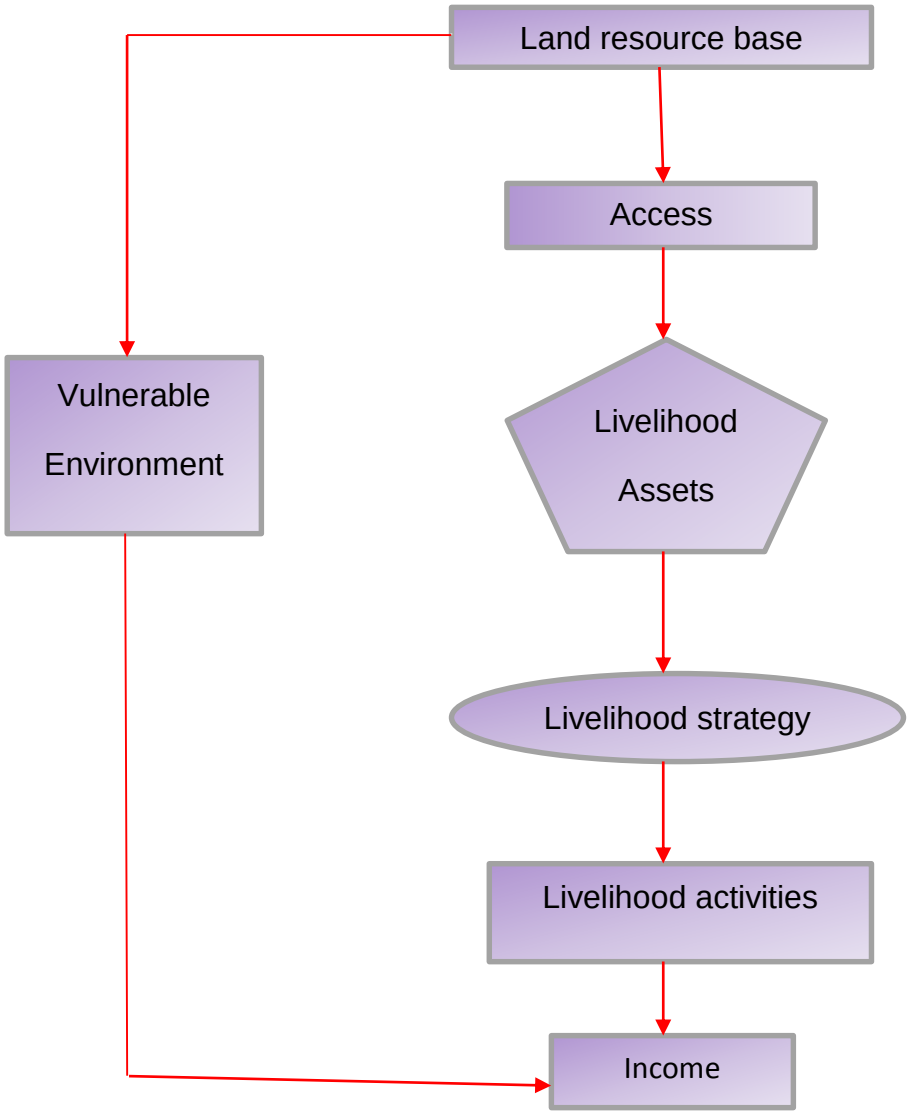
2.3 Household characteristics, livelihood strategies, income and outcome and dependency

2.3.1 Introduction

Under then arm pit of this section, lies the analysis of household characteristics, livelihood strategies, forest dependency and management of forests in Shamva resettlement areas. In Soussan *et al*., (2001), Livelihood Systems Model was used to demonstrate the relationship between forest resource availability, livelihood strategy, income and forest management. The Livelihood System Model is similar to the

Sustainable Livelihood Approach (Scoones, 1998; Ellis, 2000; DFID 2001). They both emphasise on how livelihood assets are used to build on livelihood strategies of individuals or households.

Livelihood Systems Model



2.1 Livelihood Systems Model (Soussan *et al*., 2001)

Caney (1998) presents a definition of livelihood in line with the model above. Caney (1998) defines a livelihood as comprised of capabilities, assets (both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and still maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resources base. Om Prakash *et al*., (2003) stated that households build their livelihoods on the basis of their assets and available capital, such as tree and forest resources. It therefore, entails that access to environmental resources is crucial to resettlement household livelihood strategies while the depletion of these resource is considered as a threat to their survival.

2.3.2 Household characteristics

Household characteristics include sex, gender of household head, family size, age of household head and marital status have a bearing on the use of resources. Niehof and Price (2001) stated that household characteristics have influence on how communities and groups are organised, how livelihoods strategies which include resources such as forests are utilised.

Kisaka-Lwayo (2012) state that age has a bearing on one's mental capabilities. Some researchers have established little or no link between age and metal capabilities. Generally the age of the household head is important because he/she is the decision maker on which source of fuel should be used, whether to build a house of brick or wood. Cavendish (2003) stated that adulthood and marriage brings a boom in construction uses. Every man must provide for his wife a kitchen hut and a bedroom hut and associated firewood use (for burning bricks), construction poles, roofing poles. The first harvest requires the construction of a granary for crop storage, the arrival of children will necessitate the building of a further hut and acquisition of livestock will require building a kraal and often a crib. Also, as individuals ages their resource demands also age as they can no longer carry strenuous agricultural activities, they reduce acreage and production. There the character of environmental utilisation changes within the life cycle of an individual or household (Elliot and Campbell, 2002).

The household size is used as a proxy for manpower availability at the household. Labour is being used for fetching firewood and agriculture activities. There is need for more shelter and therefore more wood for construction purposes. A bigger house

size therefore signifies more deforestation and vice versa for a lower household size (Elliot and Campbell, 2002).

Sex and gender for household head have significance in decision making. The household head has decisions on issues to do with livelihood strategy, allocation of assets and group membership. Thus the head of the household determines the rate of forest dependency by choosing what type of energy to use, what type of crop to grow such as tobacco or maize and which group to associate with. Again such decisions have a bearing on forest dependency. Cavendish (2003) supports this assertion by stating that gender stratification has a bearing on environmental utilisation. Female headed households concentrate on collection of wild fruits and firewood while male headed households are into construction activities. However widowed male households are highly dependent on environmental resources as they seek for cash income to remunerate for female labour such as fetching firewood and water and cooking. Thus it can be observed that collection of environmental resources has a strong gender differentiation. Such gender differentiation and specialisation is strongly enshrined in traditional African communities where gender roles and rights strongly exist (Cavendish, 2003). It can be noted therefore that household characteristics have a very strong bearing on environmental utilisation as well as determining livelihoods strategies and income.

2.2.3 Household livelihood strategies

Livelihood strategies are how people access and use assets, within the social, economic, political and environmental contexts (Chambers and Conway, 1991). According to Doss (2006), livelihood strategies are various activities or behaviour patterns and choices undertaken in order to meet the livelihood objectives. Doss (2006) further explains that there are three different ways on which a household can meet its objectives, which are farming activities, non-farming activities and migration. Scoones (1998) and Swift (1998) reinforce the different modes of meeting household goals by stating that rural livelihood strategies can be categorised into three namely diversification, agricultural intensification or extensification and migration.

Agricultural intensification/extensification entails increased dependence on agriculture either by intensifying resource use through the application of more labour, capital or land. The strategy pursued by the household will dependent on the agro-ecological

environment available. Diversification strategy provides the broadening of on farm activities to include more farm products or value addition and or to include off farm products such as embarking on new carrier or activities. Migration may involve movement voluntarily or involuntarily into non-farm activities away from place of origin such as expatriate labour (Scoones, 1998; Swift, 1998).

It has been argued that the relationship between livelihoods strategies and environment depend on geographical context and therefore varies from place to place. Livelihoods strategies are also shaped by the changing natural environment. Furthermore the quality of soil, air and water; the climatic and geographic conditions; the availability of fauna and flora; and the frequency and intensity of natural hazards all influence livelihood decisions.

Fortunately rural livelihood strategies in Malawi is hinged on collection of wild fruit, sale of firewood and charcoal, brewing beer for sale, emigration, opening of gardens in wetlands and weaving of baskets and mats (Whiteside, 2000; Frankenberger *et al.*, 2003). It has also been noted that in KwaZulu Natal (South Africa), poor peasants undertake a wide range of livelihood activities such as informal trading, seasonal piece work, formal jobs and other activities to cope with their environment (Cross *et al*., 1996; Shackleton and Shackleton, 2004) while in Derre forest reserve of Mozambique hunting and sale of traditional beer and pottery are common livelihood strategies (Nhantumbo *et al.*, 2003).

In Zimbabwe, the situation mimics that foregone, Mombeshora *et al*. (2001), found out that in Sangwe and Mahenye communal areas of Zimbabwe some households derive their livelihoods from wildlife and crafts. Cross et al (1996) observed that throughout Africa the issue of rural livelihoods in relation to natural resources besides being diverse can also be approached in several ways. Natural resources affect livelihoods either directly, by being used to support the household or to produce things that households need to support themselves directly or indirectly, by supplying things the household would otherwise have to pay. Doss (2006) noted that agriculture is undoubtedly the major livelihood strategy which significantly contributes towards the livelihood outcomes and employment generation of the rural smallholder farmer's livelihoods.

The forest has a significant contribution to the household income as evidenced by findings from the following researchers in Africa; for example, 22% contribution to total household income in South Africa (Crookes, 2003), 20% contribution to total household contribution to Cameroon (Ambrose-Oji , 2003) and 22% contribution to total household income in Zimbabwe (Cavendish, 2000). Forest environmental income is relatively more important for the poor than the non-poor. As such, deforestation will hurt the poor more than the non-poor (Vedeld *et al*., 2004, 2007).

2.3.4 Livelihood strategies in Zimbabwe

According to ZimVac (2014) the highest income source for the household is casual labour with 21.3 followed by Food Crop Production and remittances with 16.4 and 11.4 respectively. Mining is the least followed by pension and gifts.

2.3.5 Livelihood strategies in Mashonaland Central Province in Zimbabwe.

Agriculture is pivotal in the socio-economic development in Mashonaland Central Province because it is considered as a source of income, employment and affordable food (Moyo, 2004). The aggregate contribution of traditional agriculture to the province's total agricultural production was about 19 % (Zimconsult, 2004). The main crop grown in the province is maize due to the fact that it is the staple food for Zimbabwe (Utete, 2003). The other crops grown in the province include cotton, tobacco, groundnuts, soya beans, wheat and sorghum. The growing of agricultural crops especially tobacco has a bearing in environmental utilisation.

2.3.6 Forest dependency

Cavendish (2003), defines forest dependent people as people who live inside forests, often living as hunter-gatherers or shifting cultivators, and who are heavily dependent on forests for their livelihood primarily on a subsistence basis. People in this category are often indigenous peoples or people from minority ethnic groups. They are, thus, usually outside both the political and mainstream.

Dependent people are also defined as those who live near forests, usually involved in agriculture outside the forest, who regularly use forest products (timber, fuelwood, bush foods, medicinal plants) partly for their own subsistence purposes and partly for income generation. For those involved in agriculture, nutrient supplements from

forests are often of critical importance to productivity. Such supplements can be in the form of mulch from leaves gathered in the forest. Another source of nutrient supplement is forest grazing by livestock which converts nutrients from forest biomass into manure (Campbell, 1987).

The last definition considered stated that these are people who engaged in such commercial activities as trapping, collecting minerals or forest industries such as logging. Such people may be part of a mixed subsistence and cash economy (Grundy *et al*., 1993).

The second definition by Cavendish (1991) applies to this study. However, dependency of rural households on common pool resources (CPRs) and their diverse use pattern have become an important topical issue in developing economies (Sapkota and Oden, 2008). Empirical evidence from developing countries indicated that forest products play a significant role in rural livelihoods, particularly for the rural poor for income and subsistence and provision of prevention against food security risk, healthy risk, and environmental hazards risk (Kamanga and Vedeld, 2009). Almost a quarter of a billion people live in around the dry forest of Sub Saharan Africa. Most forest inhabitants depend on forest for building materials, food, and land on which to grow crops, fuel wood, non-wood products and many other things CIFOR (2008). Table 3.2 below shows a topology of forest products used by communal area households/resettlement farmers in Zimbabwe (Cavendish, 2003; Campbell, 1987; Grundy *et al.*, 1993).

An observation of the above forest products expose the following features: that the resources are diverse, are of economic character, originate from a variety of habitats and are a common property. Cavendish (2003) argues that there have been very little valuations of environmental utilisation at household level. Those that were done concentrated on non-timber forest products according to Wilson (1990), Mcgregor (1991), Campbell *et al*., (1991), Scoones (1998), Gumbo *et al*. (1990) whilst only Grundy *et al*., (1993) had inroads in construction.

Table 2.1 Summary of resource utilisation by communal area households and resettled farmers

Environmental Utilisation	Consumption	Durable	Production input	Asset building	Sale
A. Wild foods, wild goods and minor uses					
Wild fruits,nuts,and their products	✓		✓		✓
Wild vegetables	✓				✓
Wild animals	✓				✓
Wild fish	✓				✓
Insects	✓				✓
Others;mice,birds, honey,mushroom,leaves	✓				✓
Wild medicines	✓				✓
Other wild goods;tooth stick,dyes,oils,resins	✓		✓		✓
B.The multiple uses of wood					
Timber(commercial use,carvings)		✓	✓		✓
Firewood(cooking,heat,light,beer brewing, brick and tobacco burning	✓		✓		✓
Construction wood(huts,graineries,livestock pens,field Fencing		✓	✓	✓	✓
Agriculture implements(carts,yokes,hoes,axe handles, ploughs)		✓	✓		✓
Furniture(wardrobes,beds,tables,chairs,stools,shelvind)		✓		✓	✓
Household utensils(cook sticks,mortars, pitils,plates etc		✓	✓		✓
Musical instruments(marimba,mbira,drums,guitar		✓	✓		✓
Hunting implements(knobkerries,fishing rods,bow and arrows)		✓	✓		✓
Rope from bark(roofing,binding,whips,basckets,mats,nets)		✓	✓		✓
C Uses of grass, reeds, canes and leaves					
Thatching grass					✓
Wooven goods(sleeping mats,crop and storage baskets,brooms, hats)	✓	✓			✓
Leaf litter(as fertiliser and mulch)		✓			✓
D. Other resource utilization					
Pottery clays(water storage pots, cooking pots		✓	✓		✓
Termite moulds(as fertiliser)			✓		✓
Livestock fodder and browse			✓	✓	
Water	✓		✓		

Source:Cavendish, 2003; Campbell,1987;Grundy *et al.*, 1993.

This study contributes to the repository with special emphasis on those environmental resources that contribute to deforestation (Table 3.2.i.e. the multiple uses of wood)

It is estimated that more than 15 million people in Sub-Saharan Africa earn their cash income from forest – related enterprises such as fuel wood and charcoal sales, small scale saw-mill, commercial hunting and hand craft (Cavendish, 2003).

In Zimbabwe, rural inhabitants, who comprise over 80% of the natural population, utilise wood as their major source of energy for cooking and heating Grundy et al 2003. The importance of woodland resource to the rural population in Zimbabwe has also been documented (Campbell, 2003).

2.4 Willingness to participate and factors which determine willingness to participate in conservation of indigenous forests

This section will cover the concept of willingness to participate by defining willingness, participation and stating the theories of participating (Wilson, 1996). A conceptual framework of willingness to participate in conservation activities will also be discussed followed by the factors that determine willingness to participate.

Willingness can be defined as readiness, inclination, preparedness, enthusiasm or disposition. The willingness by communities to conserve their forests can be measured using two variables namely, community attitude towards forests and community actions regarding forest management. The Knowledge, Attitude and Practice (KAP) paradigm provides a good framework for measuring the inclination by communities to conserve their forests (Wilson, 1996). For a community to practice forest conservation (P), it should be knowledgeable about the need to conserve forests (K) and the various methods that can be employed to conserve these forests. This knowledge in turn should instil in that community the right attitude (A) towards forest conservation which attitude should drive the practice of forest conservation. Thus, community attitudes towards forest conservation and the activities they are engaged in constitute their willingness to conserve forest resources leading to their participation.

Participation means doing a task together. The concept of participation has various m and divergent meanings. Hart and Wilson (1998), regard participation as the means of involving people outside of the government in planning process, while Fagence (1977), sees it as a means of reducing power differences. In Knox and Meinzen-Dick (2001), participation means widening and distribution of opportunities to take part in societal decision making. For Magjuka (1989), participation is a process of joint decision making. United Nations Development Programme (2003), defines people's

participation as a means of mass sharing benefits of development; mass contribution to development; and mass involvement in decision making process to development.

The general definition is too broad to allow different interpretations and many issues to be labelled as participation. Therefore, participation enjoys a wide usage in developmental literature and has no single definition (Oakley, 1988). Studies have come up with theories of participation in an effort to give justice to its meaning. The following are only a few of the barrage of theories that have emerged:

2.4.1 Seymour Martin Lipset theory

Lipset (1960), addresses the conditions that lead to high rates of participation and the situations where people are not willing to participate. Surveys in different countries showed that willingness to participate was greater in men than women, more-educated than less-educated, urbanites than villagers, 35-55 year olds than younger people, married than single people, high socio-economic class than low socioeconomic class and organizational employees than self-employed people (Lipset, 1960).

2.4.2 Martin Fishbein and IcekAjzen and the Theory of reasoning

This refers to behavioural intention. Fishbein and Ajzen contend that an act of participation entails motivation and the possibility of participation. Therefore, belief toward an outcome, evaluation of the outcome, beliefs of what others think, the amount of information, motivation to comply with others, action in the past and the facilities needed to do action are considered as the components required for forming an action (AlaviTabar, 2000).

2.4.3 Homans's exchange theory

Introducing different cases, Homans exchange theory considers that behaviours are not much the result of beliefs and attitudes as they are the outcome of calculating profit and loss. In other words, behaviours including participation develop and become institutionalized when their benefits outweigh their costs. Increased participation is subject to the individual’s perception of objective benefits that outweigh the costs. The issues of reward, punishment, motivation, value and success appear in this domain. Thus, when participation entails earning points and positive evaluation of the action outcome, it will be sustained and repeated in future (Ritzer, 1993).

2.4.4 Habermas Theory

In public domain, the use of this theory suggests equal access as a requisite of discourse communities. A human being is able to change his social life and create a desirable, integrated life that governs his own life and can determine his/her own ways and means. In this regard, people need to recover the idea of social development in the civic society and in relation with others (Ansari, 2003).

2.4.5 John Turner's participation theory

The establishment of local organizations by local communities is emphasized in the process of the transformation of the theories explaining the role of people and government in project development.

Thus, the prevailing opinion among forgone scholars who propounded these theories is that without participation efforts and initiatives and strategies to come up with conservation programs to help alleviate deforestation may be difficult to achieve.

2.4.6 Factors affecting willingness to participate in conservation programmes

Given the definitions and theories above participation is therefore a process of working together with local people by involving them in planning, organising and decision making of a project from the onset towards achieving a common goal. In an effort to conceptualise the willingness to participate in conservation of indigenous forests by households, the following framework guides the analysis:

The willingness of farmers to participate in conserving forests is a function of many factors ranging from the farmer's household demographic and socioeconomic characteristics to the socio-economic, political and institutional setting that a household finds itself in. The level of participation in any program depends on how people view the benefits from it (Kothari, 2001). Thus, Figure 2.2 show the conceptual framework explaining the influence of demographic characteristics, institutional and socio economic environment in participation in conservation of forests. These factors that influence participation are discussed in detail below.

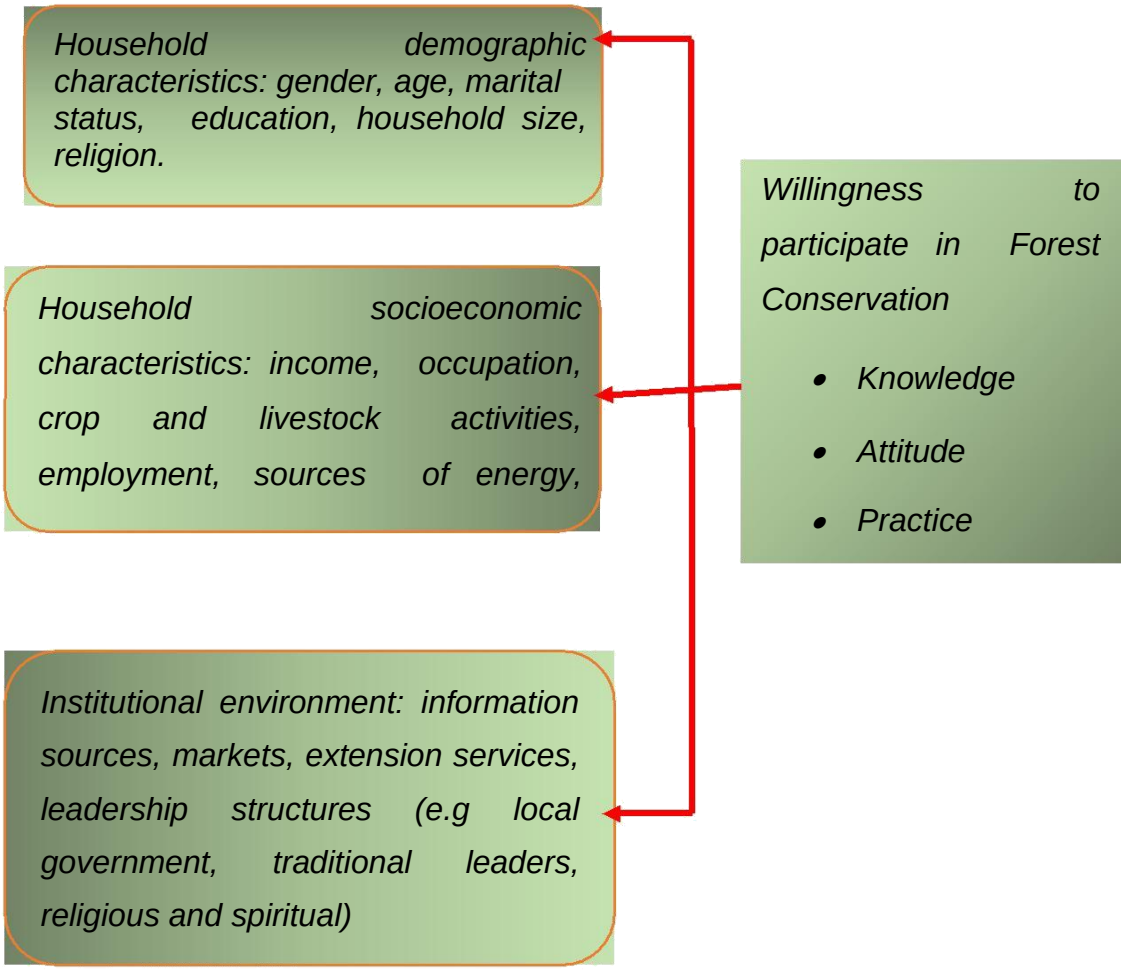


Figure 2.2 Conceptual framework for willingness to participate of resettled farmers in conservation of indigenous forests.

2.4.6.1 Age

A study by Kugonza *et al*. (2009) has found a negative significant difference between age groups and their participation in forest management. Younger people have been found to be more sensitive towards protection of forests since their relatively higher education that drives them to be more pessimistic and concerned about the future of the forests. Studies by Ozturk, *et al*. (2010) and Obua *et al*. (1998) also confirm the same assertion that. Cavendish (2003), observed the same significance but suggested that the reason why younger people are more willing to participate could be because forest related work requires more physical strength and younger people remain more active than the older people who may find themselves unable to perform.

In contrast with the above, a study by Abdel and Kobbail (2012), observed that age has a positive significance on tree planting which could be due to the fact that younger people having more livelihood alternatives leave for town in search for jobs leaving the older people to do the job. In summary, Thorai and Ranold (2010), further confirms the above assertion and argue that the older people participate more since their opportunities for employment are limited as compared to the younger people. Therefore age has a significant impact on willingness to participate in conservation of indigenous forests. As a result it would also be vital to identify how gender affects willingness to participate.

2.4.6.2 Gender

The concept of gender brings about ideas about both men and women. So while an examination of women's roles, needs and preferences are part of gender analysis, so too are the roles, needs and preferences of men. Gender also refers to the relationship between men and women and examines the role that power and institutions play in determining differences between them (Manfre and Rubin, 2012).

Women and their views and needs may be compromised by power structures which in rural areas are heavily biased in favour of men. Whereas with the job environment, most women settle down for just being members or secretaries who only take minutes and rarely voice their concern. The reason for the dominance may be due to cultural, political, economic and illiteracy barriers (Fiona and Tedla, 2003). Due to this, men are dominant in community forest management since women face constraints as the activities involved tend to overlook women specific needs regarding forestry resulting in barriers that restrict their participation (Buyinza and Nagula, 2007). In addition, women face inaccessibility to tree resources, inequitable sharing of revenue accruing from tree products and little or no ownership or control over productive resources (Kugonza *et al.*, 2009). Gender inequality in resource management is also shaped by unequal access to basic facilities such as education and health care, differences in income, extent of social political inclusion as well as social and cultural factors (UNEP, 2010). Gender is heavily skewed against participation by women.

Yet, according to Agrawal (2007) community groupings in which women are executive officials perform well in regenerating degraded forests. Fiona and Tedla (2003), also affirm that women over the years have developed knowledge and understanding of the uses and care of natural resources and have learnt to manage the resources in order to preserve them. Women are also the primary custodians of environmental resources by virtue of their position in the household that gives them the responsibility of managing energy, water and farming (UNEP, 2010). Women bring distinctive interests and values to forest management issues (Verghese and Reed, 2012). This gap between interests and outcomes may arise because the forestry is subject to gender order that privileges men's contributions to forestry, while it also constrains women's participation and ultimately the reduces the capacity of the forestry sector to achieve inclusive management as key components to social sustainability because women are left out in the equation (Verghese and Reed, 2012). Therefore understanding gender issues in this study is also paramount because even studies backdating decades allude to the fact that the gendered nature of resource use, access control, and responsibility with respect to trees and forests is highly complex (Rocheleau and Edmunds, 1997).

2.4.6.3 Household size

Household size is an essential factor in forest management since decisions about patterns and extent of resource extraction from the forest are made at the household level (Sumati, 2006). In rural Kenya, the household is a dominant social and economic unit being the primary unit of resource holding, production, consumption and a locus of decision making regarding most of the economic and social functions (Alemnew *et al*., 2011). Bigger households have more family labour and are more likely to participate in forest management since the practice is labour intensive and would require an adequate labour supply which at the end of the day is to their advantage (Thorai and Ranola, 2010). Agrawal (2009) in survey conducted in Rwanda found out that household size was a strong determinant of forest which can influence attitudes towards participation in forest management. Household size influences the demand for forest products (Kiplangat *et al*., 2010).

In a study by (Adhikari, 2002) fuel wood consumption by a household depends not only upon the number of people in the household, but also upon additional requirements for agricultural related activities such as preparation of animal feeds and enclosures like cattle kraals. Cavendish (2003) also showed that household size is positively significant with participation in forest protection, resource utilisation and decision making. Heltberg *et al*. (2000), had similar findings and also concluded that larger families provide more labour for collection of forest products. The findings also seem to support the population-environment theory which highlight that increased population negatively influence the environment.

2.4.6.4 Marital status

Marital status contributes to forest resource utilisation and establishing hierarchies among women. Bradley (1991), found that among the Luhya in Kakamega forest in Kenya, all the widows have more decision making than married women in the management of woodlot and fencerow trees. On the contrary, a study by Eneji *et al*., (2015) establish the fact that marital status play an important role, married women are expected to cook the family meal, care for the children. In most communities, meetings on forest purposes are held in the evening and may last long into the nights hence most men may not allow their wives to stay out long and many at times when family meals are supposed to be cooked. Sithole (2005), describes how the wives of community leaders harness more power and influence than other women. However it is not all women who appear to be disadvantaged as lack of participation.

2.4.6.5 Income

Sapkota and Oden (2008), observed and concluded that income category for the rich was negatively and significant associated with forest utilisation. Rich households have enough choices of energy substitutes such as coal, biogas and electricity for heating and cooking purposes. However, the poor cannot afford alternative energy sources and therefore collect large amounts of energy from the forest. These results were also supported by Jodha (1992), that poor household depend more on forest resource. Reddy and Chakravarty (1999), also argue that poor families who have less land depend on forests for greater share of their income. Therefore indigenous forest use is more attractive to the poor as it provides highest contribution to their income (Khanal, 2001).

2.4.6.6 Level of education

Education is vital for equipping individuals with vital information peculiar to their means of survival (Cavendish, 2003). Educated people find it easy to understand and analyse new strategies.

Interestingly, Panta *et al*. (2008), agrees with Cavendish (2003), that the likelihood of participation of illiterate people in decision making is significantly less than the literate ones. Shackleton *et al*. (2011), found out that the more education one attains, the more one becomes informed helps one better in forest resources management. On another dimension, Eneji *et al*. (2015), studies are also in line with the findings by (Shackleton *et al*., 2011). However, the findings are more gender sensitive in that they state that the extent to which women are educated, their occupational status, property rights, and mobility among other endowments , significantly and positively influence gender participation in the management of forest resources (Nussbaum, 2000). Therefore educated household heads and educated women are more likely to participate in forest conservation activities.

2.4.6.7 Culture

The sense of identity of a place is created by economic; social and cultural aspects, through time and space and it is made up by meanings often assigned on specific landscape features (IUFRO, 2007). The development of a better understanding of the cultural dimensions of sustainable forest management is also one of the most significant emerging policy issues. Cultural trees, not only centuries-old veteran trees but also culturally modified trees for the production of fodder as well as hedges, tree rows etc; should be preserved (IUFRO, 2007).

In a study by Harrison (2006), in Tanzania of Udzungwa forests, for all communities surveyed the forest is seemed to have significant cultural or spiritual value that is essential to the social framework of the village communities, particular among the older generation and those who are well established in the area. The forest is seen by many as “life giving”; for example it is referred to as “Kaajafiaki”- source of life. Thusbit may be vied that in Tanzania and elsewhere in Africa including Zimbabwe, the cultural beliefs, values and norms hold more situation to how forest should be preserved.

2.4.6.8 Institutions

The role of these institutions is to educate and raise awareness on the importance of sustainable harvesting of trees. The best way to protect forests and its vast diversity is to increase awareness among local inhabitants of their value and involve the people in the protection activities through aggressive forestry extension services (Agbogidi *et al*., 2005). Forest extension improves forestry by enhancing the knowledge, attitudes and skills of the forest people and it aids rural development by enabling application of technological innovations through communication of research findings to farmers (Agbogidi and Ofuoka, 2009). Reid *et al.* (2006), points out that in doing so extension contributes towards social development and poverty reduction. Technical assistance was found to influence members' participation in forest management programs in Sissili and Zero provinces of Southern Burkina Faso (FAO, 2003). Fiona and Tedla (2003), found out that forest resource use by both man and women is influenced by exposure to and level of technology.

2.4.6.9 Livestock

Adhikari (2004), in a study of community forest management in Nepal observed that the difference in number of livestock that households raise may be associated with the extent of use of local level natural resources. People's interests in forest resource differ based on whether or not they raise cattle. Wealthier households have greater need for animal fodder and for agricultural compost (Varghese and Reed, 2012). Poorer households extracted least from the forest mainly because they had less livestock and farm land which provide the main farming system demand for intermediate forests (Richards *et al.*, 1999).

Olade and Lepetu (2009), in a study carried out in Botswana found out that the more dweller owns plot and livestock within, the lower the conservation that will be carried out as there will be tendency to open up more fertile areas for farming and livestock feeding purposes.

2.4.6.10 Distance from forests

Infrastructural proxies, such as access to markets and distance to town are expected to negatively impact forest resource use and hence reduce the time devoted to forest

resource collection (Beyene, 2011). Infrastructural access is expected to promote off farm activities, reducing the time available for forestry activities (Beyene, 2011).

In a research in Nepal, distant households collected almost four times left than the proximate users (Sapkota and Oden, 2008). Distance showed negative and significant relationship with fuel wood collection from community forest. Households residing close to the forest were more likely to acquire higher amount of fuel wood from the community forest and the reverse was true for the distant users (Sapkota and Oden, 2008). Lepetu *et al*. (2009), also found similar observations in Botswana and argued that the distance involves walking and carrying the harvest resulting in increasing difficulty in collections. Adhikari *et al*., (2004), finding from a study in mid hills Nepal were central to the above findings. The households distance to the forests did not really hinder them to access the forest for fuel wood collection. This is probably to the fact that fuel wood is the basic need for a household in remote hills which can easily be obtained and difficult to substitute (Adhikari, 2004). This therefore means that those with source of wood nearby are likely to participate less than those with distant source.

2.4.6.11 Religion

In a study by Tacey (2013), suggested the importance of the forest for the Batek as going far beyond simple economic or territorial concerns. The researcher is of the view that, land is yield not only as a source of subsistence but also the place of their ancestors, an environment overflowing with meanings. The forest is known as a perfect and balanced realm which offers all its creatures' protection, shelter, food, water and medicinal plants (Riboli, 2011).

The Malshegu study in Ghana (Dorm-Adzobu and Veit, 1991) revealed that traditional and religious beliefs and practices are important to protecting and managing local resources. The small pocket of forest that comprises Malshegu's sacred grove is protected primarily because it is the sanctuary of the Kpalevorgu god. In the people's minds the defamation of the forest would dishonour the god and bring misfortune to the individual and the community (Dorm-Adzobu and Veit, 1990). In the past, offenders were lynched; they are fined several cows or goats, which are sacrificed by the Kpalna to appease the Kpalevorgu god (Dorm-Adzobu and Veit, 1990).

In a similar research on the management of natural resources (Rim-Rukeh *et al.*, 2013) findings indicate that traditional religions and agricultural practices have contributed in the conservation of resources through the ascription of psychic powers to object, rock, stream or pond, tree, forestry land, etc; these ascriptions of the supreme powers and the belief and respect of the gods of the land holds the string to reverence and respect for these objects (Rim-Rukeh *et al*., 2013).

Ylhäisi (2006), confirms that traditionally protected forests and sacred or ritual forests have different kinds of protection statuses, depending on the particular clan and the purpose of the forest with the protection varying from a very strict to total ban on use to very soft regulations

2.5 Incentives for conservation of indigenous forests

2.5.1 Introduction

As noted in the earlier section, there is high dependence on forest for provision of wood and non-wood products globally, regionally and in Zimbabwe. Forest management activities are important in determining the outcome of forest use (Kant, 2000). Management authorities are responsible for assigning property rights to various stakeholders and guiding their use and consequent outcomes (Menzen-Dick and Therefore it becomes necessary to appreciate Gregaro, 2004). the incentives/disincentive structures that govern first the use by local people so as to decide the relevant and most appropriate structures that address the community's need without degrading the conservation effort.

The increased deforestation challenges and failure of technical or economic participation clearly show that there is need to come out with most relevant forest management activities. Well thought out prescriptions of indigenous forest techniques may input negatively on the livelihoods of local communities and this may reduce effectiveness of the incentive programmes. The perception of the local people towards the management activities and the factors that affect their perceptions is necessary in designing incentives for sustainable use of indigenous forests.

2.5.2 Conceptual Framework.

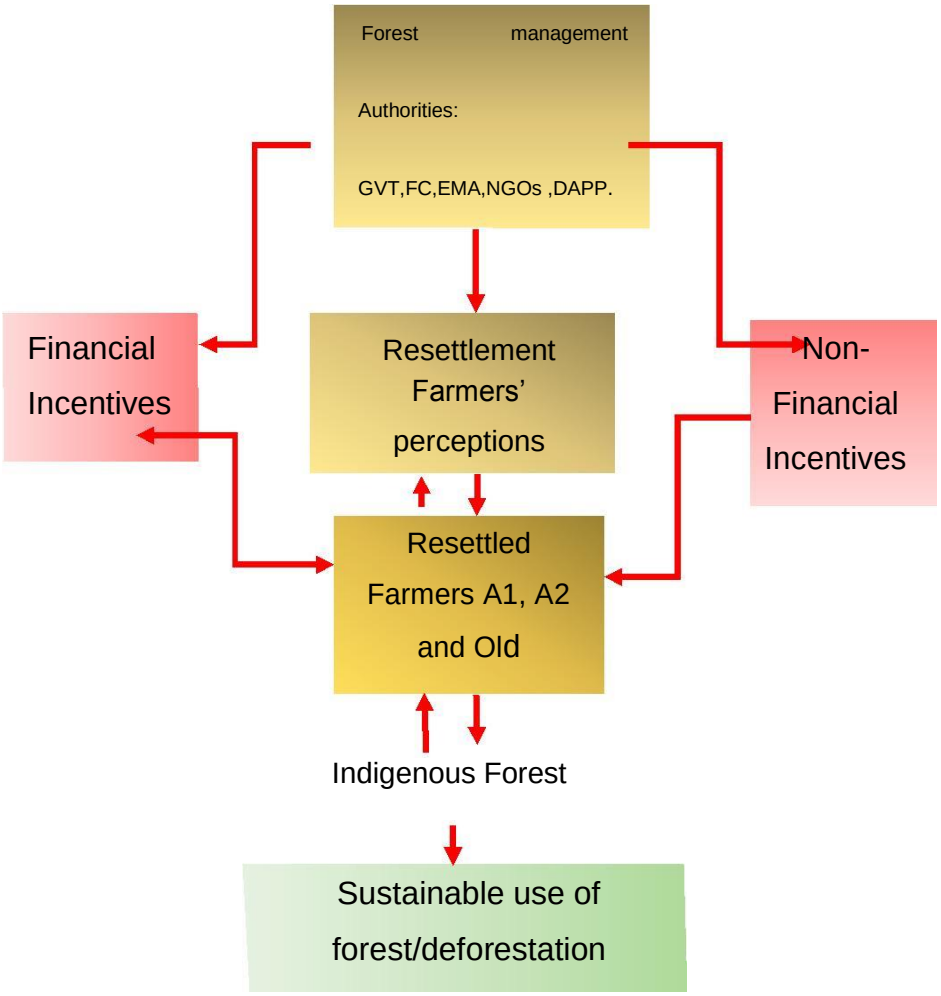


Figure 2.3 Conceptual Framework of incentives for resettled farmers in Shamva District.

The conceptual framework in Figure 2.3 above demonstrates that custodians of indigenous forests such as government and its partners like Forest commission should design financial and non-financial incentives to encourage resettled farmers to use forests sustainably. The opportunity cost of conserving forests outweigh the benefits accrued from the forests. Thus, for all resettlement farmers the return from cutting trees for converting the forest to farm land is financially attractive because benefits accrue directly to the farmer .e.g. tobacco farming and mining. To motivate the resettled farmers to conserve forests there is need to provide them with incentives equal to the benefits accrued in growing tobacco. Conservation incentives are mechanisms that encourage or stimulate resettled farmers to participate in conservation activities. Incentives can be financial or non-financial but are an

important factor in giving resettled farmers an opportunity to participate in making decisions on conservation about trees in their villages.

Incentives compensate farmers for opportunity cost forgone by the presence of the conserved forests. Willingness to participate in decision making enhances ownership of indigenous forests. By the establishment of an effective incentive model, forest authorities enable the sustainable of indigenous forests. The local people on behalf of whom the forest resource is managed are the best placed to judge the performance of the management authorities and the incentive provisions (Wiggins *et al*., 2004). Therefore their perception are important in explaining their cooperation or lack of cooperation with the authorities in conserving efforts. If the resettled farmers. If the resettled farmers perceive that the forest management authorities such as EMA is insensitive to their need, they 'uphold the axe' without reservation and exploit the forest.

2.5.3 The Incentivised conservation approach.

The incentive induced approach has two approaches (Cavendish, 2003). The first element is to allow the inhabitants property rights to participate in the conservation of forests and secondly and secondly to link the objectives of the conservation programme with the local development needs of the people (Cavendish, 2003; Hutton and Leader-William, 2003). This approach recognises the moral implication of imposing costs on local people who might already be disadvantaged by protecting the environment (Adams and Hulme, 2001). The incentive induced approach combines sustainable development projects in the resettled area and combines them with biocentric and anthropocentric arguments.

2.6 Conclusion

GIS and remote sensing is essential for assessing and monitoring deforestation in resettled areas. An evaluation of the diverse household characteristics, livelihood strategies, household income and dependency on forest is essential for formulating forest conservation strategies. Appreciating views of resettlement farmers as regard forest management is also important in formulating forest conservation policies. This is so because the willingness of the resettled farmers to conserve forests depends on

several factors some of which are: household characteristics such as age, gender, education: socioeconomic factors such as farm income, inputs, credit loans and institutional such as EMA, traditional leaders and NGOs. Therefore formulation of forest policies should incorporate these factors. Besides, resettled farmers need to be motivated to conserve forests. Incentives are thus essential but should originate from the local community and should also cover the opportunity cost for gone in conserving forests. Whilst it is essential to monitor forests using GIS and remote, evaluate livelihood strategies and dependency levels, consider the willingness and factors that determine the settlers' willingness to participate and suggest incentives for conservation of forests, this study will be incomplete without considering historical perspective of the land reform programme.

Land Reform and Indigenous Forests Conservation in Zimbabwe Resettlement Areas

2.7 Introduction

The approach to colonial and independent Zimbabwe to conservation of forests in this Chapter is in two fronts. Firstly, the land policy of colonial and independent Zimbabwe and secondly findings from other researchers. This focus will help enhance the understanding of the background to forest use and management during the colonial and independent Zimbabwe regimes. According to Musemwa and Mushunje (2011) and Basure *et al*. (2014) the land policies can be grouped into four stages: colonial 1890-1980, post independence1980-1999, Fast Track Land Reform 2000-2002 and the Post fast track resettlement program. The policies exemplified in these stages are: Rudd Concession, Native reserve order, British South African Company, Land Apportionment Act, Land Acquisition Act, Land Husbandry Act, Land Tenure Act and the Fast track land reform era. The policies were underpinned by theoretical and ideological considerations that influenced the land use and forest resource management issues.

The second approach of the background to colonial and independent Zimbabwe to forest conservation in communal and resettlement areas is informed by research. Several researchers have worked on issues of communal areas and environment, resettlement and environment, resettlement and national parks, communal areas and national parks. Literature from these studies give rise to the effect that there is a

relationship between land policies, land use, land tenure and environmental use. Basure *et al*. (2014), reinforces this assertion that there is a strong correlation between land use, tenure regimes and environmental use. It is therefore against this backdrop that this chapter examines the impact of land policies on the forest status of the time.

2.8 Historical perspectives of the Zimbabwean land issue and its implications on communal and resettlement forest use.

This section will discuss the colonial land policies from 1898 t0 1980.

2.8.1 Rudd Concession and Native Reserve Order

According to Moyo (1999), colonialists moved into Zimbabwe prospecting minerals but turned attention to the land for agricultural purposes. The settlers were granted mineral rights through the Rudd Concession of 1898. During this period members of the police force were also granted prime land in Mashonaland. Blacks were removed from the prime land into native reserves through the Native Order of 1890 (Gundani, 2002). Utete (2003), added that the native population was moved from high potential agro ecological zones 1, 2 and 3 and forced to poor regions 4 ad 5. This land seizure had serious negative repercussions on both the soil and the environment. Trees were cut for firewood, security and construction purposes.

2.8.2 British South African Company.

According to Utete (2003), the BSAC expropriated high potential land that was adjacent to the native reserves and created the Reserve Purchase areas. More land was acquired from the blacks to give way to the ever increasing settler population. The increase in settler population further worsened the condition of the black population impacting negatively on the environment due to overcrowding and its ripple effects.

2.8.3 Land Apportionment Act

The Land Apportionment Act of 1938 was done to divide the country according to races (Mukanya, 1999). Palmer (1998) stated that the land Apportionment Act,

allocated 51% land for whites (50000) 30% Africans 30 %(1.1 million) blacks and 19% to companies of the colonial government. Utete (2003), state that whites allocated themselves fertile land with high rainfall and Africans were given regions with low rainfall and poor soils. Again this had a negative impact on the environment.

2.8.4 Land Acquisition Act

The land acquisition act of 1945 was established to facilitate the parcelling out of farms to the World War II veterans of the British decent as payment or grant. Africans were moved out of the prime land to give way to war veterans (Mukanya, 1991). As the whites increased in numbers in the country the land loss to the blacks also increased exposing Africans to overcrowding which led to severe land degradation of native areas (Musemwa and Mushunje, 2011).

2.8.5 Land Husbandry Act

The Land Husbandry Act of 1951 was instituted to give white settlers permission to use forced labour, to destock cattle to five herds and have five acres per family. Mukanya (1991), Southern Rhodesia Natural Resources Board argued that the act would be used as a tool for greater environmental care (Basure *et al.*, 2014). This was implemented after observing the rate at which the land was degrading as a result of overcrowding and overstocking as a result of the continued amendment of the Land Apportionment Act to pave more land for white.

2.8.6 Land Tenure Act

The Land Tenure Act of 1969 was introduced to enable the government of Ian Smith to remove more blacks and replace them with whites Musemwa and Mushunje (2011), state that half of the country belonged to whites constituting about a quarter of a million on rich soil against 5.5 million blacks on dry arid soils.

The colonial regime gave priority to private ownership as opposed to communal as evidenced by freehold tenure on large commercial farms. Individual farmers would manage their woodlands. Again, the colonial stage is characterised by inequitable

distribution of land, forcing people into communal areas to subsist through overexploitation of natural resources, leading to resource degradation and ultimately enormous insecurity as livelihoods became threatened (Utete, 2003).

2.8.7 Post-Independence 1980-1998

When Zimbabwe attained independence, the government embarked on a land reform program to redress the colonial legacy. Thus the objective of the land reform was to address the imbalances to land access while alleviating population pressure in the communal areas, extent and promote the base for production in smallholder agriculture farming sector and bringing idle or underutilised land into full production. The first phase of the land reform program was launched in September 1980 (Musemwa and Mushunje, 2011). According to Utete (2003), one of the objectives of this program was to relieve population pressure in the communal Lands. This would assist promoting regrowth of biodiversity in the forests.

Phase one of the land reform program acquired 3498 444 hectares of land and resettled between 71000 families between 1980 and 1998 People First (2001). The majority of the settlers experienced increase in income which exceeded those of their counterparts in the communal areas (Musemwa and Mushunje, 2011). Some of the families constructed permanent housing and bought cars and tractors and scotch carts. Some families diversified into cash crops like tobacco, paprika and cotton (Musemwa and Mushunie, 2011). This, however, had a negative effect in that the settlers' wood cut wood from the forest to cure tobacco and for domestic purposes.

UNDP (2003) reported a forest loss after land reform program in Zimbabwe of 1.4% and attached this to deforestation. However, the Forest Commission provided extension services and schemes that enhanced woodland management. The government of Zimbabwe learnt that environmental losses can be reduced by instituting afforested projects and practicing good farming methods (Utete, 2003).

2.8.8 The second Phase of land reform (1989-1998)

According to Musemwa and Mushunje (2011), the Zimbabwean government and the all stakeholders of the land reform program launched the second phase of the land reform and resettlement program whose main aim was to address the inequities. Of interest in the program, were the inclusion and promotion of ensuring greater security of tenure to the land users and promotion of environmentally sustainable utilisation of land. However, the government of Zimbabwe was only able to acquire 168268 808 hectares and to resettle 4691 families between 1989 and 2000.

2.8.9.Fast track land reform program in Zimbabwe

Utete (2003), stated that the slow pace of land distribution disappointed the people of Zimbabwe who resorted to vigorous protests and farm invasions. The farm invasions had a negative effect on food security and environmental forest in the white commercial farming sector. Against the background of land occupations by the impatient landless people, government embarked on the fast track land reform program which was code named Jambanja or Chimurenga III. The Third Chimurenga gave birth to 127000 A1 households and 7200 A2 commercial farms by 2003 (Utete, 2003).

According to Basure *et al*. (2003), the A1model of resettlement was crafted in the Government of Zimbabwe policy framework of 1998 as settlement on 5 hectares of farmland and the setting aside of 70 hectares of grazing land which is supposed to be communally owned. This model is based on existing communal area set up, where peasants produce for subsistence (Utete, 2003). Model A2 on the other hand was commercial settlement scheme comprising small, medium and large scale commercial farms intended to produce black wealth commercial farms.

Again according to Utete (2003), the land redistribution of the Chimurenga III had chaos, disorder and violence but of special interest are the disrupted production and environmental resources and their management. Trees were the first victims as land hungry Zimbabweans indiscriminately cut wood for fire as a source of energy, for shelter to build small huts code named *tatora ivhu* and cleared land for agriculture. Chimhowu and Woodhouse (2007), alleged that settler households brought with them poor animal husbandry practices that would lead to land degradation in common tenure system. Again Chimhowu and Woodhouse (2007), argues that bringing

together families from different areas destroys the traditional structures that helped in resource conservation management. Moyo (2004), and also noted an increase in natural resource exploitation due to land reform because government lacked sufficient human and financial resources to manage environmental resource and enforce regulations.

2.8.10 Post Fast Track Land Reform

The aftermath of the fast track land reform program has been characterised by both negative and positive implications to the environmental resource. Firstly, Richardson (2008), stated that instead of economically elevating the lower class, fast track land reform has brought more poverty. Poverty has been the sighted as the major causes of environmental degradation (Zembe *et al*., 2014).

Secondly, Jill (2005), stated that the fast track destroyed property rights, the foundation of the economy .Utete (2003), observed that since the inception of the FTLR a new picture emerged with regard to land ownership patterns. Chimhowu and Woodhouse (2008), noted that the land reform program produced an open access system and destroyed a private regime of ownership and land utilisation enshrined in title deeds.

Thirdly, contrary to negative sentiments against FTLR impact, Utete (2003), noted that some of the resettled farmers who grew commercial crops like tobacco, paprika and cotton became instant millionaires after selling their produce. Tobacco however had a negative impact on the forest as most of the farmers used wood to cure their tobacco.

Fourthly, farm workers who joined the high unemployment rate found themselves jobless, landless and without houses. The farm workers tried various livelihood coping strategies which included selling firewood from nearby townships and schools.

2.9 CONCLUSIONS

This chapter commenced with theoretical literature in GIS and remote sensing and proceeded to livelihood income, strategies and forest dependency then socio-economic factors that influence participation and finally incentives that motivate settlers into conserving forests. In the review definitions of GIS and remote sensing,

dependency, willingness to participate and niceties were explained and discussed. A conceptual framework for forest dependency, factors that affect willingness and incentives were outlined and explained. A review of imperical studies on GIS and remote sensing, forest dependency, factors that influences willingness to participate and incentives was presented. The next chapter gives a description of the study area, the physiographic feature, the people, the general infrastructure of the area and the research methodology.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter is in two sections, description of the study area and the methodology. The section preceding this introduction gives an overview of the study area at national, provincial and at District level. The highlights under this section include a description of Zimbabwe's profile, Mashonaland Central Province's profile and Shamva District's profile using the macroeconomic environment, political environment, population levels, employment levels, education levels and infrastructure development parameters. For each of the parameters emphasis will be given to its impact to forest status as illustrated in Chapter one Fig 1.1

3.2 Zimbabwe

3.2.1 Country Profile

The study was undertaken in Shamva District. Shamva District is one of the seven Districts in Mashonaland Central Province. Mashonaland Central province is one of the ten provinces situated in Zimbabwe. Zimbabwe is a land-locked country in Southern Africa. It is lies between the Zambezi River in the north and the Limpopo River in the south. The country is bordered by Mozambique on the east, South Africa on the south, Botswana to the west and Zambia to the north. It is located between latitudes 16030' and 22030' S and longitudes 250 and 330 (Gwaze and Marunda, 2000; FAO, 2007).

Zimbabwe covers an area of 390,757 km2. One-fifth of the country is situated over 1,200 m (highveld), three-fifths is between 600 and 1,200 m (middle veld) and one-fifth is below 600 m in altitude. Most of the country is subtropical except low-lying valleys which experience tropical conditions (Gwaze and Marunda, 2000; FAO, 2007).

The rain season for most of Zimbabwe is from November to March, but along the eastern border rainfall also occurs at other times of the year. In general, the rainfall increases from south to south and with increasing altitude. Areas in the low-veld receive less than 400 mm/year, while those in the eastern highlands increases more

than 2000 mm/year and those in the central watershed increases about 1000 mm/year. Mean annual temperature is 150C at 1,800 mm, 180C at about 1400 m, 230 C at 450 m above sea level. The highest temperatures are experienced in October and November, but when prolonged dry spell occurs, very high temperatures are recorded in December and January (450C has been recorded in low-lying areas). The temperatures are also influenced by soil type. Lowest temperatures are found in very sandy soils that cool more rapidly than clay soils (Gwaze and Marunda, 2000; FAO, 2007).The differences between climatic conditions (rainfall and temperature) and soil types give rise to Zimbabwe agro ecological regions. Zimbabwe is divided into five natural regions and the dominant, determining factor for agricultural production potential and environmental condition is climate mainly rainfall as well as heat and the type of soil

3.2.2 Macro-economic environment and trends

Zimbabwe experienced a macro-economic meltdown characterised by hyperinflation between 2000 and 2008 (FAO, 2012).The Growth Domestic Product (GDP) was severely reduced with GDP down by 40% and the country become a net importer of food.

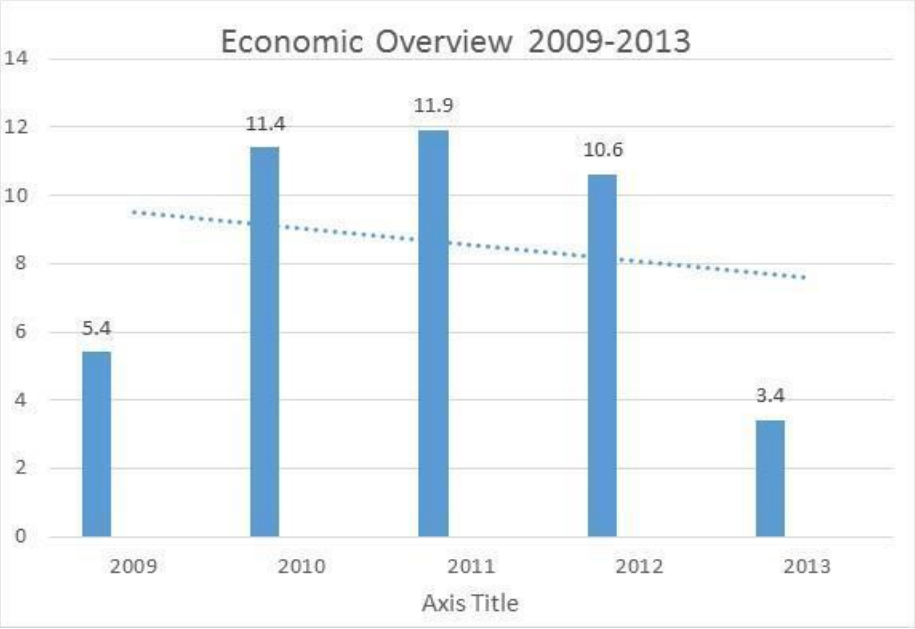


Figure 3.1 Zimbabwe Economic Overview, 2009-2013

Source: ZimVac 2014

As a result of the hyperinflationary environment, 2009 saw the formation of a Government of National Unity which introduced multicurrency system and realised an improvement of national output as shown on Figure 3.1.

According to ZimVac (2014), Zimbabwe achieved a real GDP growth rate of 5.4 % in 2009, 11.4% in 2010, reaching a peak of 11.9% in 2011. The economic recovery has had a growth decline from 11.9% in 2011 to 10.6% in 2012 and 3.4% in 2013 as shown on Figure 4.1 above. (ZimVac 2014; Zim-Asset, 2013).The decline was due to reduced output from industries because of company closures and coupled by reduced output from farms due to drought. The Gross Domestic Product (GDP) in Zimbabwe was worth 10.8 billion US dollars in 2012 which was an increase from the 7.4 US dollars billion in 2011. The maintenance of the multi-currency policy and pursuit of other economic stabilisation and growth policies have ensured macro-economic stability. The inflation is modestly below 5% (Zim-Asset, 2013). This has seen considerable macro-economic stability.

The stable micro-economic environment has seen more beneficiaries of the land reform program venturing into tobacco and other livelihood strategies. Whilst this had a positive impact on food security, there were negative repercussions on the environment as farmers cut down trees for curing tobacco and clearing the ground to dig holes for gold panning.

3.2.3 Political environment in Zimbabwe

The diversified livelihood strategies by communal and resettled households as a result of empowerment through land reform have facilitated a stable environment in Zimbabwe since independence in 1980 up to 1996. However between 1997 and 2009, there was political instability in Zimbabwe because of sanctions which were imposed by Western countries in response to the land reform program. Living standards deteriorated and livelihood standards changed with people migrating for greener pastures oversees and to neighbouring countries. However, as has been stated in Section 3.2.2; Government of National Unity was formed in 2009 between Zimbabwe African National Union (Patriotic Front) (ZanuPF) party and Movement for Democratic Change (MDC). The GNU restored stability and ushered in a new era of multicurrency use in the economy. On the background of national stability and economic growth, ZanuPF worn majority elections of the 31st July 2013.The GNU was dismantled and

the ZanuPF government embarked on The Zimbabwe Agenda for Sustainable Socio-economic Transformation (ZimAsset 2014-2018) economic blue print which was meant to reduce poverty and vulnerability for the populace, and develop environmental management strategies to reduce deforestation, land degradation and veld fires. The blue print intended indigenise the economy and increase employment among other macroeconomic fundamentals.

3.2.4 Employment levels

The increased population of unemployed youth in the resettlement increases pressure on environmental resource as they seek economic rescue. The percentage of communal and resettlement workers was 52 percent in 2012 (Zimstat, 2014). The head of the household and spouse as well as their children were considered as communal resettlement or peri-urban farmers. The 'other' employed category was 36 percent (Zimstats, 2014).The economically inactive population was distributed as follows; 48 percent were students, 18 percent were home-makers and the retired/sick/too old and others categories contributed 32 percent (Zimstat, 2014).This sector again had negative natural resource use implications as explained in Section 3.3.

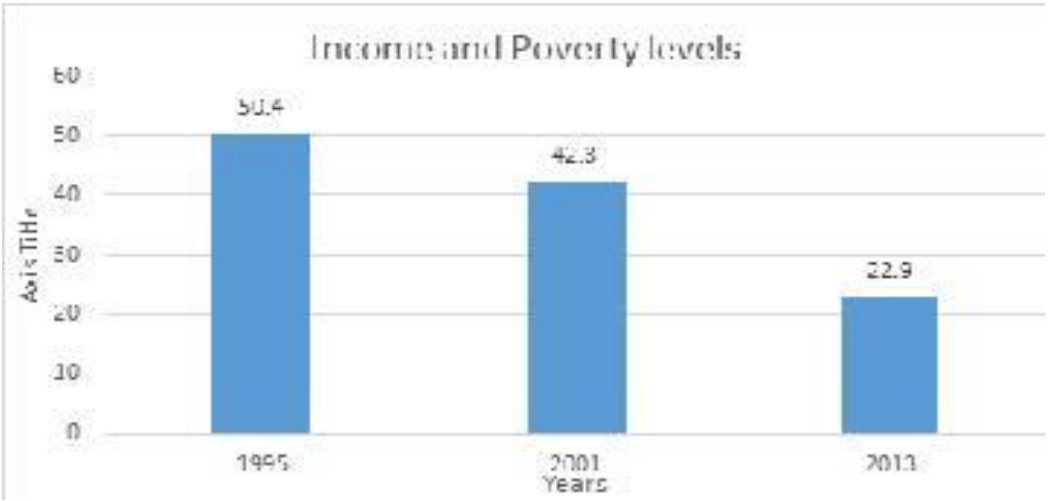


Figure 3.2 Income and poverty levels in Zimbabwe 1995 to 2013

Source: ZimVac 2014

ZimVac (2014) stated that the prevalence of poverty in Zimbabwe was estimated at 63% with 16% estimated to be in extreme poverty. Poverty is more widespread in rural households (76%) compared to the 38% in the urban areas. A total of 30% of the rural

people are extremely poor compared to 6% in urban areas. The proportion of extremely poor rural households was 22.9%, this fell from 50.4% in 1995/6 and 42.3% in 2001 (Zimstat, 2013). The prevalence of poverty in Zimbabwe's rural communities will force the rural poor to turn to natural resources as a safety net and worse with an increased population.

3.2.5 Population distribution and population density

The estimated population of Zimbabwe is 13061239 million (Zimstat, 2012). The population growth rate is 1.1% a year. The household size is 4.3 children per family. The rapid population growth puts intense strain on natural resources. Table 3. 1 shows the relationship between land areas under different tenure categories, population density, farming potential and woodland area in the different tenure-systems in Zimbabwe. The table indicates that the majority of the population in Zimbabwe is in rural and resettlement areas and this is an indication of adverse impact on woodland resources.

Zimbabwe's population density is 33 people per square kilometre (Zimstat, 2012). The population density is a significant determinant of the importance of environmental resources to the resettlement folk in that the higher the population density the less common land will there be to support environmental resource (Cavendish, 2003). In comparison with other countries in Africa, the population density in Kenya is 34.6 ,Ghana is 49.0, Nigeria 75.0 ,South Africa, Botswana, Angola, Zambia is 113 and in Malawi 162 persons per square kilometre. Population density in Zimbabwe is low but however is a worrying factor considering the high pressure on forest resources due to the resettlement program.

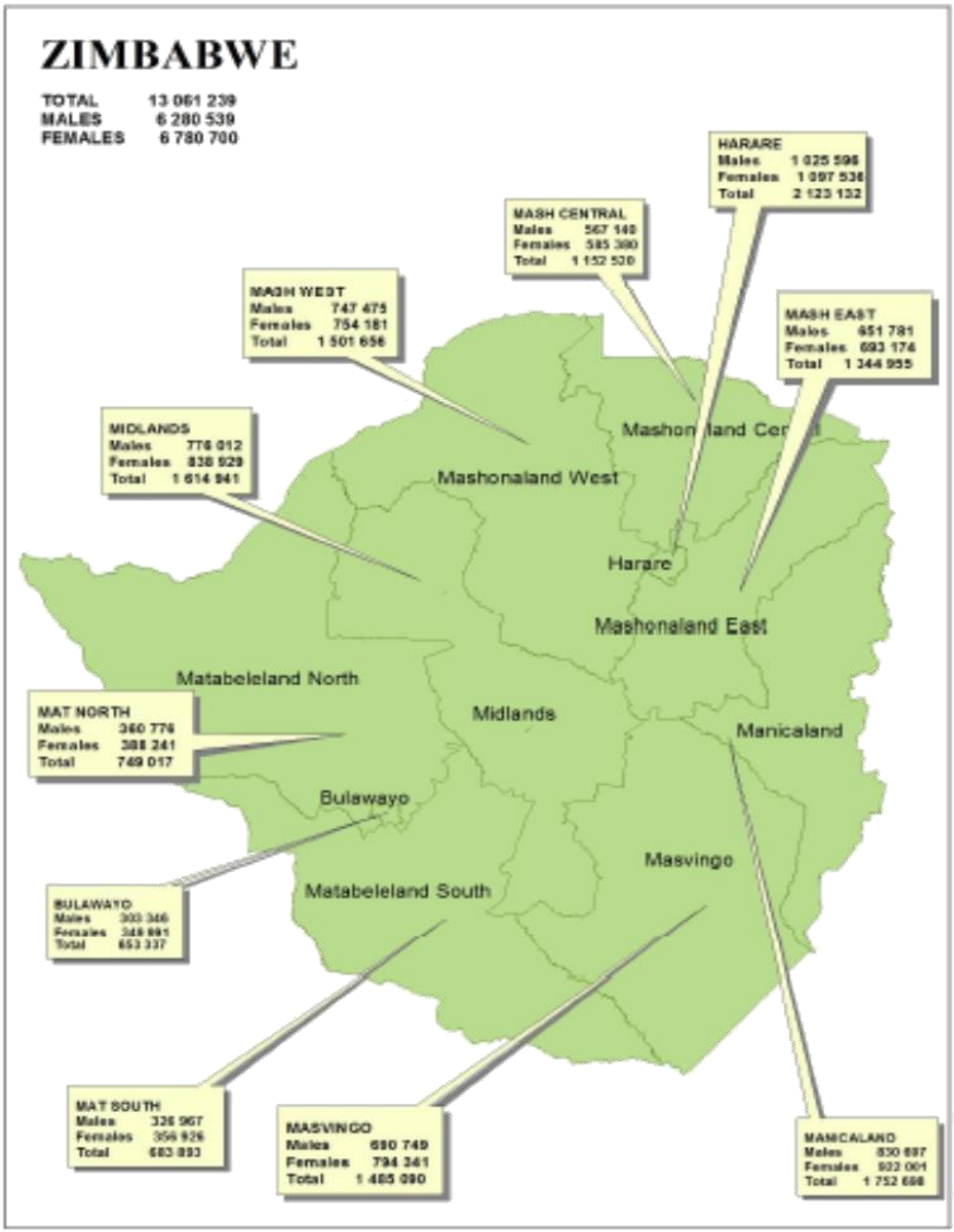


Figure 3.3: Zimbabwe population distribution and density.

Source: Zimstat Census report 2012

3.2.6 Infrastructure Development

Infrastructure development impacts on indigenous resource conservation either positively or negatively. The infrastructure elements which will be considered in this section are: water and sanitation, ICT access, irrigation facilities, road network, access to markets and access to electricity.

3.2.6.1 Water and sanitation

According to ZimVac (2014), 70% of the households in Zimbabwe have unimproved water sources and 30% have improved water sources. ZimVac stated that improved water sources include piped water into dwelling or yard, borehole, protected well, protected spring, water trucking and bottled water. Unimproved water sources include unprotected wells, unprotected springs and surface water. Improved household water sources reduce water borne diseases and promoted a healthy community which is likely to participate in forest conservation activities.

Just like water, improved sanitation facilities also improve the health of communities and enhance their ability to participate in forest conservation activities. ZimVac report (2014), stated that 39% of households have improved sanitation, 13%have shared improved sanitation and 10% have improved and another 39% are vied as open defaecation. The same organisation defines open defecation as defecation in fields, forests, bushes, bodies of water or other open spaces, or disposal of human faeces with solid waste. Unimproved sanitation facilities are facilities that do not ensure hygienic separation of human excrete from human contact. Unimproved facilities are viewed as pit latrines without a slab or platform, hanging latrines and bucket latrines. Shared sanitation facilities are sanitation facilities of an otherwise acceptable type shared between two or more households. Shared facilities include public toilets. Improved sanitation facilities are facilities that ensure hygienic separation of human excreta from human contact. They include flush or pour-flush toilet/latrine, Blair ventilated improved pit (VIP) latrine, pit latrine with slab, composting toilet and upgradable Blair Latrine.

3.2.6.2 ICT access

ICT empowers the resource poor farmers with up to date knowledge and information about agricultural technologies, best practices, markets, sources of finance, weather,

soil conditions and the environment (Singh, 2006)..The ICT instruments for the farmer are radio, TV, mobile cellular telephone, desktop computer, Internet and laptop.

Table 3: 1 Distribution of Households With access to Radio, TV, Mobile Cellular telephone, Desktop computer, Internet, laptop at Home Classified by Land Use Sector.

Land Use	Radio	TV	Mobile	Computer	Internet	Laptop
Number	Percent	Percent	Percent	Percent	Percent	Percent
Communal	41.0	17.9	42.7	12.3	22.8	15.6
Urban Council	38.7	67.6	38.2	79.2	69.8	74.5
A1 Farms	8.1	4.7	7.5	1.3	4.2	1.5
A2 Farms	2.9	2.3	2.6	1.5	2.0	1.7
Old	3.3	1.7	3.3	0.9	1.7	1.3
National	100	100	100	100	100	100

Source: ICT Household Survey 2014, Zimbabwe

At national level, the proportion of households with a radio was about 61%, 40% of households had television at home. The proportion of households with a fixed telephone line at home is 3%; however 89% of household had at least one member with a mobile cellular phone. About 90% of household received network coverage with a radius of less than 500m ZimVac, 2014.The distribution of access of these ITC gadgets by land use sector Table 3.2 below show that overall the resettlement farmers (A1,A2 and Old) have good access to ICT gadgets. This could have a positive impact on dissemination of up to date information on forest conservation.

3.2.6.3 Irrigation facilities

The smallholder irrigation subsector in Zimbabwe was considered to be of little socio-political significance since its economic contribution was low (Nhundu, 2013). However it has since increased from 10% to 25% since the fast track land reform program incorporating the new models A1 A2 and also the Old resettlement Utete, 2013.

Table 3.3 below shows the proportion of wards with irrigation schemes by province in Zimbabwe. Matabeleland South had the highest with 39% and Mashonaland had the lowest with 9%. ZimVac 2014 report stated that of the wards with irrigation schemes, 44% were functional, 13% were partly functional while 43% had non-functional

schemes. Irrigation schemes improve agricultural productivity and crop income and so reduce dependency on forest resources.

Table 3.2 Proportion of wards with irrigation schemes in Zimbabwe provinces

Province	Proportion of wards with irrigation schemes
Mashonaland Central	19
Manicaland	28
Mashonaland East	26
Matabeleland North	10
Matabeleland South	39
Midlands	23
Masvingo	23
Mashonaland West	9
National	22

Source: ZimVac 2014

3.2.6.4 Road network

There are 88 100km of classified roads in Zimbabwe shown in Figure 3.2,of those ,17 400km of the roads are paved and the remainder is either earthed or unpaved gravel (Zimbabwe report, 2013).The roads are classified as primary, secondary and tertiary. Primary roads according to the Zimbabwe report (2013), link with its neighbours and are responsible for the country's import and export as well as transit freight. The primary roads constitute 5% of the road network. This road network is maintained by Department of Roads (DoR) in the Ministry of Transport.

Secondary roads link the main economic centres with the country and this enables internal movement of people and goods within the country. Again the network is maintained by DoR. Meanwhile tertiary roads link rural areas to the secondary road network. They link rural communities and resettlement areas to social economic amenities such as schools, health centres, markets and enable government services to reach rural centres. They constitute 70% of the products which include local shops, contracting company, local markets, GMB, private traders and other households in the same area.Zimstat2014 reports that most households sell cereals to other households in the same area. Firewood and other forest products could face the same pattern

which exposes farmers to exploitation and increases the dependency on forest products. Remaining 9% of the road network are urban roads managed by urban council.

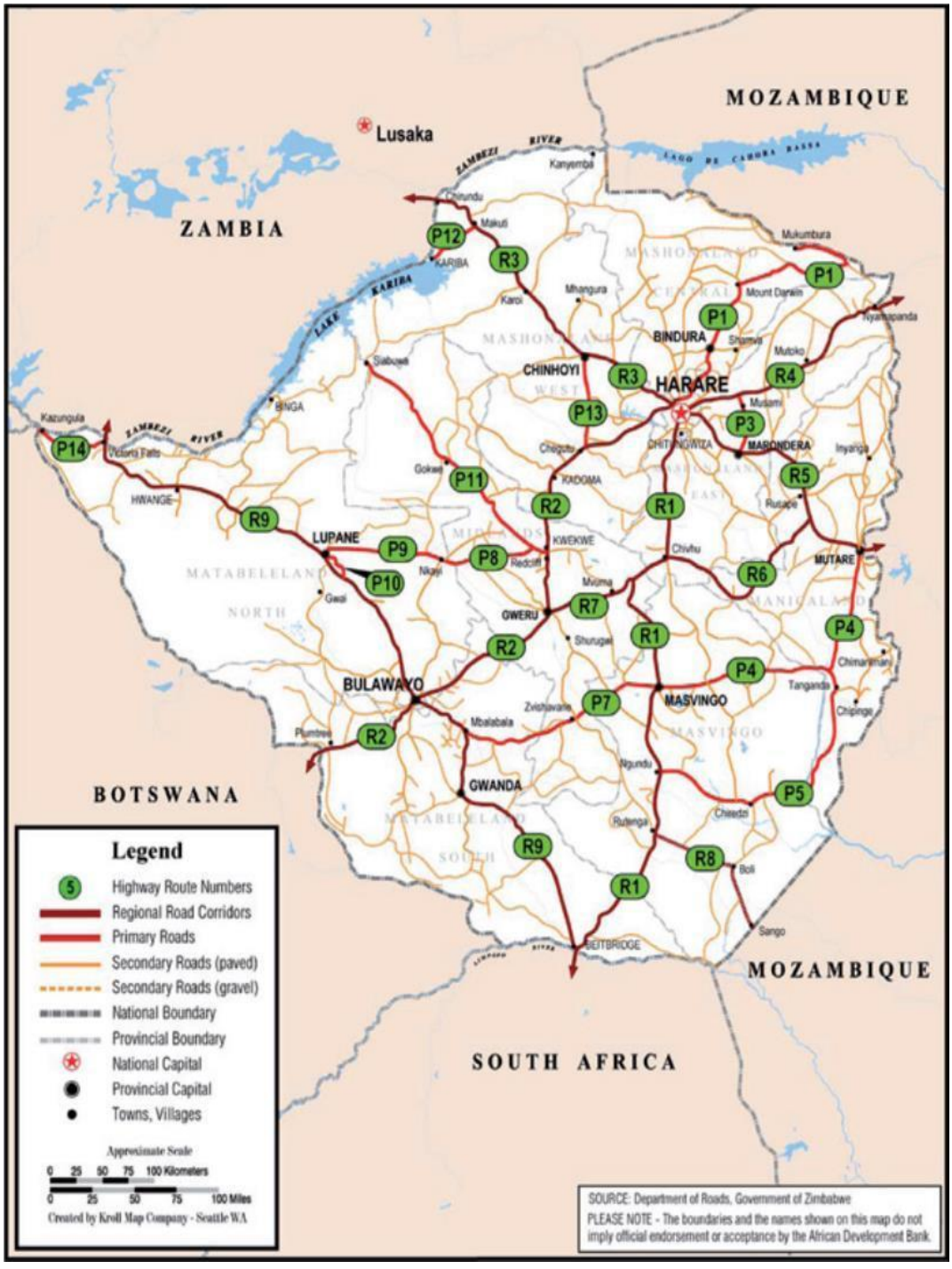


Figure 3.4 Map of Zimbabwe showing the Road Network

According to the World Bank report (2014), the condition of the roads declined significantly since 2000 as a result of lack of funding for routine and periodic maintenance. The report stated that both primary roads and urban roads had relatively

good roads and 25% remained poor while both secondary and tertiary roads had 45% each that remained poor and needed attention.

Road density in Zimbabwe is 0.23km/square km. This is higher than many developing countries implying that a higher proportion of the population has access to the road network. Also, Zimbabwe is estimated to have a fleet of 828 395 vehicles meaning 48 people in every 1000 have a motor vehicle. The well organised network in Zimbabwe, high road density and increased fleet of vehicles has a negative implication to forest resources since they become easily accessible and exploited. The poor road condition however, might reduce the rate of exploitation but the increased unemployment and poverty sighted earlier on Section3.2.6.4 and 3.2.6.5 mitigates against its favour.

Access to electricity

Table 3.4 shows the results of the survey that was carried out to establish the percentage of distribution of households within land use sector with or without access to electricity. In the survey urban areas had the highest proportion of about 50% of households with access to electricity followed by communal areas with 30%. In the resettlement category, A1 resettlement had the highest of only 6.5% followed by Old resettlement with 3.0% and A2 having the least 2.7% household with access to electricity. The survey indicates that there is a possibility of a high dependency on forest resource as a source of energy in resettlement areas because the majority of households have no access to electricity

Table 3.3 An ICT survey of Zimbabwe

Land Use Sector	**Households With Access**		**Households Without Access**		**Total Households**	
	Number	Percent	Number	Percent	Number	Percent
Communal	618 968	31.8	866 130	66.8	1 485 098	45.8
A1	125 957	6.5	128 200	9.9	256 157	7.8
A2	51 825	2.7	34 339	2.7	86 164	2.7
Old	58 239	3.0	53 792	4.2	112 031	3.5
National	1 947 993	100	1 295 778	100	3 243 770	100

Source: Zimstat 2014 ICT Survey for Zimbabwe..

3.2.7 Education levels

Zimstat (2012) stated that 89% of the total population aged 3 years and above had never been to school in the province. Of the population which had been to school there were more males than females. Of the 89% who had gone to school, 30% had completed secondary education and above. However, 96% of those aged 15 years and above were literate (Table 3.5). Males and females had about similar literacy rate from age 15 years to 39 years and thereafter the female literacy rate were lower than males. Literacy rate also declines with age.

Table 3:4 Literacy Rates for the Population Aged 15+ by Province and by Sex, Zimbabwe 2012 Census

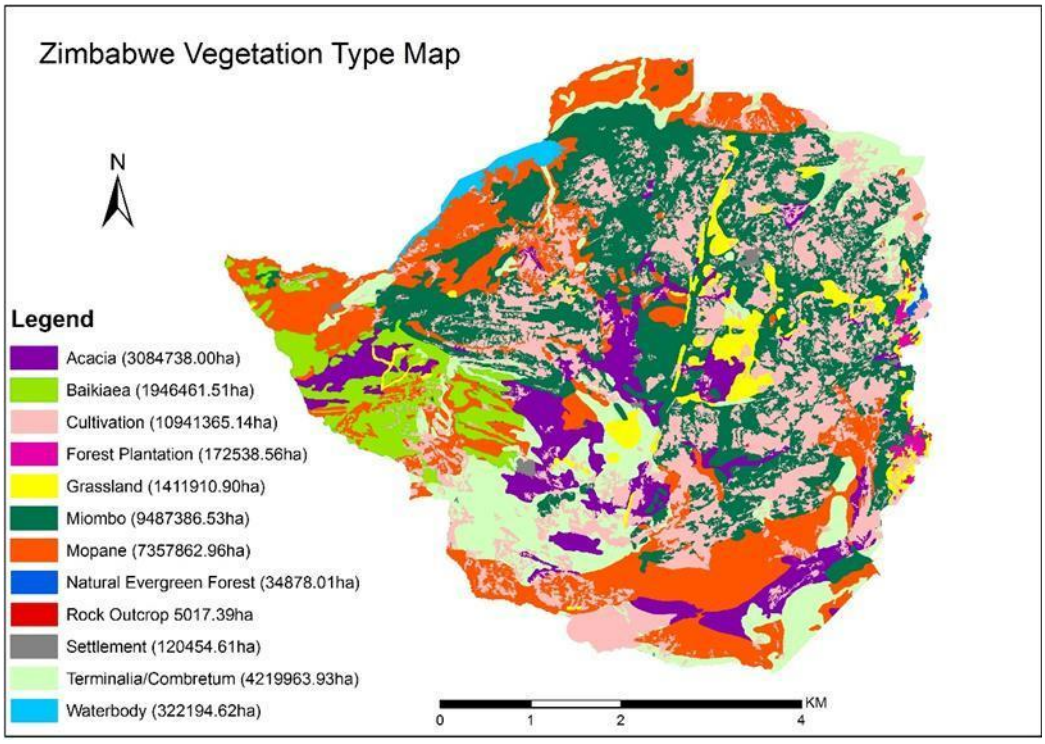
Province	Literacy rate		
	Male	Female	Total
Bulawayo	99	98	98
Manicaland	97	94	96
Mashonaland Central	96	94	92
Mashonaland East	97	95	96
Mashonaland West	97	95	96
Matebeleland North	95	92	93
Matebeleland South	96	94	95
Midlands	96	94	95
Masvingo	96	93	95
Harare	99	98	97
Total	97	95	96

Source: Zimstat, 2012

Forest Network Zimbabwe (2014), stated that education provides products that come out of school with an appreciation of packaging and delivery of forest conservation. As such education has a likelihood of positively enhancing forest participation in conservation of indigenous tree in resettlement areas.

3.2.8 Extent of forest resources

The forest (both natural and plantations) and woodlands in Zimbabwe cover about 66% of the total land area of the country (39 million ha) (Table3. 2). The majority of indigenous woodlands are situated in communal areas and the Old, A1 and A2 resettlement areas where they are traditionally exploited for fuelwood and pole supply. There is a decline in woodlands mainly due to clearing for agriculture, and partly due to fuelwood and pole collection, infrastructural development and overstocking of domestic animals. Approximately 100,000 ha are cleared annually (Gondo and Mkwanda, 1991). Most forest cover is in the gazetted state forests, Old, A1, A2 (former white commercial areas) farming areas and the eastern highlands of the country. (Gwaze and Marunda, 2000; FAO, 2009)



Source: Forest Commission

Figure 3.5 Forest vegetation types of Zimbabwe

The indigenous woodlands and bushlands of Zimbabwe can be divided into 5 types (Bradley and McNamara, 1993).The Miombo woodland is dominated by Brachystegia spiciformis in together with Julbernardia globiflora. It covers most of the highveld at altitudes above 1200 m. The woodland is normally associated with sandy soils. Mopane woodland is characterised by the species Colophospermum mopane and

occurs at low altitudes below 900 m, where the climatic conditions are hot and dry. The woodland is normally associated with clay soils. Teak Woodlands are found on the aeolian Kalahari sands in the north west of the country. The woodlands are characterised by Baikiaea plurijuga which grows in association with Pterocarpus angolensis and Guibourtia coleosperma mainly. These species are the main sources of commercially exploitable timber. Acacia woodlands are dominated by various acacia species, depending on soil type. Terminalia combretum woodlands are characterised by Terminalia sericea and Burkea africana species (Gwaze and Marunda, 2000; FAO, 2007).

Indigenous forests of Zimbabwe

Indigenous woodlands are very extensive. The woodlands are divided according to tenure system into communal areas, resettlement areas and gazetted state forests. The communal areas and the resettlement areas woodlands provide rural households with firewood, merchantable timber, construction timber, browse, fruits, medicines, mushrooms, bark and many other non-timber products. The woodlands are severely degraded due to over-exploitation as a result of high population growth, insecurity of tenure (communal ownership), agricultural expansion and conflicting land use policies. (Gwaze and Marunda, 2000; FAO, 2007).The resettlement areas were once commercial farms and were endowed with tree resources. Because of population influx into these areas, the resettlement areas woodlands are now experiencing high rates of deforestation as land is cleared for farming, construction and firewood. The woodlands found on state land and a few left white commercial farms are fairly intact as the demand for forest resources (e.g. firewood) is low when compared to the communal areas and the resettlement areas woodlands (Gwaze and Marunda, 2000; FAO, 2007).

Forest resource utilisation, protection and conservation are a result of the governance of forest and woodland resource of an area. Forest and woodland resources in the resettlement areas of Zimbabwe is managed through formal (mainly government institutions) and informal institutions (largely local and community based institutions). According to Mukwada (2006), the challenges inherent in community based natural resource management in the resettlement areas are twofold: firstly they evolve from the multiple institutions that have emerged as a result of the resettlement program

which have conflicting roles as a result of a diverse and stratified community and secondly the legal framework that is incompetent to support management of indigenous forests as stated in Chapter 1.

3.2.9 Governance of forest and woodland resource use inA1, A2 and Old resettlement areas of Zimbabwe.

Figure 3.6 Resettled villagers at a Village development committee meeting.

The formal institutions which are responsible for the management of indigenous forests include the Ministry of Local government, department of natural resources, Forest commission and Environmental Management agency. The provincial administrator and the District officers are responsible for coordinating other government departments within the resettlement scheme. The activities for those formal and informal included those to do with health, education, roads and building construction, farming and forest resource management. Resettlement officers oversee land allocation activities including issues to do with forest monitoring, utilisation and protection. However these officers are not conversant with forest issues and rely on expertise from Forest commission, EMA and natural resource management department from council. Other government related institutions thus include Forest commission, department of natural resources, AGRITEX and EMA. However these institutions are underfunded, poorly staffed with under qualified personnel, lack transport and face community apathy. The approach is also top down as technocrats direct programs and policies which have been drafted by central government.However

the challenges highlighted apparently exposes the formal sector as incapable of fulfilling its mandate and thus unable to manage indigenous forests making the informal sector as the only substitute.

The informal sector is comprised of traditional and local institutions. Traditional institutions include chiefs, spirit mediums and herbalists whilst local institutions involve VIDCO, WADCO and RDCs. The role of these institutions in CBNRM has been widely documented (Murphee and Cumming,1993; Mukamuri,1995; Mukwada, 2006; Cavendish, 2003).

Mukwada (2006), stated that historical links between pre-colonial chiefdom and areas that they were displaced from during colonisation, the natural resources in the resettlement schemes are generally considered as jurisdiction of the displaced lineage that are now in the communal areas. Chiefs and spirit mediums are thus custodians of all land reform beneficiaries in the resettlement scheme. This is manifested in the eco-religion beliefs in the resettlement area such as traditional shrines, sacred places for traditional ceremonies, such as fertility rituals, rain making and rest days, planting days and harvest days. Transgressing the rules of the chiefs will meet full wrath of the law such as ox/goat/cock fine, face drought and crop attack by wild animals. As a result this promoted forest protection and sustainable use of forest resources. However, the informal sector (eco-religion) as a method of natural forest conservation faces several challenges that threaten their effective implementation: firstly the proliferation of Christian sects in all the parts of the resettlement scheme promotes Western values and beliefs and dilutes traditional institutions. Secondly, the coexistence of different tribes in the resettlement scheme(Zezurus, Korekore, Manyikas, Karangas, Malawians, Mozambicans) brings different taboos ,bylaws, customs, traditions, norms, values, rules and regulations which are difficult to harmonise (Campbell 2002; Kayambazinthu *et al*., 2001), Campbell and Shackleton 2002).However, despite their weakened state, traditional institutions such as chiefs and spirit mediums still play a recognised role though the roles are not so conspicuous in resettlement areas (Mukwada, 2006).

Local institutions that control resources in Zimbabwe resettlement areas are made of village development committee, ward development committee, rural District development committee and the provincial development committee. Matyszak (2010),

stated that VIDCOs are chaired by a village head also known as a chairman as promulgated in the Traditional Leaders Act of 1998.

The village committee is comprises of all village members above 18 years. The WADCO consists of all VIDCO chairman and ward councillors and is chaired by an elected member of their own. The Rural District development committee is headed by the District Administrator. The committee is composed of the DA, Chairman of Council, Chief Executive Officer of Council, senior officers of ZRP, ZNA and CIO, the head of each ministry in the District and members representing other organisations in the District such as FC, EMA, GMB, etc. The provincial development committee consists of PA, town clerk and town board members, senior provincial officers of ZRP, ZNA and CIO, provincial head of each ministry in the province and any member of an organisation of interest to the governor who chairs the committee.

The control of natural resources at grassroots level in the resettlement thus rests with the VIDCO chairman. The VIDCO chairman however faces many challenges as narrated by Mukwada (2006), Matyszak (2010) and Centre of Conflict Management and Transformation (2014): firstly since VIDCO chairman is appointed , those opposed to the appointment and strict control of resources accuse the chairman of lack of patriotism and allegiance to opposition parties; secondly, the chairman might find it difficult to deal with offenders since EMA act and Forest Act do not give the chairman jurisdiction; thirdly, chairman, by nature of being appointed might be merely executing the mission of those who appointed him/her and not serving the interest of the constituency including forest protection; the authority of the chairman has been rendered powerless in some cases and therefore unable to protect natural resources. Lastly village chairman may also have difficulties in harmonising their traditional roles and those of the local government structures. Therefore, since VIDCOs are ineffective in controlling resources at grass root level, it follows that WADCOs and RDCs are also incapacitated since these rely on VIDCOs for their administrative execution in terms of Rural District Act, Traditional Leaders Act and the EMA act. Thus the local institution system in the resettlement areas find it difficult to control resources since there are no set parameters for organs that are purported to be responsible for managing these resources. Conclusively, the legal instruments mentioned in Chapter 1 attempt to regulate indigenous forest utilisation and conservation in the country. As mentioned

earlier in this section, the provisions have their shortcomings which render them ineffective and those are elucidated to brief below.

The Traditional Leaders Act (TLA)(Chapter 29:17) number 25 of 1998 stated that one of the duties of village leaders is conservation of natural resources in areas that fall under their jurisdiction. However the TLA does not give the village chairman the power to prosecute offenders as the power to do so rests with the Minister of Environment through EMA act, which if followed is too in cumbersome and erroneous. Instead, the TLA ln section12 (2) stated that:

…. *no village head shall purport to exercise power or authority by himself or through a village assembly or other local institution, except in accordance with the act.*

Whilst the provisions of the EMA act of 2002 spell out excellent intentions of indigenous forest use and management, the same act specifies the need for an EIA in the event of any conversion of forest land to any other use. However, no AIE has ever been done in Zimbabwe for the sake of clearing land for ploughing or settlement. Besides, the villagers are not aware of act provisions as regards to AIE.

Natural Resource act (NRA) of 1941 was promulgated to guard against use of certain tree and animal species considered rare. However, because of lack of effective enforcement organ as discussed earlier on in Section 3.2.2 the communities continue to exploit the timber for construction purposes willy nilly. Besides, there are no provisions made for incentives for lack of use.

The Communal Land Act of 1982 and the Rural District Act of 1988, assigned power for control over land and resources to RDCs and the Minister of Environment instead of devolving rights and authority to traditional leaders so as to enable them to sustainably control use of their own resources. Jones (2004) also argue in support of this assertion by stating that if a resource is vulnerable and inhabitants have exclusive rights to use and benefit from the resource then the resource could be used sustainably. Mukwada (2006), sighted CAMFIRE as one of such success projects where devolution has been successful in CBHRM in Zimbabwe.

As mentioned earlier on in Chapter 1, that The Forest Act of 1948 empowers the Forest Commission, to monitor the state of vegetation in all parts of the country including

resettlement schemes. However, the unfair situation is due to the fact that Forest Commission lacks the capacity to fully discharge of its designated roles and functions

The Natural Parks and Wildlife act of 1975 protects certain indigenous forest resource and other wildlife resource which can only be accessed through the permission of RDC after having been granted permission from the Minister of Environment. However, the number of species was not drawn from the stakeholders who the communities felt were essential for their survival because they act as safety nets especially during drought. Traditional leaders, therefore become onlookers in the destruction of tree species that they consider essential for sustenance of their livelihoods.

The communal Land Forest Act of 1928 forbids unlicensed trade in forest products that emanate from the communal areas. The Act clearly stated that the products originate from communal areas and not resettlement areas therefore omit control of use and management of these products in the resettlement areas. The act also omits incentives as it forbids use of these products .Unfortunately the settlers are not aware of the legislative instrument. In which an equally perplexed issue is that an account of the Zimbabwe legislature which deals with conservation of indigenous forest reveals certain short comings and renders them ineffective in empowering village heads to assist in controlling deforestation in resettlement areas.

3.3 Mashonaland Central Province

3.3.1 Province profile

Shamva District, which is the focus of the study, is in Mashonaland Central Province. Which is one of the ten Provinces in Zimbabwe as shown in Figure 3.7 below.

Figure 3.7. Map of Mashonaland Central

Mashonaland Central Province is traditionally well known for agricultural output. The high rate of agriculture production is attributing to favourable temperatures, good rainfall and size (ZimConsult, 2004).It has an area 28,347 km². Mashonaland central is divided into seven Districts namely Mt Darwin, Shamva, Guruve, Mazoe, Bindura, Muzarabani and Rushinga.

3.3.2 Economic activity

The main economic activity in Mashonaland central province is farming as most of the people live in rural areas where formal employment opportunities are minimal (Musemwa, 2011). The main crop grown in the province is maize due to the fact that it is the sample food for Zimbabwe (Utete, 2003).The average maize production is 468.5kg/household (ZimVac, 2014). Other crops grown in the province include cotton, tobacco, groundnuts, soya beans, wheat and sorghum. Amongst the small scale farmers, maize, groundnuts, sweet potatoes and cotton are the most grown crops. The production of tobacco in the province has an effect on indigenous forests as wood is used for curing the crop. Also the low household yield on maize has a negative effect

on food security which is likely to affect forest resources as families turn to them as a safety net in times of hunger.

Livestock production is also a major farming activity in the area and the main livestock enterprises in Mashonaland central regions include cattle, poultry, pigs and goats (Musemwa, 2011). Following a series of droughts over the past two decades in Zimbabwe, the livestock sector has suffered a major setback. Drought has effect on forest resources in that besides its physiological effects on the trees, farmers cut trees to provide forage for livestock and sell firewood to sustain livelihood Most small scale farmers produce cattle and goats using the extensive production system.

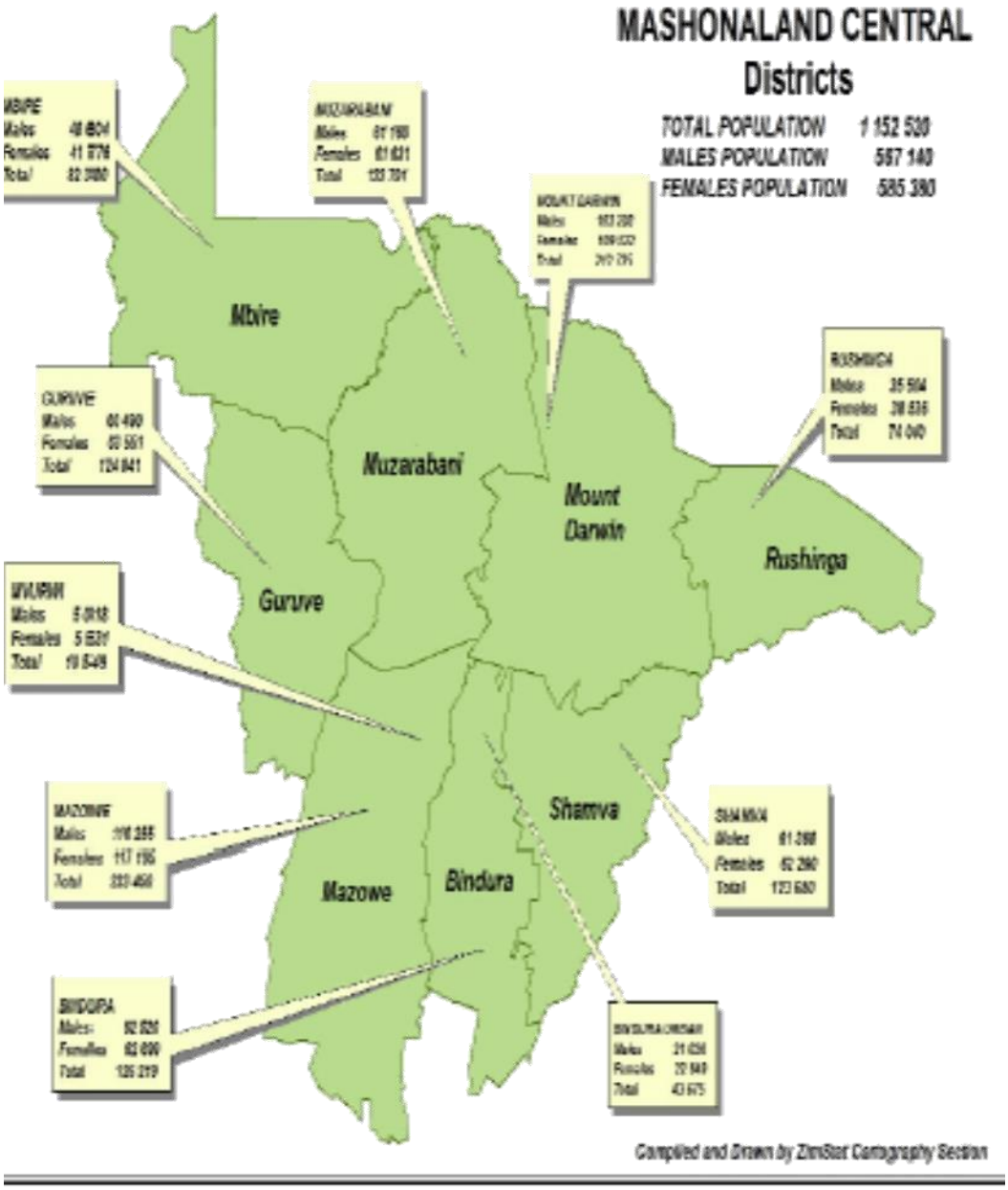
Besides farming, there are well established mines in the District like Madziwa and Shamva. Residents also practice gold panning. This has an effect on forest resource as gold panners recklessly cut trees to dig holes in search of gold. Tourists' attractions like Mana pools and Mufurudzi Game Park attract tourists and generate income for the District.

3.3.3 Employment

Mashonaland Central Province has 644730 labour forces actively participating (Zimstat, 2012). Of the active labour force, 69.8% are own account workers in the communal and resettlement areas (farmers), 8.4% are also own workers (other activities) and 0.8 constitute own contribution to family. Only 7.9 %are permanently paid employees and 8.5% are casual workers (Zimstat 2014).This implies that the majority of the workers are farmers who are dependent on the natural resources.

3.3.4 Population

. The population of Mashonaland Central is 1139940 which represent about 8.8% of the Zimbabwe population. The annual rate of population growth is 1.3 % which above the national growth rate of 1.1%.reason behind this may be because the resettlement program has had an influx of people from other provinces into the province because of its good rainfall and soil type. The population density is 40 persons/km2. Again this is above the national average of 33 persons /km2. Again this brings pressure to the natural resources.



Source: Zimstat 2012 Census report.

Figure 3.8 Mashonaland Population Census

3.3.5Topography and soil type

Mashonaland has a flat and undulating terrain. However some Districts such as Mt Darwin and Centenary are mountainous and fall in the Zambezi valley which is a low lying area (Musemwa, 2011). The soil types vary from sandy loams to clays. Similarly soil fertility varies from place to place. Low lying areas such as the Zambezi valley

tend to have deep clay soils whilst high areas such as Shamva South have shallow sand soil which allows tobacco production (Mathende, 1999). In terms of agricultural production, the soils are not much of a limiting factor since crops grow well in both heavy and light soils (Musemwa, 2011).

3.3.6 Climate

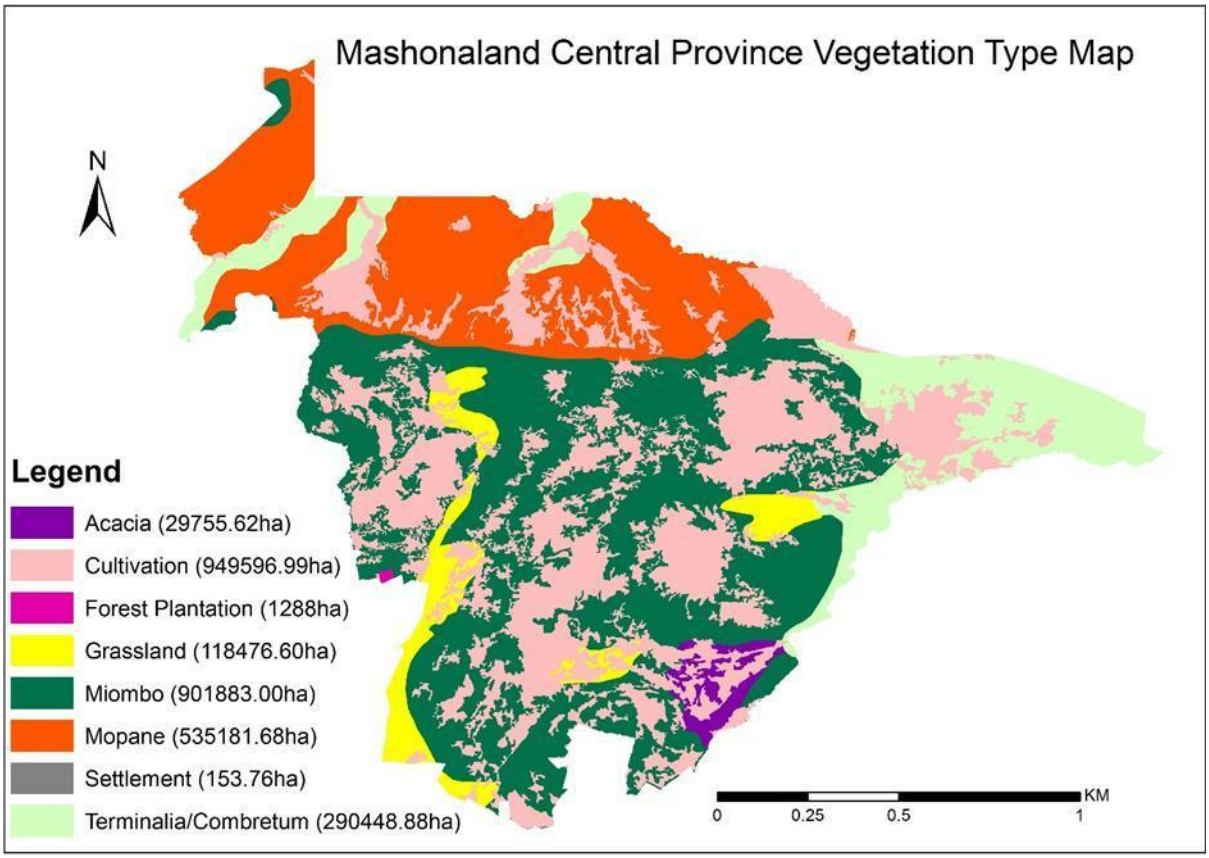
3.3.6.1Rainfall

Majority of Mashonaland Central is confined to agro-ecological region II, which is good for cropping and intensive livestock production. The summer rainfall is moderately high (750-1000 mm) in this region (Anderson, 1993; Campbell, 2003). The province also has some small portions falling in regions III and IV which are good for semi-intensive farming and semi-extensive farming respectively (Utete, 2003). Natural region 111, rainfall is moderate (650-800 mm) and region IV is found on the part of the province where Zimbabwe borders Mozambique. Rushinga is the only district in the province that does not have commercial farms as it lies in region IV. Rushinga experiences fairly low total rainfall (450-650 mm) and is subject to periodic seasonal droughts and severe dry spells during the rainy season.

3.3.6.2Temperature

Temperatures vary according to area. Generally annual temperatures tend to rise with latitude and summer temperatures can rise to more than 37 degrees Celsius in the Zambezi valley (Mathende, 1999). Winters are generally cool to warm and dry. Droughts and floods are common in Mashonaland Central. In the Zambezi valley, floods which are as a result of heavy rains are also a common feature especially in Muzarabani area. Households in this area have developed livelihood strategies as safety nets against drought and floods which again impacts negatively against natural vegetation.

3.3.7 Vegetation type



Source: Forest commission

Figure 3.8 Vegetation types of Mashonaland Central

Mashonaland province has the following species as shown on Figure 3.8: Acacia, Mopane and Miombo. Miombo species are dominant with over 90 1883.60 ha central province and down south whilst Mopane 29755.62 also dominant up north.

3.3.8 Infrastructure development

According to census information Zimstat (2012), 67% of the population in the province have access to clean water. As compared to ZimVac (2014), which stated that 74% of the population have water facilities. Meanwhile the same source Zimstat (2012), stated that 75% of the population had toilet facilities while ZimVac (2014) has 61% as the population with toilet facilities. .As regards to energy source, census reports that 85% of the population use wood for cooking whilst 20% have access to electricity.

3.3.9. Education

Zimstat (2012), census report states that 14% of the age group 3- 24 years have never been to school whilst 56% of the age group has been attending school by the time of census and 31% of that age group left school. The province had 37% of the population age 23 years who had completed secondary education and above, However; more females (52%) had completed primary education than males (48%) while more males (55%) than females (45) had completed secondary education and above. The literacy rate in the province is 86% of those aged 15 years and above with males and females having similar literacy rates. However those between the ages 15-39 years had the highest literacy rate of above 90% hence literacy rate declines with age in the province.

3.4 Shamva District

3.4.1 District Profile

Shamva District is one of the seven Districts in Mashonaland Central province (Figure 3.6 and Figure 3.9. The elevation of the District varies from 450 to 8091 m above sea level. It is about a 100km north of Zimbabwe's capital city, Harare. Its coordinates are 17o 100' 0" S and 31040'0" DMS.

Shamva District was purposively selected because it contained the research interest and substance. Firstly it is one of the Districts with all the models of land reform in Zimbabwe, that is, A1, A2 and old resettlement. Secondly the District is an emerging giant in agriculture especially tobacco. Besides tobacco there is rampant illegal gold mining in the District. Both agriculture and mining are drivers of deforestation.

Thirdly, the District is richly endowed with Miombo species (Mutondo, Mupfuti, Musasa) which are good sources of firewood for domestic use, curing tobacco, brick moulding and construction of houses and structures. Fourthly, some of the resettlement farmers border with Mupfurudzi Game Park which is endowed with fauna and flora.

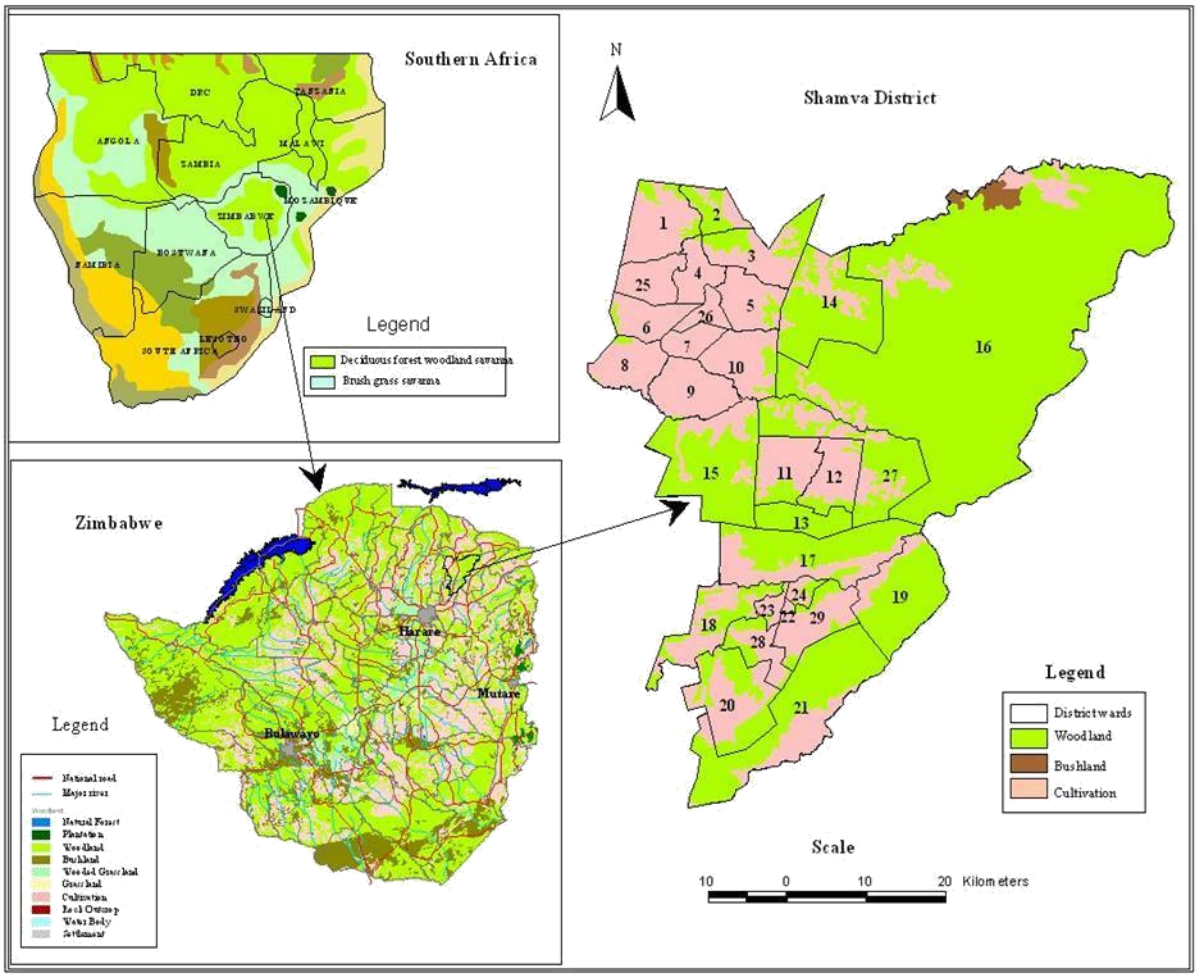


Figure 3.9: Map of Shamva District

3.4.2 Economic activity

The main economic activity in the areas is farming and illegal gold panning. The main crops grown include maize, tobacco, cotton, groundnuts, sunflower, soya beans, sweet and Irish potatoes and small amounts of small grains. The farmers also keep cattle, goats, sheep, pigs and a variety of poultry breeds (Mathende, 1999). The main reason for practising agriculture is for family consumption. Excess produce is sold to meet other household requirements which include payment of schools fees, purchasing of clothes and other food items.

3.4.3 Employment

The percentage of the population who are economically active in Shamva District is 97% (Zimstat Census report, 2012). The same report stated that the unemployed

persons in this category is 2.3%.The majority of the employed persons are in the agricultural sector 56.5%, with14.9% in the small scale and large mining sector(Shamva and Madziwa mines). The rest are in the service sector 9.8%, education 1.8 and other sectors of the economy (Zimstat, 2012).A larger proportion of employed persons in the agriculture sector puts pressure in forest resource as the majority of farmers use these resources for production and construction purposes.

3.4.4 Population

According to the Census 2012 report, the District has a population of 119 530 people of which 59431 are males and 60099 are females. The population in the District is subdivided into 29 wards. The 29 wards have 3962 households that benefited from the Zimbabwean government land reform program (Lands Report, 2013). There are 2320 A1 land reform beneficiaries, 139 A2 beneficiaries and 1503 Old resettlement beneficiaries in the District. Part of the District is the communal area and there are only two white commercial farmers remaining in Shamva District (AGRITEX Report, 2013).

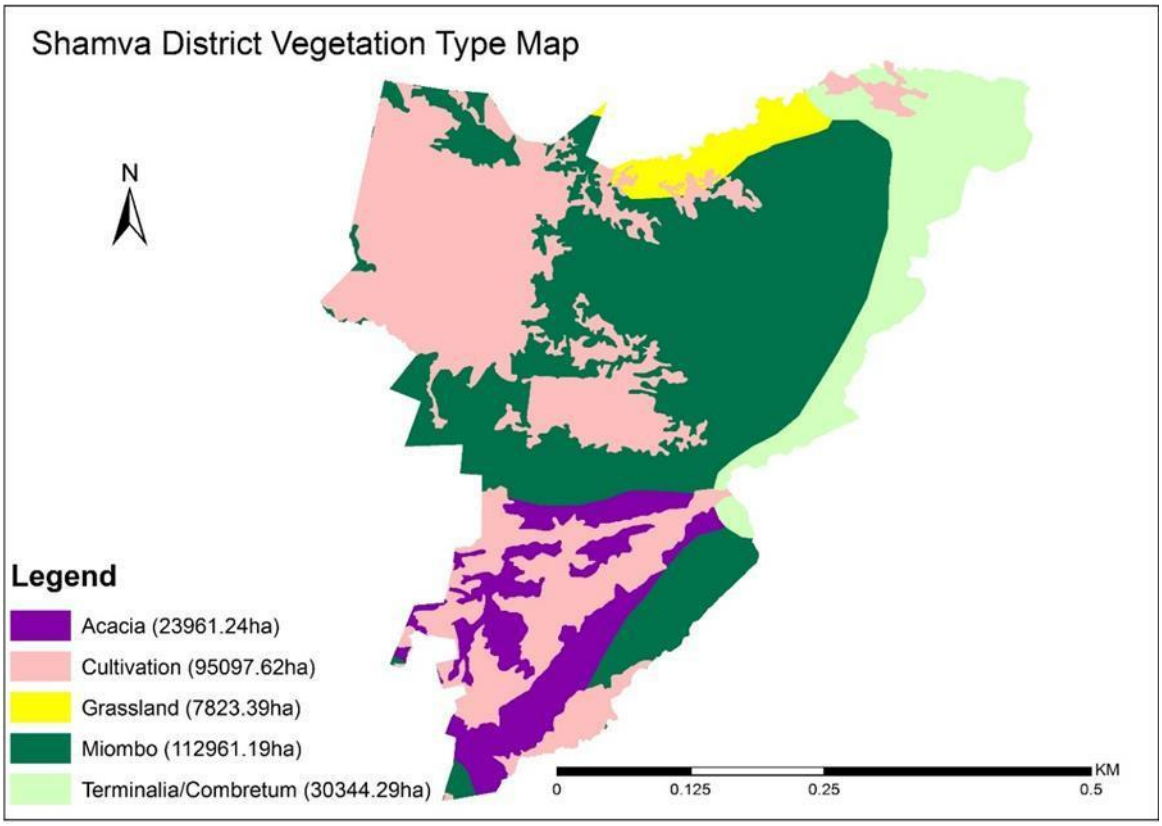
3.4.5 Topography and soil characteristics

Shamva District has high mountains, mid hills and valley floors. The soils types vary from sandy loams to clays. Similarly soil fertility varies from place to place. Low lying areas tends to have deep clay soils whilst high areas such as Shamva South have shallow sand soils which are good for tobacco production (Mathende, 1999).

3.4.6 Climate

Shamva District lies mostly in agro-ecological regions II and III, which is good for cropping and intensive livestock production. Rainfall is confined to summer and is moderately high (650-850mm) in the District (Campbell, 2003). Generally annual temperatures tend to rise with altitude and summer temperatures can rise up to $37^{o}C$ (Mathende, 1999). Winters are generally cool to warm and dry. The amount of would that is used for firewood is likely to be more in winter than in summer as households warm out the cold.

3.4.7 Vegetation type



Source: Forest commission

Figure 3.11 Shamva vegetation types

The prevalence of good soils and a favourable climate facilitates a high vegetative growth and density. Most of tree species found in this District are Miombo and Acacia Figure 3.7. The trees species are economically important for timber, poles, firewood, fruit and medicine. Most of the rural houses in Shamva resettlement area are built of wooden poles, clay or brick, often with roofs of thatching grass or occasionally corrugated metal or asbestos. Other structures around the home like cattle kraal, goat pens, shed and fowl run are mainly constructed of wooden poles. The trees also have high browse value and support a rich diversity of faunal species.

3.4.7 Infrastructure development

Shamva has one primary road that cut across from Bindura, via Shamva mine to Madziwa mine ending at Madziwa Township. This pave road is like any other primary road in Zimbabwe is in a good state (World Bank, 2012).However the tertiary roads in

the resettlement are in a bad state as has been state in Section 3.2.6 and supported in PORTRAZ report 2012, subjecting vehicle operators with challenges to carry goods to the market as well as inputs to the farmers. This reduces food security of the farmer who would rather sell imperishable goods like wood and reduces agricultural production thus impacting negatively on forest resources. Communication is however not a challenge as stated in Section 3.2.6 since all mobile network providers (Net one, Econet and Telecel) are accessible in Shamva District. Internet connectivity is also available in Shamva. Good communication influences information dissemination farm inputs costs and availability, climate changes and market alert. This is likely to increase agricultural productivity and food security while reducing dependency on forest resources. The main source of energy is wood in the whole District. Although ZESA grid transect across the District, few settlers can afford to install and pay for electricity.

3.4.8 Education

Zimstat (2012), census report stated that 0.07% (8847 people) of total population in Shamva District has never gone to school. Of the total population in the province, 86.3% were attending school at the time of census with 52.3% preschool, 32.3% primary and 1, 7% secondary education. The literacy rate in the District is 95% with males more literate97% than females 95%. Literacy rate increases with age with a 97% literacy for the age group 15-19years and 72% for age group 75+years and above. As a result the majority of household heads are likely to be endowed with higher education and therefore are likely to appreciate conservation of indigenous forests. The younger generation are also likely to appreciate more than their older counterparts since they are more literate to issues regarding conservation of forests..

3.5 RESEARCH METHODS

3.5.1 Introduction

This section focuses on discussing the research method that was employed in this study. The chapter begins by describing the sampling procedure that was followed in the study and proceeds to elaborate on the data collection and data analysis techniques.

3.5.2 Sampling Procedure and sample size

The study was carried out in Shamva District in Mashonaland Central Province. The study area was purposively chosen because of the reasons stated in section 3.3 above. The household heads were chosen as respondents because they are the decision makers in their families.

The households were stratified according to resettlement schemes, consisting of old resettlement, A1 and A2 settlers. The selection of sample was done as shown in Figure 3.1 below. A complete list of beneficiaries was collected from the Ministry of Lands and Agriculture, Zimbabwe. Two hundred and forty two households were selected randomly from the list of beneficiaries constituted by 91 from A1, 42 from A2 and 99 from old resettlement.

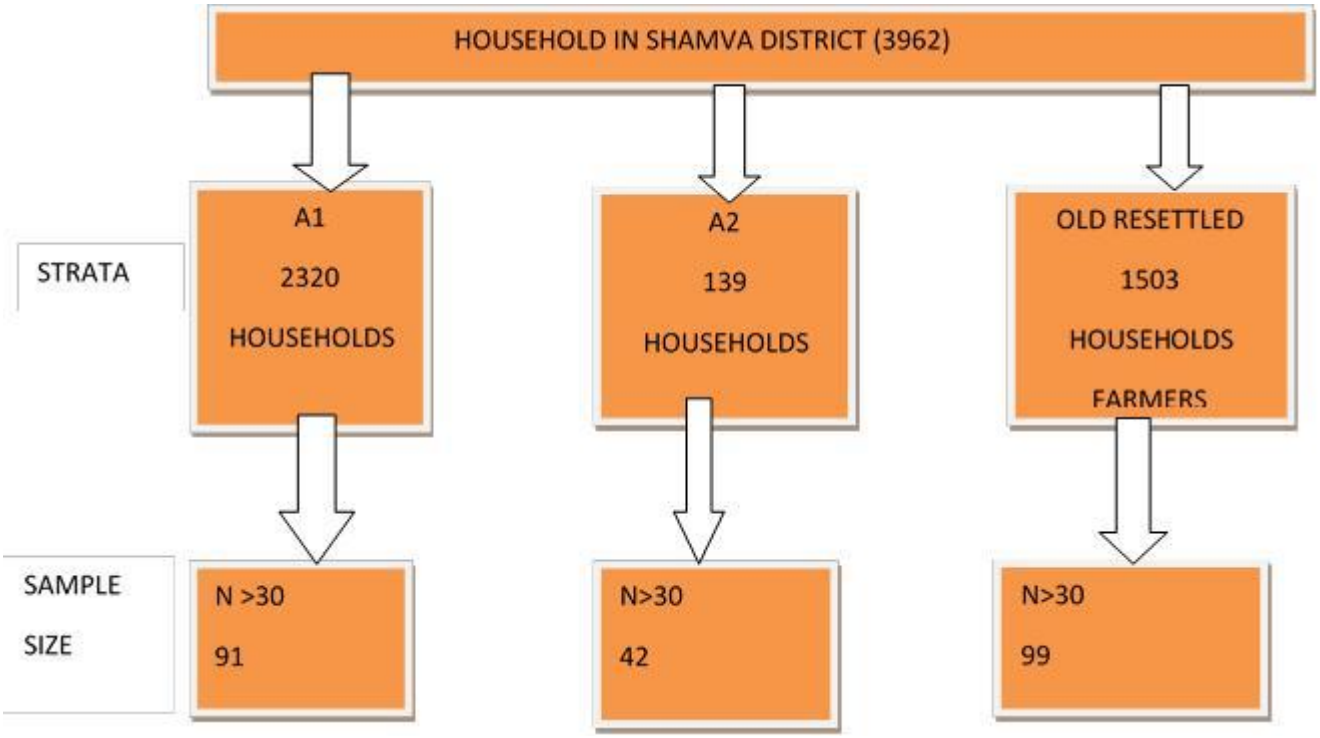


Figure 3.12 Beneficiaries of Shamva resettlement programme

The reason for this type of grouping is because land reform emerged from different models and in most cases these models differ on how they were implemented and supported thus as a result of this might lead to different farmer variables which influence natural indigenous forest dependency and participation in conservation differently. Random sampling was used to select households in each stratum mainly

because each of the household in the model had an equal chance of being selected. In addition, stratified sampling was used because of the following reasons:

Since the population is first divided into sub-populations and then samples are drawn independently from each of the segments by simple random sampling, a higher order representativeness of the sample is assured. Fewer cases will be needed for the same degree of precision as in simple random sampling for the simple reason that stratification makes stratum more homogenous and that between strata variation does not enter into the measurement.

Sample size for each of the models was calculated using proportional to size sampling technique. In this technique the probability of selecting a sampling unit (household) is proportional to size of its population. The technique is most useful when the sampling units that vary considerably in size because it assures that those in larger sites (A1) have the same chance of getting into the sample as those in smaller sites(A2 or Old resettlement) and vice versa (Holloway and Wheeler, 2006).

The random sampling was applied to each stratum to obtain the number of respondents. Wards with Old, A1 and A2 resettlements were isolated. Names of beneficiaries were listed for each stratum and the number of respondents required randomly selected. Household heads of all the selected households were interviewed at their homesteads. In the absence of the household head any elderly member of the household was interviewed. In the event that there were no people on the day of the survey at a selected household, the neighbouring household was selected for interview.

Agricultural Extension Officers within the area of study were recruited and trained to assist in the collection of data. Selection of enumerators was based on willingness to participate in the research and fluency Shona, Korekore, and Zezuru that are local languages. The extension officers were also selected as enumerators because they were hypothesised to have broader knowledge of the areas they worked in, culture and socio-economic activities prevalent in Shamva District. The enumerators were trained for five days in May 2015 so as to familiarise with the sections of the questionnaire. The pre-testing of the survey questionnaire was conducted on the fourth day of training. The fifth day of training was used for moderating the

questionnaire based on the pre-test results. The pre-testing allowed flexibility to explore new and unanticipated issues which were relevant to the study.

3.5.3 Data collection

A combination of remote sensing and GIS data and a self-administered structured questionnaire generated data was used. The advent of spatial data acquisition using GIS and remote sensing technology combined with institutional-socioeconomic data makes assessment of forest resources become more accurate and sophisticated (Panta, 2009).

3.5.3.1 GIS and remote sensing

Remote sensing technology and Geographical Information System (GIS) was used to assess the spatial coverage of natural indigenous forest in Shamva resettled areas from 2002 to 2014. The year 2002 represented the state of natural indigenous forest at the beginning of the Fast track land reform program whilst year 2014 represented the state of the forest after the fast track land reform. Image supervised classification and change detection method used the ENVI software to classify images using multispectral moderate resolution data from Landsat 5, 7 and 8 satellite. Remote sensed data was done when trees were still green before shading leaves and during this period the fields were having dry matter. Data was collected every April because the trees are still green while the grass is yellowish and brown due to senescence. The process followed the procedure stated in Figure 3.12: The process of GIS and remote sensing

i) Data acquisition

Field land-use/land-cover observations – GPS points. A field visit was conducted to obs erve GPS points for A1, A2 and Old resettlement areas of Shamva District

ii) Image processing

To estimate the current land-use/land-cover status for the District, a satellite image which was obtained from google earth image domain was acquired as a set of screen by screen images, each covering relatively small area of the resettlement areas A1, A2 and old resettlement of the District. This was done in order to capture as much detail as possible relating to water bodies, fields, roads, vegetated areas,

deforested/degraded areas and bare land. A total of 100 images were captured and saved in GPEG format.

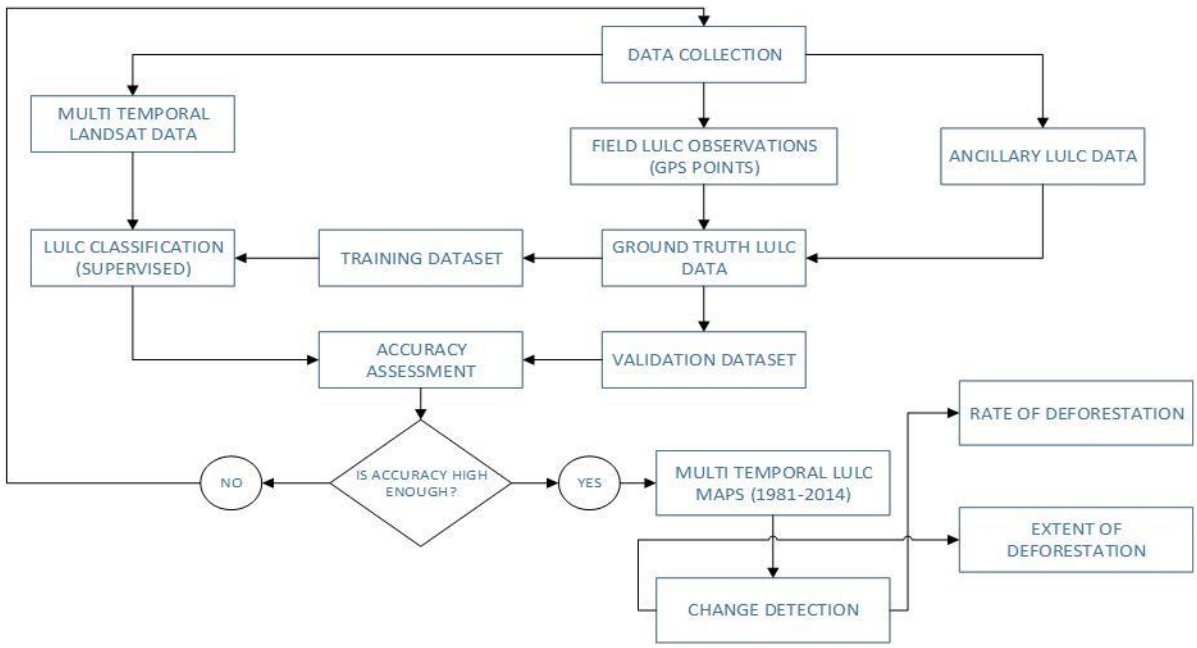


Figure 3 13: Diagram showing the process of remote sensing and GIS.

On completion each scene was imported and geo-referenced in Landsat 5.7. The geo-rectification was performed according to the geographic projection system from each single image, after which 100 scenes were combined into one image.

iii) Image classification

The image classification process involved both supervised and unsupervised classification in order to come up with the current depiction of the current state of land-use/land-cover in the districts. Seven vector layers of vegetation areas (water body, wet lands, woodland dense, woodland grassland, woodland moderate, bush land and cropland) were digitalised as training sites for the supervised classification. The registered classes provided spectral images which guided the classification because all the pixels were assigned to a class in which they fitted into the range of an identified (training site) and land use type. The supervised classification was verified by field data (ground trothing) and was clearly discernible from the images with the assistance of Google earth domain which helped to identify and clear features.

iv) Land-use/land-cover changes

The downloaded images were obtained in TIFF picture format, with spatial references (coordinates) known as geo-referencing. The Landsat images were geo-referenced by co-registration. The two 2014 geo-referenced image was assumed as the master image from which the other Landsat images were co-registered to minimise errors. Since the study involved multi-temporal analysis on a pixel by pixel basis meant that any improper registration will give wrong results. The average error was 0.03 per pixel in all the images.

On completion, the geo-referenced images were stacked together into a single image having been imported into ENVI 4.7. A shape file of A1, A2 and Old resettlement that was imported were then used to study the subset of the area (A1, A2 and Old resettlement) from overall Landsat scene image. Normalisation of the image was undertaken with respect to the other images and the topographic images.

v) Conversion of digital to reflectance

Reality of the image was improved through calibration, a process which involved the top of atmosphere signals being converted to band-wise spectral surface reflectance. The images were then converted from digital numbers to spectral radiant from which they were converted into feature reflectance, which recognises terrestrial reflectance.

vi) Change detection

The images were analysed using ENVI 4.7 to come up with the extent of the changes that have occurred. Image differencing of each image's bands was done to analyse and compare the different images in order to identify and establish the changes. Prominent changes in the land-use/cover which were observed were zoomed to identify the extent to which the classified digital layers' statistics were analysed to show direction of change, nature, magnitude of change in the three models of the resettlement program using EXCEL 2013.

vii) The rate of land cover change

The rate of land cover change was obtained through determining the proportion of change that occurred in each land-use/land-cover in between the five year period interval.

(Trend) percentage change = (Observed change)/(Sum of change) x 100

3.5.3.2 Livelihood strategy, dependency and household perceptions

A personally administered pre-tested structured questionnaire was used as the main tool for data collection. The questionnaire items that included household demographic data, household on farm and off farm activities, farmer's perceptions on forest management activities and forest related socio-economic activities. A personally administered questionnaire was used mainly because of the following reasons:

High response rate which is associated with the technique as the person conducting the interview will ensure that all questions are answered.

High reliability of the data as the interviewer can query to solicit for more data where the information given is vague or need more explanation (Hollaway and Wheeler, 2006).

The questionnaire had both open ended and close ended questions in order to improve the quality of data collected. Open ended questions gave the respondents greater freedom of expression as respondent had an opportunity to qualify their answers thus reducing bias due to unlimited response ranges. The questionnaire was balanced with closed ended questions that were quick to answer and easy to code during data analysis. All closed ended questions were pre-coded to facilitate data recording, entry and further statistical analysis

Secondary data sources on conservation of indigenous forests were used in designing the questionnaire. The information was obtained from extension officers, experts in natural forests conservation, IFRI handbook, books, bulletins, newspapers, journals and the internet.

3.5.3.3 Determination of factors influencing willingness to participate in conservation of indigenous forests methodology

A personally administered questionnaire was used to solicit information on the willingness of farmers to participate in conservation of indigenous forests. The questionnaire items (Appendix 1) that contained household on farm and off farm activities, farmer's perceptions on forest management activities and institutional-socioeconomic activities had variables that elicit knowledge of the farmer on forest

conservation, practice of the farmer in forest conservation and attitude of the farmer on forest conservation. The following variables were extracted and the number of respondents who would say YES for willing or No for not willing for each variable across all the resettlement models were recorded as shown in Table 3.6 below. Individuals with a score above 50 for yes will be considered as willing to conserve and the mean of Yes above 50% for yes also will be considered as willing to participate.

Table 3.6 Willingness to participate in forest conservation

	A1 Resettlement		A2 Resettlement		Old Resettlement	
	Yes %	No %	Yes %	No%	Yes %	No %
Knowledge variables						
Aware forest conservation?						
Know cultural forest norms?						
Know spiritual forest norms?						
Know aesthetic forest value?						
Know forest penalties?						
Heard of forest conservation?						
Heard of fencing?						
Heard of bush encroachment?						
Practice variables						
Participated Agroforestry						
Participated fireguard?						
Participated in preventing tree cutting						
Attitude variable						
Is forest conservation important						
Member of conservation group?						
Total						
Mean						

Again, a questionnaire was administered and the items that were captured included household characteristics, on farm and off farm activities, market distance, forest

distance, education, household size, tobacco growing, and number of cattle, income, culture and religion. The questionnaire also included penalties, institutions governing forest use such as EMA, AGRITEX, Forest commission, media, private sector and NGOs, type of energy used such as solar. Further questions were linked to farmer's forest management and technical skills.

3.5.3.4 Incentives for the conservation of indigenous forests

Lastly. The same questionnaire mentioned in section 3.5.5.4 above also contained items which solicited preferred incentives to militate against unsustainable use of indigenous forests. The incentives which were given as examples ranged from financial to physical rewards.

3.5.4 Data analysis

This section describes the analytic tools and related literature that was used in the project on each objective. Descriptive statistics was applied on change detection on remote sensed maps to find the rate of deforestation in Shamva District. Again, as such descriptive statistics was applied to assist determine the level of dependency on forest by resettled farmers. The KAP framework was used to find the level of willingness to participate on conservation programs. A binary regression analysis was used to determine the socio-economic and institutional factors which influence resettled farmers' willingness to participate in indigenous forest conservation programs. Finally descriptive statistics was used to determine the incentives most suitable for enticing resettled farmers in Shamva resettlement areas to conserve indigenous forests.

3.5.4.1 Rate of deforestation of A1, A2 and Old resettlement area

In order to address the impact of the first research question, a series of techniques were employed to come up with empirical results which are in the next chapter. The following specific objectives were set in pursuit of the overall objective:

- To determine the different land use /land cover distribution in A1, A2 and old resettlements in Shamva District.
- To determine the land cover land use changes in Shamva District's A1, A2 and old resettlement.

- To demonstrate the integration of GIS and remote sensing with socio-economic factors in determining rates of deforestation.
- To examine the influence of human activities in land use /land cover changes.

In order to address the above objectives three analytic methods where adopted in this study:

Calculation of the area in hectares for the resulting land use/land cover types for each study year and subsequent comparing the result (Campbell and Elliott, 2002; Akingbogun *et al*., 2012)

Overlay Operations-that is the mathematical and logical operation between two raster layers on a pixel to pixel basis to be able to detect changes (Campbell and Elliott 2002, Akingbogun *et al*., 2012).

Calculation of annual rate of change by adopting Jean-Philippe Puyravaud's equation of calculating the annual rate of deforestation (Puyravaud, 2002)

3.6.1.1 Related literature

Several studies that integrate GIS and remote sensing in calculating land use /land cover changes use linear vegetative change statistics (Akingbogun *et al.,* 2012), others use Overlay and image differencing (Campbell and Elliott 2002, Akingbogun *et al*., 2012).Markovian transition estimator is used by others (Campbell, 2002).Another school of thought uses Normalised difference vegetative index as well as integrating all the methods stated (Akingbogun *et al*., 2012). However more studies are needed which incorporates further historic and time series data sets (Leach and Mearns,1996) and especially comparative research that goes beyond exploring narrative and counter narrative based on single studies (Campbell and Elliott, 2002). As a result gaps still exist in addressing the predominant crisis narratives of environmental change.

Different authors use different formulae to calculate the annual rate of change of forest cover and use different terms to describe it (Puyravaud, 2002).This study is going to use *Puyravaud's formula= □1/(t2 □ t1))ln(A2 / A1)□* derived from Compound Interest Law and the mean annual rate of change. It is more intuitive that the formulae used by

$\left(FAOq = ((A2 / A1)1/(t2 - t1)\right)-1$ in that the rate r is significantly higher than q only when deforestation is extremely high.

Mathematical representation of Puyravaud's formula

Puyravaud's formula $= \left(1/(t2 - t1)\right)In(A2 / A1)$

Where *r*= rate of annual change

And *t1*= time/year 1

And *t2*= time/year 2

And *A1*= forest cover at year 1

And *A2*= forest cover at year 2

3.5.2 Livelihood strategies, level of dependency and household perceptions

The data that was collected using questionnaires was coded, entered, cleaned and run in Statistical Package for Social Sciences (SPSS Version 21) software and Microsoft Excel 2013 program for analysis. The following specific objectives were set in pursuit of the overall objective:

- To identify and explain the demographic data the influence indigenous forest dependency and conservation.
- To identify livelihood strategies and incomes that influence forest dependency and conservation of indigenous forests.
- To calculate the level of dependency of resettled farmers in Shamva resettlement area.
- To identify and explain household perceptions that influence management of indigenous forest conservation.

3.6.2.1 Related Literature

Several studies have been done on the influence of household demographic characteristics on dependency or conservation of indigenous forests (Shackleton *et al.*, 2011; Wilson, 1996; Clarke *et al.*, 1996; Cavendish, 2003; Campbell and Elliott, 2002).The characteristics ranged from gender, marital status, sex, education to

employment status. The researchers mainly focus on econometric analysis regarding the extent of the influence without concentrating on the finer explanatory details of the reasons behind forest dependency as revealed by the respondents.

Mohammed et al (2006) stated that livelihood strategies can be identified by household income sources since these provide clear signs on how they are conducted and obtained.

Several researchers agree to the formula for calculating level of forest dependency which Cavendish (2001), stated as the difference between total household incomes minus income from forest sources. For this study, forest dependents is defined as a household having a positive income from the forest related strategies Adam and El Tayer (2014).Forest dependency is classified based on the relative forest income rather than the absolute income. Relative income it is difficult to say what level of absolute income determines forest dependency. Relative dependency is classified as the percentage of total income contributed by forest products while absolute dependency is classified as quantities of forest products collected (Cavendish, 2003). The computation of household income, forest income and Agriculture income was carried as follows:

Household income=∑ (forest income+agriculture income+wage income+remittances+pension)

Forest income=∑ (fuel wood income+poles income+thatching grass income+wild fruits income)

Agriculture income=∑Crop income+ livestock Income)

3.6.2.2 Analytic presentation

Descriptive statistics was applied to the demographic data, livelihood strategies, dependency activities and household perceptions on conservation of indigenous forests in Shamva District. The descriptive statistics such as mean, percentages, standard errors, frequencies, and standard deviation were used to explain the livelihood strategies, levels of dependency and household perceptions.

3.5.3 Socio economic factors that determine willingness to participate in indigenous forest conservation.

3.5.3.3a) Willingness to participate in conservation of indigenous forest

The data that were collected using a questionnaire and entered in SPSS Version 21 software as stated in section 3.6.2 above. The data were used to complete Table 3.1 on willingness to participate in conservation of indigenous forests. The process was done in order to accomplish the following specific objectives:

- To demonstrate level of knowledge, practice and attitude on conservation of indigenous forests by resettled farmers.
- To determine the level of willingness of the resettled farmers to conserve forests using the KAP framework.

3.5.3.3 i) Related literature

Willingness can be defined as readiness, inclination, preparedness, enthusiasm or disposition. The willingness by communities to conserve their forests can be measured by using two variables namely, community attitude towards forests and community actions regarding forest management. The Knowledge, Attitude and Practice (KAP) paradigm provides a good framework for measuring the inclination by communities to conserve their forests (Wilson, 1996). For a community to practice forest conservation (P), it should be knowledgeable about the need to conserve forests (K) and the various methods that can be employed to conserve these forests. This knowledge in turn should instil in that community the right attitude (A) towards forest conservation which attitude should drive the practice of forest conservation (Wilson, 1996)

3.5.3.3ii) Analytical representation

A data analysis using counts and frequencies was carried out on a number of factors to produce a Knowledge, Attitude and Practice (KAP) framework representing the extent to which communities in the A1, A2 and the Old resettlement schemes are willing to conserve their forest resources as highlighted in Table 3.1. Cell count frequencies were used to indicate the percentages of households that answered yes or no to different forest conservation parameters that included individual's knowledge of the various aspects of forest conservation, the attitude towards forests and forest conservation and the activities being carried out to conserve and resuscitate forests.

Just as stated in section the data that was collected using a questionnaire was entered in SPSS Version 21 software for analysis to observe the following specific objectives:

- To identify and define the household characteristics, institutional and socio-economic factors that affect willingness to participate in conservation of forests'
- To determine the household characteristics, institutional and socio-economic factors for willingness to participate in conservation of forests.

Below is the description of the variables.

Table 3.7 Description of variables

Variable	Variable Definition	Hypothesized effect
Willingness to conserve	Binary dependent variable of whether or not farmer is willing to conserve forests, 1 = Yes; 0 = No	Dependant
Age	Age of household head - continuous	Positive
Gender	Gender of household head; 1 = Male; 0 = Female	Positive
Married	Whether household head is married or not; 1 = Yes, 0 = otherwise	Positive
Secondary	Whether or not household head has reached secondary school education; 1 = Yes, 0 otherwise	Positive
Employed	Whether household head is formally employed or not; 1 = Yes, 0 = Otherwise	Positive
Christian	Whether or not household head is Christian; 1 = Yes, 0 = Otherwise	Positive
Culture	Whether or not household follows cultural forest norms; 1 = Yes, 0 = No	Positive
Income	Total household income	Positive
Cattle	Number of cattle owned	Negative
Tobacco	Grow tobacco? 1 = Yes, 0 = No	Negative

Coal as substitute for wood	Use of coal? 1 = Yes, 0 = No	Positive
Paraffin as substitute for wood	Use paraffin? 1 = Yes, 0 = No	Positive
Solar as substitute for wood.	Use of solar energy? 1 = Yes, 0 = No	Positive
Penalties	Whether farmer is aware of forest penalties or not; 1 = Yes, 0 = Otherwise	Positive
Forest distance	Distance from nearest forest	Negative
Household size	Size of household	Negative
Market distance	Distance from input and output markets	Negative
Institutional (AGRITEX)	Effect of AGRITEX activities on forest conservation; 1 = Positive, 0 = Negative	Positive
Institutional (EMA)	Effect on EMA on forest conservation; 1 = Positive, 0 = Negative	Positive
Institutional (Media)	Effect of media on forest conservation; 1 = Positive, 0 = Negative	Positive
Institutional (Private sector)	Effect of the private sector on forest conservation; 1 = Positive, 0 = Negative	Negative
Institutional (NGOs)	Effect of NGOs on forest conservation; 1 = Positive, 0 = Negative	Positive
Institutional (Community leaders)	Effect of community leaders on forestconservation; 1 = Positive, 0 = Negative	Positive
Institutional (Forestry commission)	Effect of Forestry Commission on forest conservation; 1 = Positive, 0 = Negative	Positive

3.6.3.2b)iRelated literature

According to Cavendish (2003), linear regression models have been widely used in most economic models and social investigations because of availability of simple

computer packages, as well as ease of interpreting the results. However, Arene and Anyaeji (2010), argues that results derived from the linear regression analysis may lead to fairly unreasonable estimates when the dependent variable is dichotomous. Therefore, the use of the logit or probit model is recommended to counter the drawbacks of the linear regression models (Gujarati, 2003).Which model to choose between logit and probit is, however, difficult for they are similar in most applications. However, for its comparative mathematical, interpretational simplicity and close approximation to cumulative normal distribution many researchers tend to choose the logit model (Hosmer and Lemeshew, 1999). Therefore, for the purposes of this study the binary logistic regression model is used.

3.6.3.2b)ii Mathematical representation of the Binary Logistic Regression model

The parameter of the logistic regression model was estimated with the Maximum Likelihood Estimation (MLE) technique. A binary response function (willing to participate and not willing to participate) was specified and estimated by the procedure. The binary logistic regression specification is suited to models where the endogenous variable is dichotomous, which in this case is willing to participate and not willing to participate. Willingness to participate will be measured using a bid value of one and zero, where one represents willing to participate and zero not willing to participate. The logistic regression model then provides a model of observing the probability of willing to participate or not willing to participate. The binary logistic model adopted from Bigsten and Shimeless (2003), is econometrically specified explicitly as:

$$P_i = F(Z_i) = \frac{1}{1 + e^{-(\alpha + \sum \beta_i X_i)}} \qquad (1)$$

Where Pi is the probability that the resettled farmers are not willing to participate

Xi stands for the1th explanatory variable.

α and β are regression parameters to be estimated and e is the base of the natural logarithm.

Furthermore, for simplicity and ease of interpretation of the coefficients, a logistic model could be written in the form of the odds and log of odd. The odds ratio is the ratio of the probability of the resettled farmers not to participate (1-Pi). Thereby yielding: (2)

$$\left(\frac{P_i}{1-P_i}\right) = e^{zi_i} \quad (3)$$

Taking the natural logarithm of equation (2) yields

$$In\left(\frac{P_i}{1-P_i}\right)=Z_i=\alpha+\beta_i X_i + \ldots.. +\beta_n X_n$$

If the disturbance term Ui is taken into account, the logit model becomes:

$$Z_i = \alpha + \sum_{i=1}^{n} \beta_i X_i + U_i \quad (4)$$

Where α and β are parameters of the model and can be estimated using the Maximum Likelihood (ML) method.

Where Z_i = Willingness to participate (1 = willing to participate, 0 = not willing to participate) and βi is the slope of the equation in the model.

3.6.4 Incentives for forest conservation by resettled farmers in Shamva District

Appendix I section H provides a list of possible incentives that were gathered from secondary data as mentioned earlier on in section 3.5.2 of this Chapter. The preferred rewards which ranged from financial to physical were captured using SPSS version 21 and analysed to observe the following specific objectives:

- To identify and describe the incentives preferred by resettled farmers for conserving forests.
- To generate satisfaction ranking of resettled farmers' preferred incentives for conservation of forests.

3.6.4i) Related literature

Most studies broadly classify incentives as activities that reduces deforestation while alleviating poverty Peskett *et al*. (2008), programs that have used payments for

environmental services Engle *et al*. (2008) programs that involve direct payments to families Fraser (2009), integrated conservation and development programs (Wells and Shane, 2004). Most programs initiated by government, NGOs and organisations with interest in forest as mentioned in section 1,1 are top down. As a result gaps still exist in literature with regard to specific consideration at local level (Fraser, 2009). Moreover more studies also concentrate on voluntary carbon markets or 'carbon forestry' (Corbera and Brown, 2006) and the clean development mechanism (Paulsson, 2009). However, more effort is focused on econometric modelling with regard to direction and significance of influence at the expense of soliciting for specific demands and preferred incentives. Thus this study targets demands and preferred incentives at local level.

3.6.4ii) Analytical Presentation of results

Frequency count percentages were used to produce a bar graph for the three resettlement schemes' preferred incentives for forest conservation.

3.7 Limitations of the study

Farmers did not have proper records and relied mainly on recall .Farmers had to be assisted with leading questions that help recall. This had negative implications on time and accuracy of the data collected.

Respondents suspected the researchers were EMA agents and they were afraid that they would be victimised. As such some of the respondents were reluctant to divulge information regarding forest resource uses The team had to identify themselves with official permission letters from the Ministry of Lands and Agriculture and The Ministry of Local, Rural and Urban Development..

The roads were poor in some areas and the farmers were far apart in A2 resettlement. The enumeration team had to be boosted and the team had to use motor bikes. This had negative implication on time spent and cost and induced a general fatigue to the researchers.

3.8 Conclusion

The study was carried out in Shamva District's A1, A2 and old resettlement schemes. A total of 232 interviewees were purposively selected through stratified random sampling. Well trained enumerators assisted the primary data collection

process using focus group discussions and personally administered questionnaires. The methodological approaches which were used by other authors as well as those used in the study were outlined. Combinations of different methods were required, where each serves a different but complimentary role within the overall research design. Descriptive statistics were used to analyse rates of deforestation and level of forest dependency. Logistic regression analysis was used to analyse willingness to participate in forest conservation programs. The next chapter will present and discuss the results of the findings of objective one.

CHAPTER 4

ASSESSING RATES OF DEFORESTATION IN SHAMVA RESETTLEMENT AREAS

4.1 Introduction

The following chapter contains a summary of Geographical Information System (GIS) and remote sensing findings and observations on land use/land cover changes and annual rate of increase/decrease of Shamva resettlement areas for the period 2002 to 2014.It is followed by a detailed analysis and discussion of the socioeconomic activities in explaining the influence of land cover/land distribution and the subsequent annual rate of increase or decrease over the period.

4.2 Land use/land cover distribution

This section shows land use/ land cover distribution and changes in the three resettlement models of Shamva District. The change detection will enable the establishment of the rates of deforestation in the three models of resettlement.

A1 Resettlement

Table 4.1 below shows the changes in distribution of land-cover classes in the A1 resettlement model of Shamva District from 2002 to 2014. Cropland was reduced between 2002 and 2014 from 857, 98ha (20, 58%) to 6385, 436ha (15, 32%) which is a loss of 2186, 54ha or 5,248%.There was also a decrease in Bushland and woodland moderate from 2002 to 2014. Bushland decreased from 10565, 91ha in 2002 to 9332, 188ha in 2014 and woodland moderate reduced from11810, 11ha to 10585ha. Woodland dense and woodland grassland increased tremendously in size from 2002 to 2014(12 years). The A1 resettlement scheme's woodland dense increased from 2002, 43ha to 5916, 46ha and woodland grassland increased from 8237, 91ha to 9200, 962ha.

Table 4.1: Land use / land cover distribution 2002, 2005, 2010 and 2014 in the A1 resettlement area of Shamva District

	2002		2005		2010		2014	
Land-cover	**(HA)**	**(%)**	**(HA)**	**(%)**	**(HA)**	**(%)**	**(HA)**	**(%)**
Water body	28.47	0.07	165.96	0.40	174.47	0.42	171.82	0.41
Wetland	181.66	0.44	138.27	0.33	163.32	0.39	70.04	0.17
W/dense	1982.43	4.76	6602.73	15.85	10966.2	26.32	5916.46	14.20
W/grassland	8237.91	19.77	10189.0	24.46	13326.1	31.99	9200.96	22.08
W/ moderate	11810.11	28.35	8188.99	19.66	7517.19	18.04	10585.04	25.41
Bushland	10565.91	25.36	8953.80	21.49	7165.40	17.20	9332.19	22.40
Croplands	8571.98	20.58	7423.15	17.82	2349.21	5.64	6385.44	15.33
Total	41661.95		41661.9		41661.9		41661.95	

Source: Field survey

A2 Resettlement

Table 4.2 indicates changes in land cover distribution for the period 2002 to 2014 in the A2 resettlement area of Shamva District. Cropland was reduced from 1835,587 ha in 2002 to 1198,018 ha in 2014 which is a loss of 637, 57 ha (-5, 49%).There was also a decrease in woodland moderate and Bushland during the period 2002 to 2014. Bushland was reduced from 3180, 92 ha to 2585, 56 ha whilst woodland moderate reduced from 3793, 57 ha to 3210, 91 ha.

Table 4.2: Land use / land cover distribution 2002, 2005, 2010 and 2014 in the A2 resettlement model of Shamva District

	2002		2005		2010		2014	
Land cover	(HA)	(%)	(HA)	(%)	(HA)	(%)	(HA)	(%)
Water body	15.21	0.13	34.24	0.00	26.73	0.00	33.90	0.29
Wetland	23.51	0.20	286.81	0.02	55.24	0.00	22.30	0.19
W/ dense	624.64	5.39	2029.86	0.17	3345.61	0.29	1826.99	15.76
W/ grassland	2118.94	18.28	2985.09	0.25	4200.65	0.37	2714.70	23.42
W/ moderate	3793.58	32.72	3011.14	0.25	2062.50	0.18	3210.91	27.70
Bushland	3180.92	27.44	2306.70	0.19	1629.10	0.14	2585.57	22.30
Croplands	1835.59	15.83	1186.25	0.10	74.77	0.01	1198.02	10.33
Total	11592.39		11840.09		11394.58		11592.39	

Source: Field survey

Woodland dense and woodland grassland in the A2 resettlement increased between 2002 and 2014. Woodland dense increased from 624, 6402(ha) in 2002 to 1826, 99(ha) in 2014. Woodland grassland increased from 2118, 936(ha) to 2714, 70(ha).

Old Resettlement Table 4.3: Land use/land cover distribution 2002, 2005, 2010 and 2014 in Old resettlement area of Shamva District.

	2002		2005		2010		2014	
Land cover	**(Ha)**	**(%)**	**(Ha)**	**(%)**	**(Ha)**	**(%)**	**(Ha)**	**(%)**
Water body	40.45	0.08	47.03	0.09	57.99	0.11	76.95	40.14
Wetland	32.95	0.06	70.59	0.13	55.42	0.11	17.46	0.03
W/dense	827.19	1.55	1748.02	3.27	7720.87	14.71	2503.63	4.69
W/grassland	3147.90	5.89	2257.41	4.23	4420.25	8.42	6187.09	11.58
W/moderate	5646.57	10.57	7239.16	13.55	20968.45	39.94	14758.22	27.63
Bush land	20287.13	37.97	16449.12	30.79	13559.50	25.83	17067.67	31.95
Croplands	23442.57	43.88	25613.43	47.94	5716.82	10.89	12811.66	23.98
TOTAL	53424.76		53424.76		52499.3		53422.68	

Source: Field survey

Table4.3 above shows the land cover distribution changes in the old resettlement area of Shamva District for the period of 2002 to 2014. Cropland decreased from 25329.03 ha in 2002 to 12811.66 ha in 2014 which is a reduction of 12517.49 ha (-23.43%) Bush land decreased from 24012.28 ha in 2002 to 17067.67 ha in 2014.

In the Old resettlement scheme, woodland dense, woodland grassland and woodland moderate increased tremendously between 2002 and 2014. Woodland dense increased from 827.19 ha to 2503. 63. Woodland moderate increased from 5646.57(ha) to 14758.22 ha. Woodland grassland increased from 3147.90 ha to 6187.092 ha.

4.3 Change detection

i) Old Resettlement

Table 4.4 below show that cropland decreased from 25329, 03 in 2002 to 12811, 66 in 2014 which is a reduction of 12517, 49ha) (-23, 43%) Bushland decreased from 24012, 28 in 1981 to 17067, and 67 in 2014. However, woodland dense, woodland grassland and woodland moderate increased tremendously between 1981 and 2014. Woodland increased 221, 031(ha) to 2503, 632. Woodland moderate increased from 3455, 45(ha) to 14758, 22(ha). Woodland grassland increased from 404, 2858(ha) to 6187, 092(ha).

Table 4.4: Area/Percentage and Annual rate of decrease/Increase of land Use / land cover changes 2002-2014 for the Old resettlement Scheme.

Land Cover	(Ha) 2002	(Ha) 2014	Difference(Ha)	Increase/Decrease (%) 2002-2014	Annual rate of decrease/ increase%
Waterbody	40.45	76.95	76.95	0.14	5.36
Wetland	32.95	17.46	14.79	0.03	-5.29
W/dense	827.19	2503.63	2282.6	4.27	9.23
W/grassland	3147.9	6187.09	5782.81	10.82	5.63
W/moderate	5646.57	14758.22	11302.77	21.16	8.01
Bush land	20287.13	17067.67	-6944.61	-13	-1.44
Cropland	23442.57	12811.66	-12517.4	-23.43	-5.04

Source: Field Survey

iii) A2 Resettlement

Table 4.5 show that cropland was reduced from 1835,587 in 2002 to 1198,018 in 2014 which is a loss of 637, 57(ha) (-5, 49%).There was also a decrease in woodland moderate and Bushland during the period 2002 to 2014. Bushland was reduced from 3180, 92 to 2585, 56 whilst woodland moderate reduced from 3793, 57 to 3210, 91. However, woodland dense and woodland grassland in the A2 resettlement increased between 2002 and 2014. Woodland dense increased from 624, 6402(ha) in 2002 to 1826, 99(ha) in 2014. Woodland grassland increased from 2118, 936(ha) to 2714, 70(ha).

Table 4.5: Area/Percentage and Annual rate of decrease/Increase of land Use / land cover changes 2002-2014 for A2 Resettlement.

Land cover type	(Ha) 2002	(Ha) 2014	Difference (Ha)	Increase /Decrease%	Annual rate %
Water body	15.21	33.9	18.69	0.16	6.68
Wetland	23.51	22.3	-1.21	0.2	-0.44
W/dense	624.64	1826.99	1202.35	10.37	8.94
W/grassland	2118.9	2714.7	595.77	5.14	2.06
W/ moderate	3793.58	3210.91	-582.67	-5.03	-1.39
Bush land	3180.92	2585.57	-595.35	-5.14	-1.73
Cropland	1835.59	1198.02	-637.57	-5.5	-5.56

Source: Field Survey

(iv) A1 Resettlement

Table 4.6: Area/Percentage and Annual rate of decrease/Increase of land Use / land cover changes 2002-2014

Land cover type	(Ha) 2002	(Ha) 2014	Difference (Ha)	Increase/ Decrease% 2002-2014	Actual rate Decrease /increase%
Water body	28.47	171.82	143.35	0.34	0
Wetland	181.66	70.04	-111.62	-0.27	-7.94
Woodland dense	1982.43	5916.46	3934.03	9.44	9.11
W/ grassland	8237.91	9200.96	963.05	2.31	0.92
W/ moderate	11810.11	10585.04	-1225.07	-2.94	-0.91
Bush land	10565.91	9332.19	-1233.73	-2.96	-1.03
Croplands	8571.98	6385.44	-2186.54	-5.25	-2.45

Source: Field Survey Survey

Table 4.6 above show that cropland was reduced between 2002 and 2014 from 8571, 98(ha) (20,575%) to 6385, 436(15, 3268%) which is a loss of 2186, 54(ha) or 5,248%.There was also a decrease in Bushland and woodland moderate from 2002

to 2014. Bushland decreased from 10565, 91 in 2002 to 9332,188 in 2014 and woodland moderate reduced from11810, 11(ha) to 10585(ha). The A1 resettlement scheme's woodland dense increased from 1982, 43(ha) to 5916, 46(ha) and woodland grassland increased from 8237, 911(ha) to 9200, 962(ha).

4.4 Summary

Table 4.7: Summary of Land use /Land cover changes statistics in %

	Old Resettlement			**A1 Resettlement**			**A2 Resettlement**		
Land use/land cover	% changes 2002/2014			%changes 2002-2014			%changes 2002-2014		
	2002	2014	%	2002	2014	%	2002	2014	%
Water body	0.00	0.14	0.14	0.07	0.41	0.34	0.13	0.29	0.16
Wetland	0.01	0.03	0.03	0.44	0.17	-0.27	0.20	0.19	-0.01
W/dense	0.41	4.69	4.27	4.76	14.20	9.44	5.39	15.76	10.37
W/ grassland	0.76	11.58	10.83	19.77	22.09	2.31	18.28	23.42	5.13
W/ moderate	6.47	27.63	21.16	28.35	25.41	-2.94	32.73	27.70	-5.02
Bush land	44.95	31.99	-13.00	25.36	22.40	-2.96	27.44	22.30	-5.14
Croplands	33.21	23.98	-9.22	20.58	15.33	-5.25	15.83	10.34	-5.5

Source: Field Survey

4.5 Discussion

The Old resettlement, A1 and A2 resettlement land use/land cover practice for Shamva resettlement was determined in order to ascertain the causes and rates of deforestation. Seven major classes were identified and classified as the land use / cover as follows: water body, wetlands, woodland dense, woodland grassland, woodland moderate, bush land and cropland.

4.5.1. Area of land use/land cover classes lost to other classes

There is generally a reduction in cropland in all the resettlement schemes. Cropland reduction contradicts Elliott and Campbell (2002), who stated that over 80% of the villages were utilising their full allocation of 12hactares as sited in the literature review

of this study. However, Musemwa and Mushunje (2011), observed a low land utilisation rate of 67% for A2, 53% for A1 and 46% for old resettlement in. The low land utilisation rate could be attributed to lack of machinery and inputs as stated in Chapter 2 and 3. Basure (2014), also confirms that rather than seeing an increase in farmland under cultivation in resettlement many new farmers did not exhaust the land which was previously cleared for cultivation by the previous white owner due to lack of inputs and implements.

The bush land and woodland moderate was also reduced mainly due to use of forest products. Forest products use is the domain of women and children as stated in Chapter 2 (Basure, 2014; Bradley, 1991; Campbell *et al*., 2003), though the study reported that men are also involved. However, it was reported that children and women would rather collect forest products from the environment surrounding their households (bushland and woodland moderate) rather than from far afield (moderate dense) for fear of attack by wild animals, reduction of time spend to walk to the forest and also a reduction in the amount of effort exerted on the load from the forest to the homestead. Grundy *et al*. (1993), supports this statement as stated in literature review of Chapter 3 by reporting that wood harvesting has a much more local effect on woodland structure, its impact being limited to within 300m of a village. Elliot and Campbell (2001) also stated that the impact of greater availability on resource demand was highly varied and in fact, factors of ecology (the location of desired species) and time available in relation to agricultural labour demands were found to mediate the link between resource supply and demand. Mining also contributed to the rate of land cover and land use change as the establishment of both mining and panning activities reduced bush land and woodland moderate into mines and panning sites. This would also be the reason why the woodland dense increased during the 12 years for A1 and A2 and old resettlement.

4.5.2 Area of land use/land cover classes gained by other classes.

There is a general increase in woodland dense and woodland grasslands across all resettlement areas of Shamva District. Woodland grasslands increased due to the reduction of cropland as most of the land is left farrow due to lack of capacity to farm. During the visit to the study area, the researcher observed that rampant bush encroachment by acacia species into the cropland is taking place. The lack of capacity

to farm is caused by shortage of labour maybe due to old age of land owners and migration of the rural populace to urban areas as stated in the reviewed literature

Another reason for the increase in grassland could be that new farmers have fewer grazing livestock than the previous white farmer and rampant poaching of wild animals increased woodland grassland and woodland dense. The results from this study are contrary to Matsa and Muringanidza (2010), who reported that the resettlement program led to an increase in livestock like cattle, goats and donkeys in the settled areas which reduced grasslands as stated in Chapter 3. Hoogeveen and Kinsey (2001), also cited in this study's literature review supports Matsa and Muringaniza (2001)'s views by stating that a long term panel data for three resettlement schemes has confirmed that resettled household are larger, wealthy and earn more cattle than communal area households and therefore given the points raised above, the demand for woodland derived goods necessary for cattle maintenance increases (Clarke *et al*., 1994). However, the results of this research support the growing literature that indicates that the wood crisis in Zimbabwe has been overstated (Leach and Mearns, 1988; Attwell and Cotterill, 2000). In fact Grundy *et al*. (1993), argues as stated in the chapter of reviewed literature that the levels of luxury consumption of wood in Zimbabwe's resettlement areas are sustainable.

4.6 Summary

The 2002, 2005, 2010 and 2014 satellite data were used to identify, classify and evaluate land cover types in Shamva Resettlement areas of Zimbabwe. A GIS database of land use/land cover categories and their changes within the 12 years for Old resettlement scheme, A1 and A2 resettlement schemes was used for remote sensing. The results show that woodland moderate and bush land were decreasing due to livelihood activities such as firewood collection, mining, cutting timber for construction purposes and farming activities. Croplands were also decreasing due to incapacity by new farmers to till all the newly acquired land. However, woodland dense and grassland were increasing in size. This is due to regrowth as a result of lack of harvest due to fear of moving in dense forests, time constrain, incapacity to carry heavy loads from forests afar and reduced numbers of livestock and wildlife. The dynamics of social activity and the reported nature, extent and change within livelihood strategies of Chapter 5 have confirmed the possibility for deforestation and

reforestation as revealed and quantified by the GIS analysis in Tables 4.1 to 4.6 above. This is also in line with the findings of Elliott and Campbell, 2001 as stated in previous literature.

4.7 Conclusion

There is both deforestation and afforestation in Shamva district. However the rate at which the woodlands moderate and bush land is being degraded will leave these areas bare and then the settlers will begin to encroach the woodland dense forests. The use of remote sensing and GIS is important for mapping, monitoring and predicting the land use/ land cover in the forest. The following Chapter investigates the livelihood activities that contribute to deforestation.

CHAPTER 5

HOUSEHOLD DEMOGRAPHIC DATA, LIVELIHOOD STRATEGIES, FOREST DEPENDENCY AND MANAGEMENT PERCEPTIONS IN SHAMVA RESETTLEMENT AREAS

5.1 Introduction

This section presents results and discussion of a survey of livelihoods strategies and forest dependency. It covers demographic characteristics, livelihood strategies and income sources, forest dependency and its monetary value, types and purposes of energy used, stakeholders and forest management challenges.

5.2 Demographic characteristics

The total population in the sample that was studied was 232 people. Household size had an average of 5 people and the following were household heads: 69.2% of old resettlement, 76.77% of A1, and 81.4% of A2 resettlement. In general, the level of education was low in Old resettlement with 49.5% primary education and high in A2 resettlement with tertiary education at 51, 2%. The household demographics for the resettled farmers are presented in Table 5.1 below.

5.3 Livelihood strategies

The resettled farmers derived their income from six different occupations: (i) crop farming, (ii) livestock farming, (iii) pension, (iv) remittances, (v) salaries and wages, and (vi) other activities such as mining. Forest products are an important component of Shamva household livelihoods. Firewood for domestic use, curing tobacco and poles for construction purposes are the basic products extracted on daily or weekly basis in the villages as shown in Table 5.2 overleaf.

Table 5.1: Demographic characteristics

Population	OLD n-99	A1 n-91	A2 n-42
Male	76.77%	69.2%	81.4%
Female	23.23%	30.8%	18.6%
Population characteristics			
Average household size	5	5	5
Education of respondent			
Primary	22.22	49.5	18.6
Secondary	74.75	35.2	75.2
Tertiary	3.03	0	51.2
No education	0	15.35	0
Employment status			
Formal	0	0	34.9
Informal	24	14.3	18.6
Unemployment	76	85.7	46.5

Source: Field Survey

Besides use of forest products, Shamva settlers grow cash and food crops, livestock production and vegetables. The sample households had 100 % household practicing crop production across all resettlement programs and 96.97%, 81.4% and 58, 25%, under livestock production in Old, A1 and A2 resettlement program respectively. The other strategies as shown in the Table 5.2 were mining, remittances, gardening, salaries/ wages, pensions, buying and selling, building and grinding mill. Firewood collection for sale as a livelihood strategy was never mentioned though codes could be seen by the roadside as the team drove from village to village during the field survey see (Platte 7 and 8).

Table 5.2: Livelihood strategies of sample households

Livelihood strategies	OLD n-99	A1 n-91	A2 n-42
	%	%	%
Food and cash crop	100	100	100
Livestock	58.25	96.97	81.4
Other e.g. mining	13.18	61.62	16.3
Remittances	1.08	15.15	60.5
Gardening	2.03	10.10	0
Salaries and wages	4.83	10.10	39.5
Pensions	1.08	8.08	39.5
Buying and selling	1.06	0.04	9.3
Building	0.07	0.03	0
Small businesses	0.03	0.01	9.3

Source: Field Survey

5.4 Income sources

Survey results on Table 5.3 showed that the forest- derived income (food and cash crop + livestock) totalled $2396.68 for Old resettlement, $2269.06 for A1 resettlement and $10554.47 for A2 resettlement as compared to $223.00, $446.25, $334.55 for Old, A1, A2 resettlement programs respectively for non-forest -derived income sources. For the other sources of income in all the households the mean total income differed significantly with old resettlement having the least and A2 having the highest. The difference was mainly due to access to non-forest- derived income such as mining and small scale businesses. Old resettlement scheme had the highest forest dependency index of 91% while A1 and A2 had 73% and 50% respectively.

Table 5.3: Income sources of livelihoods

Income source	OLD n-99		A1 n-91		A2 n-42	
	Mean income/per year/household.	**%**	**Mean income/per year/household**	**%**	**Mean income/per year/household**	%
Crop farming	2057.76	78.56	2069.46	75.18	9223.54	44
Livestock	338.92	12.94	199.59	7.25	1330.93	6.4
Pension	48.35	1.85	139.90	5.08	1123.14	2.6
Remittances	82.53	3.15	54.55	1.98	1171.63	5.4
Salary and wages	64.84	2.48	374.94	1.36	3427.09	16.4
Others e.g. mining	109.86	4.19	251.80	9.15	4623.744	22
Total Forest dependency*	2619.73 19.27%	100	3090.24 15%	100	20900.074 0.02%	100

Source: Field Survey

$$Foresty\ Income = \frac{Forest\ Income}{Total\ Income}$$

5.5 Forest dependency in Shamva resettlement area

The amount of wood collected from the forest is shown in Table 5.4. The data on Table 5.4 explores the argument that there is high dependency on indigenous trees in the study area for firewood and construction to provide shelter and security.

All (100%) resettlement farmers in A1, A2 and old resettlement use firewood for domestic use.

Table 5.4: Indigenous forest dependency in Shamva resettlement area

Description		Old n-99		A1 n-91		A2 n-42	
		%	Average quantity/ household/y (cubic metres)	%	Average quantity/ household/y (cubic metres)	%	Average quantity / household/y (cubic metres)
Firewood domestic use		100	20	100	22.44727	100	27.88279
Firewood burning tobacco		56.0	15.21	45.45	13.35	6.97	11.662791
Brick thatch hut		69.2	1.32	46.46	1.36	34.88	0.330698
Brick house		28.5	4.67	20.20	0.669	11.62	0.843023
Pole and dagger thatched hut		0	0.00	11.11	0.544343	55.81	2.466744
Pens	Cattle	68.3	3.39	58.59	2.96	62.79	2.85
	Goat	23.0	0.47	25.25	0.65	39.53	0.87
	Pig	0	0.00	0	0	4.65	0.02907
	Poultry	56.0	0.83	35.35	0.63	46.51	0.89
Ngarani		36.2	1.46	32.32	1.12	58.14	0.245
Mutando		0.09	0.25	0.37	0.37	11.62	0.24
Dura		18.18	0.94	12.12	0.56	9.30	0.13
Garden fencing		22.47	2.91	11.11	0.11	32.56	1.03
Ban		47.29	2.06	27.27	1.25	0	0
Change room		0.09	0.10	0.03	0.018	0	0
Homestead fence		29.69	0.83	0.03	0.01	6.97	0.16
Shed Total		30.76	0.54 50.50	22.22	0.47 46.09	9.30	0.04 48.94

Source: Field Survey

Also, 55% of the Old resettlement farmers, 45% A1 and 35% A2 resettled farmers used firewood for burning tobacco. The dependency on forest for construction of shelter was highest in cattle kraal which had 68.33% and *Ngarani* 58.14% in Shamva's Old, A1 and A2 resettlement programs. Indigenous trees are thus an important component of household livelihood in Shamva resettlement villages where it is used for domestic purposes and burning tobacco and collection of poles for construction purposes on daily or weekly basis as mentioned in Chapter 1.

5.6 Types and quantities of energy used.

Table 5.5 reveals the type and quantities of energy used, what the energy is used for and the percentage of households that use the source in the sample. Eight types of energy sources were identified in the sample. These were firewood, paraffin, torch, candles, solar, electricity, gas and ethanol. The various purposes which energy is used for in Shamva resettlement programs constitute cooking, lighting, charging phones, powering radio and TV. Out of 232 households sampled 100% responded using firewood for cooking and lighting. Interesting to note is that 31.68% use paraffin for cooking in A1 resettlement model. Another emerging source of lighting is the Chinese touch with 29% of the sampled households using it. Solar in A2 is very conspicuous at 90.70% whilst electricity in A1 is the least at 0.01%. These findings explore the fact that there is a very high dependency on forests reason being that firewood is used for cooking and it is collected from the forest.

Table 5.5: Types and purposes of energy used

Type	Purpose			
		OLD	**A1**	**A2**
Firewood	Cooking	100	100	100
Paraffin	Cooking	20.08	31.68	16.28
Torch	Lighting		28.71	2.33
Candles	lighting	17.58	24.75	81.40
Solar	Lighting/charging batteries for phones, radio and television	70.32	17.82	90.70
Electricity	Lighting/charging phones/radio and television	0.01	10	37.21
Firewood and electricity	Cooking and lighting	0/01	3.96	0
Gas	Cooking	0.0	3.96	18.60
Ethanol	Cooking	0.0	0.99	0

Source: Field Survey

5.7 Forest management and challenges

Table 5.6 reveals aspects on forest management and forest management problems encountered in Shamva resettlement. The survey revealed that all household heads were aware of forest conservation support services. Agritex and EMA had the highest (60%) extension support share followed by private companies (23%) forest commission (20%) and the least neighbours with 15%.

Most respondents acknowledged extension officers visited them often during the month (60%). However the settlers revealed that very little (85%) training on conservation is done. Despite lack of training, the farmers in Shamva were satisfied (41%) with the quality of service provided.

Table 5.6: Response on aspects of forest management and challenges

		OLD		A1		A2	
		Yes	NO	Yes	No	Yes	No
Aware of forest conservation support services in your region/area?		91	0	99	0	43	0
From where do you get agricultural extension services?							
	None received	2	89	99	0	2	41
	Neighbours	17	74	84	15	34	19
	Forest commission officers	10	81	70	29	27	16
	Private company extension workers	24	67	76	23	5	38
	AGRITEX	54	37	39	60	40	3
	EMA	50	41	39	60	39	4
	Media	23	68	71	28	5	38
	Other: specify :community leader	29	62	75	24	1	42
How often do extension officers visit your farm in a month?		60	31	35	64	38	5
Have you ever received any training from the extension officers?		77	14	14	85	42	1
What is your opinion on the quality of service provided by extension officers who visit you?	Very poor	5	86	89	10	2	41
	Poor	4	87	97	2	0	43
	Satisfactory	30	61	58	41	21	22
	Very good	31	60	67	32	17	26
	Excellent	14	77	0	99	0	43

Source: Field Survey

Table 5.6: show the responses on aspects of forest management and challenges faced by A1, A2 and Old resettlement farmers. All the A1, A2 and Old resettlement farmers across all models indicated that they were aware of the need to conserve indigenous forests. Of the three models, A2 and Old agreed that they received forest

extension services mainly from AGRITEX (Old 54%, A2 60%) but only 39% in the A1 model were in agreement. Meanwhile neighbours and community leaders were prominent in the A1 model. .All the models agreed that extension workers do visit them for extension on forest conservation but at varying responses from 93% for A2, 66% for Old resettlement to 34% for A1 resettlement. Extension officers visit more the Old and A2 resettlement areas. Again, A2 and Old resettlement farmers received more training than the A1 farmers 94%, 93% and only a paltry 14% for A1 resettlement. The resettled farmers in the Old resettlement model evaluated the quality of services provided by extension officers. The farmers ranked the services from satisfactory 32% to very good 31$ whilst the A1 considered the extension services as very poor 97 % to very poor 89% ,

5.8 Discussion

This section discusses the results of demographic characteristics of households, livelihoods strategies in the Old, A1 and A2 resettlement areas, forest dependency by the settlers and the management of the forest by the stakeholders as stated above.

One of the objectives of this study is to identify the livelihood strategies of the inhabitants of Shamva resettlement areas. The emerging results indicate that each household had a multiple of strategies to sustain their livelihood as stated in Chapter 2 by Scoones (1998) and Swift (1998), who observed that the strategies are diversified. In spite of a number of livelihood strategies agriculture remains the dominant (100%) source of income for meaningful and sufficient livelihood sustenance, this is also echoed by the observation by USAID (2007) and World resource Institute (2013) Doss (2006) and Moyo (2004), as stated in Chapter 2 and 3. However, agriculture is directly related to forest resource use in Shamva resettlement through curing of tobacco, clearing land for ploughing, cutting poles to build farm structures at the homestead such as livestock pens and roofs for huts and houses. This increases the rate of dependency on forest. Plate 1-9 below presents some of the activities that consume timber from the forest during the day to day chores of the settlers' life cycle in Shamva resettlement areas.

Plate1: Ban and adjacent shed

Plate 2: Brick walled thatched huts

Platen3 Cattle kraal with adjascent *mutanho* for storing maize/soya stover.

Plate 4 A crib loaded with the season's harvest

Plate 5: Granary for storing the season's harvest

Plate 6 A garden fenced with poles

Plate 7 A boy carting firewood from the forest

Plate 8 A woman carrying firewood from the forest Plate 9 A girl child carrying firewood from the forest

Figure 3.14 Pictures showing forest dependency in Shamva resettlement areas.

The mean household income of the sampled households is $2619.73 for Old, $3090.24 for A1 and $20900.46 for A2 resettlements (Table 5.3). The mean total income differed significantly between Old, A1 and A2. The income varied with A2 having the highest and old resettlement has the least. The difference could be due to access to non- forest income sources such as mining, small business, pensions and salaries and wages. A2 farmers have more access to non-forest income than their A1 and Old counterparts because they have more disposable cash from bank loans, salaries, pensions and small businesses. Meanwhile Old and A1 settlers have a mean monthly income of $257.52 and $218 respectively. This is below the poverty threshold in Zimbabwe of $505.00(CSO Nov 2015). A2 monthly income was $1741.69 way above the poverty datum peg. Forest derived income ranged from $505.00 for Old, $460.90 for A1 and $485.40 for A2 resettlement per annum. This yields a forest dependency index for Shamva of 19.27% for Old, 15% for A1 and 0.02% for A2 resettlement. The dependency index of Shamva resettlement is similar to the figures stated in Chapter 2 for Zimbabwe 22%, South Africa 20% and other SADCC countries. It is however different from the 90% for Fiji. The national poverty rate is 63% as stated in Chapter 3; this could contribute significantly to the heavy reliance on forest. This is close to IFA (2014) findings which also asserted that about 90% of the population in developing countries uses forest products on a daily basis and about 75% of the poor people that live in rural areas depend on forests for subsistence.

All resettlement programs in Shamva District from the sampled population use firewood for domestic purposes (Table 5.4). As stated in Chapter 3, this observation is in agreement with studies carried out in Zimbabwe by Campbell and Elliot (2002) and Cavendish (2003), who also observed firewood was used for cooking in rural and resettled households. In Africa it is estimated that 90% of the entire continent use firewood for cooking UNEP (2000). The quantity of firewood used for domestic use by Old, A1 and A2 is significantly different at 20m3, 22.44m3 and 27.88m3 respectively. It was noted that the amount of wood consumed varies with season and special occasions, this same line of thought was also expressed by (Grundy *et al.*, 1993). Wood is used more in winter during the cooler months and during special occasions such as funerals, weddings, traditional gatherings and beer brewing.

Comparative data on annual fuel consumption from Zimbabwe and elsewhere in Africa show a range from 1.6t/hh/year in Transkei (Best, 1999) to 6.0t/hh/year in Kenya (Anold et al 1999). Zimbabwe annual consumption is set at 4.5t/hh/year (forestry commission1985) and 6.5t/hh/year Grundy *et al*. 1993). The value of 6.7t (20m3), 7.3t (22.44m3) and 9.0t (27.88m3) for Old, A1 and A2 resettlement respectively is generally higher than other countries. This is same line of thought was also observation expressed by (Grundy *et al*., 1993). This could be because the farmers are settling and therefore heavily rely on wood for energy, construction and curing tobacco.

As Sapkota and Oden (2008), noted the amount of fuelwood collection varied greatly between the rich and the poor. A2 farmers who are richer use more than their A1 and old counterparts do. This is in disagreement with Tieguhong and Zwolinski (2008), who stated that the poorer the village, the larger the proportion of the overall livelihood value derived from the forest. Again, Timilsina's (2014), it is contrary to the foregone sentiments and asserts that higher incomes are less dependent on subsistence resource than lower incomes because transaction cost for collection of resource from the forest is higher for higher income households and are less willing to trade off the time for low value income. However, we argue that the reason for the contradiction could be that because of Zimbabwe Electrical Supply Authority's electrical power cuts A2 farmers, who are mostly employed in town and are mostly visiting farmers who reside in Shamva and Bindura mining towns, commute or drive and carry firewood from the farm for household use as substitute energy source in the event of a power

cut off in town. They have the capacity to transport wood from their farms to urban centres.

Surprisingly, none of the respondents revealed that they harvest wood for use in town and for sale to teachers at schools nearby and lecturers at Madziwa teachers college and businessmen nearby Chakona Township, Madziwa mine, Bindura and by the roadside for possible fear of being victimized by EMA. This is despite the fact that the researcher could see truckloads, scotch cart loads (Plate 7) and women and children (Plate 8 and 9) trafficking to the market during the field visit. Observation was made in the study that those who sell firewood either did not have or had a few hectares of land to grow crops and vegetables, more so, they had no jobs in the village nor outside because of liquidity challenges, and to make matters worse drought left them with very little to harvest, and nothing to grow in the garden, low remittances from children and friends again because of liquidity problems facing the nation and general decline of social responsibility among the youth, low productivity due to lack of inputs and take advantage of ZESA power cuts to sell firewood in town. These observations show that poverty and socioeconomic factors force villagers to sell firewood.

Besides using firewood for domestic use, Shamva Old, A1 and A2 resettlement farmers also use it for curing tobacco. Zimbabwe is estimated to have lost 15% of its forest cover in the past 15 years as stated in Chapter one (1998-2013) due to tobacco production (Forest Commission, 2013). Meanwhile, Forest Commission (2013), reports that Virginia flue-cured tobacco consumes between 82.5 and 175 million cubic metres of round wood harvested worldwide each year and that translates to equivalent of 1.2-2.5 million hectares of open forests or woodlands removed annually. In Shamva resettlement area, 55.0% Old, 45.45% A1 and 34.88% A2 resettled farmers use firewood for burning tobacco. The means that the amount of wood used per household by Old, A1 and A2 resettled farmers was 15,21m3, 13.33 m3, and 11.66m3 respectively (Table 5.1), therefore more firewood is used for burning tobacco in the Old resettlement than the A1 and A2. This could be because the A1 and A2 farmers have increased awareness because they are more educated as observed from Chapter 5, have funds to buy coal for curing because they are more endowed with resources or because of reduced farmers for tobacco production in A2 resettlement. Both uses of firewood for domestic and curing tobacco increase rate of forest

dependency. Similarly, construction of farm structures in the resettled areas also increased forest dependency.

A variety of structures are constructed in Shamva resettlement areas. These structures include huts (Plate 1 and 2), livestock pens (Plate4 and 5), structures for storage and security (Plate5 and 6), bans and sheds (Plate1) (Table 6.1). The huts also have a variety of construction methods which include the following (i) brick walled thatched hut (Plate 2), (ii) brick walled thatched house and (iii) dagga thatched hut or house (Plate 5).Meanwhile, there are no pole and dagga huts in Old resettlement but 11.11% in A1 and 55.81% in A2. The reason could be because the Old resettlement was long established from 1980 whilst the A1 and A2 farmers came after 2000 and are still building structures.

The quantity of wood used for a brick walled thatched hut roof for Old, A1 and A2 is 1.32 m^3, 1.36m^3 and 0.33m^3 respectively. These figures are lower than those observed by Grundy et al 1.6 m^3 for a hut but similar to Liegme (1983). Lepetu *et al*. (2009), recorded a much higher volume hut in Botswana at 4-5m3.The average volume of a brick wall thatched house roof for Old, A1 and A2 was 1.67m^3, 0.66m^3, 0.8m^3 respectively. These results are higher than those observed by Grundy et al (1993) of 0.46m3.

Most household in all the resettlements had cattle kraal, goat pens, maize crib and plate stand. Cattle kraal had the highest volume of wood (3.39m3) among all the structures per household. The change room had the least (0.08m3).

The majority of the households had gardens (82%) for Old (75.6%) for A1 and (58.2%) for A2. The gardens were fenced with poles and withes and acacia branches to protect against livestock and wild animals. These gardens were located along river banks, near boreholes, dams and wells for easy access of irrigation water. Volumes of wood in branches were not measured. However similar studies in Kwazulu, Natal were found to use 300kg of thorn branches per 0.025ha of a garden per year (Grundy *et al*., 1993). Homestead fence was more conspicuous with the Old resettlement (29.69%) and very few had fenced their homesteads in A1 (0.03%) and A2 (6.97%).

Calculating the quantity of wood used on farm structures per household, on average household construction has 15.29m3 for old, 10.29m3 for A1 and 9.4m3 for A2. The Old resettlement uses more wood per individual household whilst A2 uses the least.

This difference could be attributed to the premise that Old resettlement had to construct all its structures whilst the majority of the A2 farmers either reside on the previous white owner's premises or use the existing white farmer's workers' cottage and farm structures. The old resettlement farmers are already established and have already put up their structures whilst A1 and A2 framers are still developing their homesteads.

Resettled farmers in Shamva district have mixed feelings on the quantity and quality of services rendered on forest conservation. Resettlement farmers are all aware of forest conservation initiatives. This is in line with the sentiments of Cavendish, 2003 and Elliot and Campbell, 2004. Meanwhile only more than 50% of the Old and the A2 farmers stated that they received extension services whilst only 39% in the A1 stated they received extension services. This could be as a result of the poor infrastructure in the A1 resettlement areas as mentioned in previous literature making them inaccessible and inhabitable for extension workers (ZimVac, 2014). Whilst A2 and Old resettled farmers feel that the quality of extension workers is satisfactory to very good, the A1 farmers have contrary sentiments. The A1 farmers are in agreement with Cavendish, 2003 and Elliot and Campbell, 2004 who stated that the quality of extension services has deteriorated in Zimbabwe due to inadequate manpower and poor infrastructure caused by inadequate funding by central government.

5.9 Conclusion

The results for the demographic characteristics show that Old, A1 and A2 resettlement farmers are not homogenous entities that can be isolated and identified by a single objective and common interest. Shamva resettled farmers are different in social and economic status, perspectives and knowledge systems, value, understandings and objectives. Therefore policy makers should not start from a general assumption of group homogeneity but should take cognisant of the heterogeneity nature of the resettlement farmers in formulating tree conservation programs.

Old, A1 and A2 resettlement farmers do not have one source of income, their income sources are diverse. However A2 farmers are more endowed with income sources than their A1 and Old counterparts hence are less dependent on forest. The Old and A1 have monthly income below the poverty datum line whilst the A2 farmers are above the poverty threshold. The dependency ratio of the resettled farmers is 19.27%, 15%

and 0.02% for Old, A1 and A2 resettlements respectively. It therefore means that in Shamva resettlement areas, the Old and A1 resettlement farmers have a higher forest dependency than A2 farmers hence there is higher deforestation in these areas as shown in the previous chapter. Forest policy should be directed in shifting their livelihood strategy from direct exploitation of forest to alternative income generating activities, such as mining and other innovative income generating activities wax and honey production from Bee keeping, canning from guava and mango production that provide income to the poor. The extension services are perceived as good by the Old and A2 farmers whilst the A1 farmers feel they are inadequate. The next chapter will present and discuss the findings of the results on socio and economic factors that influence willingness to participate in conservation of forests.

CHAPTER 6

SOCIO-ECONOMIC AND INSTITUTIONAL FACTORS WHICH DETERMINE WILLINGNESS TO PARTICIPATE IN CONSERVATION OF INDIGENOUS FOREST

6.1 Introduction

This chapter is in two sections, the first section represents descriptive results and discussion of the counts and frequencies of the respondents to questionnaire items on knowledge, attitude and practice on willingness to participate in conservation of indigenous forests. This section serves as a proxy to the independent variable for the next section.

6.2 Results

Table 6.1 shows the results of the KAP analysis for the 3 resettlement areas in Shamva District. The table indicates those variables that reflect knowledge and those that representing attitude and finally those that have a direct indication on practice against each of the 3 resettlement schemes (A1, A2 and Old) and the percentage of farmers who indicated yes or no to each of the attributes under consideration. Knowledge, although it is not a direct indicator of willingness to conserve forests, has been included in the results presented in Table 6.1 because it influences both attitude and practice which are the direct measures of willingness used in this study. It is interesting to note the discrepancies that exist between knowledge and attitude and knowledge and practice or even attitude and practice. These discrepancies would indicate that knowledge alone or practice alone or even in combination are necessary but not sufficient conditions for “practising” forest conservation.

Table 6.1: Willingness to participate in forest conservation: KAP analysis results

	A1 Resettlement		A2 Resettlement		Old Resettlement		Overall	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Knowledge Variables								
Aware forest conservation?	100	0	97.7	2.3	89	11	95.6	4.4
Know about forest penalties?	94.9	5.1	100	0	87.9	12.1	94.3	5.7
Attitude Variables								
Willing convert land to conservation?	76.8	33.2	84.0	16.0	89.1	19.9	83.3	26.7
Cultural beliefs	51	49	2.3	97.7	51.7	42.9	33.6	72.4
Religious Beliefs	30.3	69.7	0	100	25.3	74.7	17.0	83.0
Aesthetic respect	27.3	72.7	0	100	26.4	73.6	17.9	86.1
Conservation important?	52.5	47.5	88.4	11.6	71.4	28.6	70.8	29.2
Willing to buy seedlings?	61.6	38.4	97.7	2.3	79.1	20.9	79.5	20.5
Willing plant seedlings?	55.6	44.4	100	0	92.3	7.7	82.6	17.4
Membership of group?	13.1	86.9	95.3	4.7	91.2	8.8	66.5	33.5
Practice Variables								
Participated Agroforestry?	100	0	100	0	100	0	100	0
Bush encroachment control?	90.9	9.1	97.7	2.3	87.9	12.1	92.2	7.8
Fencing	91.9	8.1	83.7	16.4	68.1	31.9	58.8	41.2
Participated fireguard?	100	0	100	0	73.6	26.4	91.2	8.8
Preventing tree cutting	90.9	9.1	86	14	64.8	35.2	80.6	19.4

Source: Field Survey

6.3 Discussion

Table 6.1 presents results of the study in the form of the knowledge attitude and practice framework. Knowledge is assumed to drive attitude which in turn drives practice. Governments can intervene in the management of forests through coercion, such as is the case with the Environmental Management Agency (EMA) in Zimbabwe or they may use education to increase knowledge and awareness about the value of forest conservation. Some governments can also offer incentives in the form of competitions and awards of recognition in forest conservation. Non – governmental organizations often complement governments in providing incentives and mass education to encourage communities to conserve their forests. The willingness to conserve forests measured in this study might have come from a myriad of these governmental and non-governmental efforts and it is difficult to separate voluntary

farmer's effort to conserve forests from the results of coercion by government arms (mainly EMA and local authorities in Zimbabwe).

The Table 6.1 shows aspects of willingness to conserve forests that were reflected by communities in the study areas. A commendable 84% of the interviewed households indicated that they are willing to give up some of their agricultural land to pave way to forest revitalization programs. This willingness was more pronounced in the old resettlement areas (89.1%) and lowest for the A1 resettlement farmers (76.8%). The reason for this might be that farmers in the old resettlement areas are older than their A1 counterparts and therefore do not need as much land as the still vibrant A1 farmers who are likely to still have the energy and the need to cultivate their land to feed and raise their young families.

Results also indicate how different farm typologies are affected by cultural beliefs or the effect of the cultural mode of viewing forests on famer willingness to conserve forests. A greater proportion of A1 and old resettlement farmers (51% and 57.1% respectively) indicated that they attach some cultural significance to forests which in turn induces a greater proclivity to conserve these forests than the A2 farmers (2.3%). This might be due to the fact that most A2 farmers are modernized and educated and thus free from the influence of traditional cultural beliefs. Religious affiliation and the aesthetic respect for forests also indicated the same trend as for cultural norms with the A2 being affected much less than their A1 and old resettlement counterparts.

The proportion of farmers who have a positive attitude towards forest conservation (who answered "yes" to the question, " is forest conservation important"?) is higher for the A2 farmers (88.4%) followed by the old resettlement farmers (71.4%) and then the A1 farmers where only 52.5% of the interviewed farmers answered that it is important to conserve forests. The low opinion on forests by A1 farmers is a worrisome outcome considering the fact that they occupy lands that have already suffered profoundly from deforestation. This seemingly negative attitude towards forests is probably because these farmers have a heavy direct reliance on their environment (including forests) for survival because they are located at the lower end of the wealth spectrum.

The three other factors that were used as proxies to determine the extent of communities' willingness to conserve forests are their willingness to buy indigenous tree seedlings, their willingness to plant indigenous tree seedlings if donated to them

and their willingness to join groups on forest conservation and management. Again the A2 resettlement farmers scored highly on these indicators (97.7%, 100% and 95.3% respectively per each of the same three indicator variables), then followed by the old resettlement scheme farmers (79.1%, 92.3% and 91.2% for the 3 indicator variables) and then A1 farmers with the lowest proportions of 61.6%, 55.6% and 13.1% respectively for the 3 indicators. It is both interesting and alarming to note that A1 farmers are scoring very low (a greater proportion of them are not pro forest conservation). This might be a clear indication of disaster if the activities of these farmers are not checked. They obviously have a very low opinion of forests and have a general inclination towards forest destruction (Hogarth *et al*., 2013) for they seem to have a very high discount rate for the future of forests.

Besides using proxies of willingness to conserve forests such as attitudes, it is better still to look at the actual actions taken by farmers as a true reflection of their

"willingness to conserve" forests. Farmer willingness to participate in agroforestry activities is one such indicator. All farmers in the 3 resettlement areas indicated that they participate in agroforestry activities but what they construe as agroforestry is not the planned mixing of crops with tree plants that takes advantage of the planned biological symbiosis between indigenous trees and crop plants. It is a system of leaving some trees in their fields to reduce the negative effects of complete land clearing. However, since it is also a way of forest conservation, it has been captured in this study as a positive to willingness to conserve forests by the farmers. The construction of fireguards is also one of the most popular forest conservation practices in the study area especially for the A1 and A2 farmers with 100% of the farmers in both resettlement schemes practicing it. The lower percentage of old resettlement farmers constructing fireguards could be due to shortage of labour for these largely geriatric farmers. Interesting to note is also the fact that farmers themselves have participated in activities geared at the prevention of illegal cutting down of trees. This is particularly the case for the A1 and A2 farmers (90.9% and 86% respectively) and an overall of 80.6% for all the resettlement areas. This might be a manifestation of the effects of local administrative structures that include traditional leaders and other organizations like FC and EMA working in these areas to police and promote forest conservation activities.

Groups are important in any information dissemination or extension system. They shape individual behaviour so that it suits and is in line with the generally acceptable codes of contact which in most cases are going to result in better outcomes than individual decision making and practices. The same applies for groups that are meant for forest conservation. It is an unfortunate outcome that only 13.2% of A1 farmers indicated that they belonged to any group that deals with forest conservation as compared to 91.2% for the old resettlement farmers and 95.3% of the A2 farmers. This might be the reason why A1 farmers in the study areas have performed badly on almost all the indicators of willingness to conserve forests that were used in this study.

6.4 socio economic and institutional factors affecting willingness to participate in conservation of indigenous forest

6.4.1 Introduction

This section is a presentation of results analysis of the Logistic Regression Model on the socio economic and institutional factors that affect willingness to participate in conservation of indigenous forests. The expected results of the econometric models are presented as described in Chapter 3. These results focus on factors that are statistically significant at the 10% level or better, unless otherwise noted.

The results are presented according to the research question stated in Chapter 1, where the independent variables are summarised in Chapter 3 section and the description of the econometric model (binary logistic regression model) in the same Chapter 3. The aggregated KAP results of the previous section 6.1 Table 6.1constitute the dependent variable ‘willingness to participate’. Below are the results of the Logistic Regression Model Table 6.2:

6.4.2 Results

Table 6.2: Results of the Logistic Regression Model

Variable	A1		A2		Old	
	Coeff.	Sig.	Coeff.	Sig.	Coeff.	Sig.
Constant	0.564 (0.008)	0.010	1.966 (0.004)	0.023	1.735 (0.099)	0.080
Gender	1.013 (0.032)	0.012***	1.495 (0.084)	0.241	1.397 (0.027)	0.227
Marital Status	-3.772 (0.019)	0.146	1.765 (0.038)	0.184	1.358 (0.015)	0.015***
Age	2.056 (0.013)	0.045**	0.257 (0.005)	0.612	0.257 (0.092)	0.612
Secondary/higher	1.173 (0.053)	0.002***	3.025** (0.015)	0.048	0.636 (0.027)	0.408
Employed	1.221 (0.009)	0.034**	2.092 (0.053)	0.148	2.092 (0.065)	0.148
Christian	0.996 (0.034)	0.997	-1.241 (0.296)	0.314	-0.530 (0.093)	0.515
Traditional culture	2.723 (0.069)	0.835	0.181 (0.030)	0.671	2.301 (0.004)	0.005***
Household income	1.222 (0.124)	0.180	0.326 (0.051)	0.568	0.326 (0.021)	0.568
Number of cattle	0.549 (0.034)	0.559	4.617 (0.032)	0.074*	2.142 (0.063)	0.216
Paraffin energy	1.951 (0.008)	0.001***	2.290 (0.037)	0.130	2.290 (0.014)	0.130
Solar energy	1.001 (0.078)	0.256**	1.785 (0.027)	0.086*	1.894 (0.098)	1.534
Grow tobacco	-1.569 (0.913)	0.046*	0.572 (0.097)	0.149	-1.165 (0.076)	0.394
Forest penalties awareness	2.340 (0.045)	0.031**	0.327 (0.114)	0.981	5.274 (0.011)	0.007***
Distance - forest	0.229 (0.089)	2.114	0.743 (0.888)	0.389*	0.743 (0.476)	0.389*
Household size	1.256 (0.097)	0.557	0.595 (0.082)	0.635	0.913 (0.219)	0.099*
Distance market	0.152 (0.777)	0.524	2.543 (0.078)	0.215	5.267 (0.057)	0.022**
AGRITEX	1.991 (0.311)	0.011***	0.572 (0.049)	0.449	0.915 (0.044)	0.042**
EMA	2.513 (0.078)	0.001***	0.784 (0.067)	0.376	2.122 (0.453)	0.012**
Media	0.010 (0.043)	0.221	4.270 (0.089)	0.039**	1.650 (0.091)	0.056*
Private sector efforts	2.770	0.018**	0.784	0.376	0.024	0.075*

	(0.077)		(0.083)		(0.099)	
Community leaders efforts	1.995 (0.065)	0.044*	0.181 (0.074)	0.671	3.012 (0.058)	0.006**
Forestry Commission	0.942 (0.012)	0.433	2.562 (0.094)	0.109	3.413 (0.021)	0.261
Use coal	1.123 (0.084)	0.559	0.102 (0.097)	2.01	1.125 (0.055)	0.435

Source: Field Survey

Cox &Snell R2 = 0.571, Model Chi square = 33.817, Sig. = 0.019

For each of the resettlement models, the table gives the regression coefficient with its standard error in parentheses, then the level of significance (probability value).

Significance p<0.1* p<0.5** p<0.01***

6.4.3 Discussion

The explanatory variables were categorised into different sets of factors for easy of conceptualisation. These categories or groups are: demographic factors such as gender, age and marital status; economic factors such as income, employment status, education and number of cattle; social factors including religious and cultural issues; institutional factors to include sources of information, markets and finally issues related to agricultural activities and energy sources.

Gender: the gender of the household head significantly affects willingness to conserve forests in the A1 resettlement areas (p = 0.012). The results show that women are less likely to be engaged in forest conservation activities than men. This could be attributed to the fact that women are more dependent on forests for firewood since they are the ones responsible for the domestic use of firewood the possible reason could be most men have migrated to urban areas leaving women with the single handed responsibility to fend for themselves domestically. Studies carried out by Sapkota and Oden (2008), in Nepal confirm this finding.

Marital status: the results of the study are indicative of that the marital status affects the respondents significantly and positively (p = 0.015) the willingness to conserve forests for the Old resettlement farmers. The reason could be that married men and women in these areas are more mature and responsible people who care about their environment as compared to their younger counterparts. Thus it may be argued that married people understand the need to leave a legacy and the importance of the environment for their livelihood and food security. In their own words, they are more

willing to conserve their environments and natural resources. This is in agreement with the findings of the study by Abdel and Kobbail (2012), as stated in Chapter 2 who observed that age has a positive significance on tree planting which could be due to the migration of younger people to town living elders to manage the environment.

Education: it was observed that being educated was a positive and significant factor to the A1 and A2 resettlement farmers (p value A1 = 0.002, p value A2 = 0.048). This implies that the current school curricular are effective in inducing a sense of environmental awareness in the students that makes them value trees more and as a result, be more willing to conserve them. For the old resettlement farmers, the effect of secondary or higher education is positive not significant even at all the levels of significance. Reasons could be due to the fact that old resettlement farm owners are older therefore the effect of education on their farming and other activities is less ostensible. These results are in line with the findings of Ayuya *et al*. (2002), which established that farmers who have attained higher education are able to analyse and respond to new and better livelihood strategies. However, these results contradict with what emerged from Hogarth *et al*. (2013), who established that education has no effect on the livelihood strategies used therefore, even those who did not go to school can manage trees.

Formal employment: one of the factors that also had a positive effect on willingness to conserve forests was formal employment and this effect is significant for A1 resettlement famers. The effect might be as a result of the fact that A1 resettlement farmers have few resources to conserve the forests and also little access to other sources of power other than firewood since they are poor– the effect could be a spurious manifestation of income.

Beliefs: an individual beliefs and values play a pivotal role in their lives and, these were found to significantly enhance forest conservation in the old resettlement schemes (B = 0.530; p = 0.005). The older farmers who constitute the majority household heads of the old resettlement schemes were aware of the traditional customs and rules to wards respecting certain tree species, certain forest areas, moreover, they alluded to even holding some traditional beliefs that burning forests scares away benevolent spirits and invites evil ones. Chipadze Mountain, Vasowe areas of worship and Kudziva kwambuya are a few examples of such areas in the

study area. People's life styles are shaped by their religious and cultural affiliations. This should be true also for their knowledge, attitude and practice towards willingness to conserve forests. The way people view and value the conservation of forests is in line with their cultural and religious beliefs. Some societies have a number of taboos and regulations regarding forest utilisation. This is also in line with the findings of Harrison (2006), in Tanzania of Udzungwa forests who observed that for the surveys done the forest seemed to have significant cultural and spiritual value that is essential to social framework of the village.

Institutions: the findings of the study also highlight that institutions play a pivotal role in all facets of human knowledge systems, attitudes and behaviours. They are the "rules of the game" and govern human's ways of thinking and acting. The invisible institutions manifest themselves in the rules and regulations enforced or recommended by organisations regarding the utilisation and conservation of forests (Hogarth, 2013). Different organisations have different modes of operation as regards forest conservation leading to different rates of effectiveness and success rates in different areas. In Zimbabwe, the main contributors to forest conservation are Forestry Commission (FC), the Department of Agricultural and Technical Services (AGRITEX), Environmental Management Agency (EMA) which are government or quasi government departments. In addition, there are also a number of environmental conservation non–governmental organizations and private companies. The mode of operation of these organisations differs. While some impose penalties on forest offenders while some give incentives for forest conservation, and others educate communities by giving forest conservation advice. However, it may be concluded that whichever way these organisations operate, a clear message that is sent, is, 'forest conservation'. This study analysed the effectiveness of the activities of these different organisations on willingness to conserve forests by resettlement farmers in Shamva District.

AGRITEX: the results of the study also show that AGRITEX had a significant positive effect on forest conservation in the A1 resettlement areas and a positive but insignificant (A1 $p = 0.011$; A2 $p=0.042$) effect in other resettlement areas. This can be explained by its heavy physical presence in the A1 resettlement areas. EMA is generally found to operate across all resettlement areas and uses the punishment approach to enforce forest conservation. The positive significant impact on farmer

willingness to conserve forests (p = 0.001 for A1 farmers, 0.026 for A2 farmers and 0.012 for the old resettlement farmers) might not be a reflection of genuine voluntary farmer willingness to conserve forests, but of the fear of the penalties associated with forest destruction. Such an impact, which is based on fear and not farmer knowledge and attitudinal attributes can be very short lived and unsustainable. The guise of willingness to conserve induced by heavy penalties is unlikely to result in permanent solutions to forest conservation.

Forestry commission: this also have a significant impact on forest conservation in A1 resettlement areas (p=0.044) and in the old resettlement areas (p = 0.016) where their power tentacles have the strongest grip. Forest Commission seeks to have a more participatory approach to forest conservation in most areas. The insignificance of its efforts to conserve forests might be as a result of the fact that it hardly uses force and it is therefore less “felt” than EMA. The presence of Forestry commission is also thin because it is largely under staffed and resourced. Its approach is however likely to provide long lasting solutions to forest conservation and management for it works with communities and other stakeholders in its quest to have a green environment.

Community leaders: the existence of community leaders is vital in communities an as such in this study it emerged that community leaders are positively significant for (A1 p=0.044 and Old p=0.006). Community leaders are highly felt in the Old resettlement schemes. Traditional chiefs and village heads are considered to be custodians of the country’s culture and heritage. They are the government’s eyes on the ground in preventing deforestation for they have, vested in them by tradition, the mandate to punish forest offenders.

Media: resettlement scheme A2 farmers indicated a significant (p = 0.039) contribution of the media in reducing forest destruction and encouraging conservation. The media however does not work on its own and is in most cases used by other organisations as a platform for communication and promotion of forestation and forest conservation. This positive significance of the media is also manifested in Chapter 3 which shows that resettlement farmers are endowed with ICT gadgets like mobile phones, radios and TVs for easy communication of conservation programs. Private companies and

NGOs: non-governmental organisations play a considerable role on forest conservation. Since the onset of concerns about the devastating effects of climate

change on humanity, donors have increased their budget allocations to mitigatory measures. In Shamva, the role played by the NGOs operating in the area such as Development Aid from People to People (DAPP) and others has had a positive impact (B = 2.770; p = 0.018) on forest conservation in the A1 resettlement areas.

Paraffin: the use of paraffin as an energy source has been rampant in the A1 resettlement areas and this has seen it being a significant (p = 0.001) contributor to the willingness of these farmers to conserve forests. The old resettlement farmers have access to and also use coal as an alternative source of energy and this results in them being more willing to conserve forests (p = 0.017).The use of solar energy has had significant contributions to willingness to conserve forests across all the resettlement areas but its impact has been more pronounced in the A2 and old resettlement areas. For the A1 farmers, its lack of significant contribution to forest conservation could be due to affordability. The availability and use of alternative power sources is an obvious relief on forest dependency for energy (Wilson, 1996). This is also commensurate with the steps taken by the government of Zimbabwe that has also been making frantic efforts to promote other sources of power especially solar and rural electrification but to little avail.

Household size:the findings of the study also point out that household size coefficient is positive and statistically significant for the Old resettlement scheme (p=0.099) on willingness to conserve forests. Old resettlement households have large families that contribute to labour for management of forests. This is in line with the findings of Alemnew *et al*. (2011) and Thorai and Ranola (2010), who stated that bigger households have more family labour and more likely to participate in forest management since the practice is labour intensive and would require adequate labour supply.

6.6 Conclusion

The chapter has looked at different factors that determine farmer willingness to conserve forests across different resettlement schemes in Shamva. Results of the binary regression model indicted that the significant factors which explain willingness to participate in forest conservation are age, education, marital status, household size, gender, institution, belief and culture.

Older heads of household are more willing to conserve forests than the younger household implying that efforts to improve willingness to conserve forests will yield higher marginal returns if focused on younger households. The same can be concluded for female headed households and household heads with less than secondary school education. Unemployed households also need to be considered when deciding on the provision of forest conservation incentives for they were found to have a lower inclination to forest conservation.

The effect of culture and religion on willingness to conserve forests is varied but religion and culture work well in the Old resettlement and A1 farmers than in the A2 resettlement scheme. Efforts should be made to reinforce these cultural and religious influences on forest conservation in order to increase their effectiveness. This can be done by working with the custodians of religion and culture to inculcate the importance of forest conservation on their teachings and value systems.

Finally, the importance of the availability of substitutes to firewood for energy provides a striking opportunity to conserve forests. The type of substitute energy source varied with the resettlement scheme under consideration with paraffin having a greater impact in the A1 scheme, solar in the A2 and old resettlement areas while electricity was left out because only some A2 resettlement farmers have access to it. Governments and other organisations that crave to increase willingness by farmers to conserve forests should therefore provide alternative energy sources to farmers that match the ones with a significant impact on forest conservation willingness. The next chapter will present and discuss the findings of the incentives that were proposed by resettled farmers to motivate them into conserving forests.

CHAPTER 7

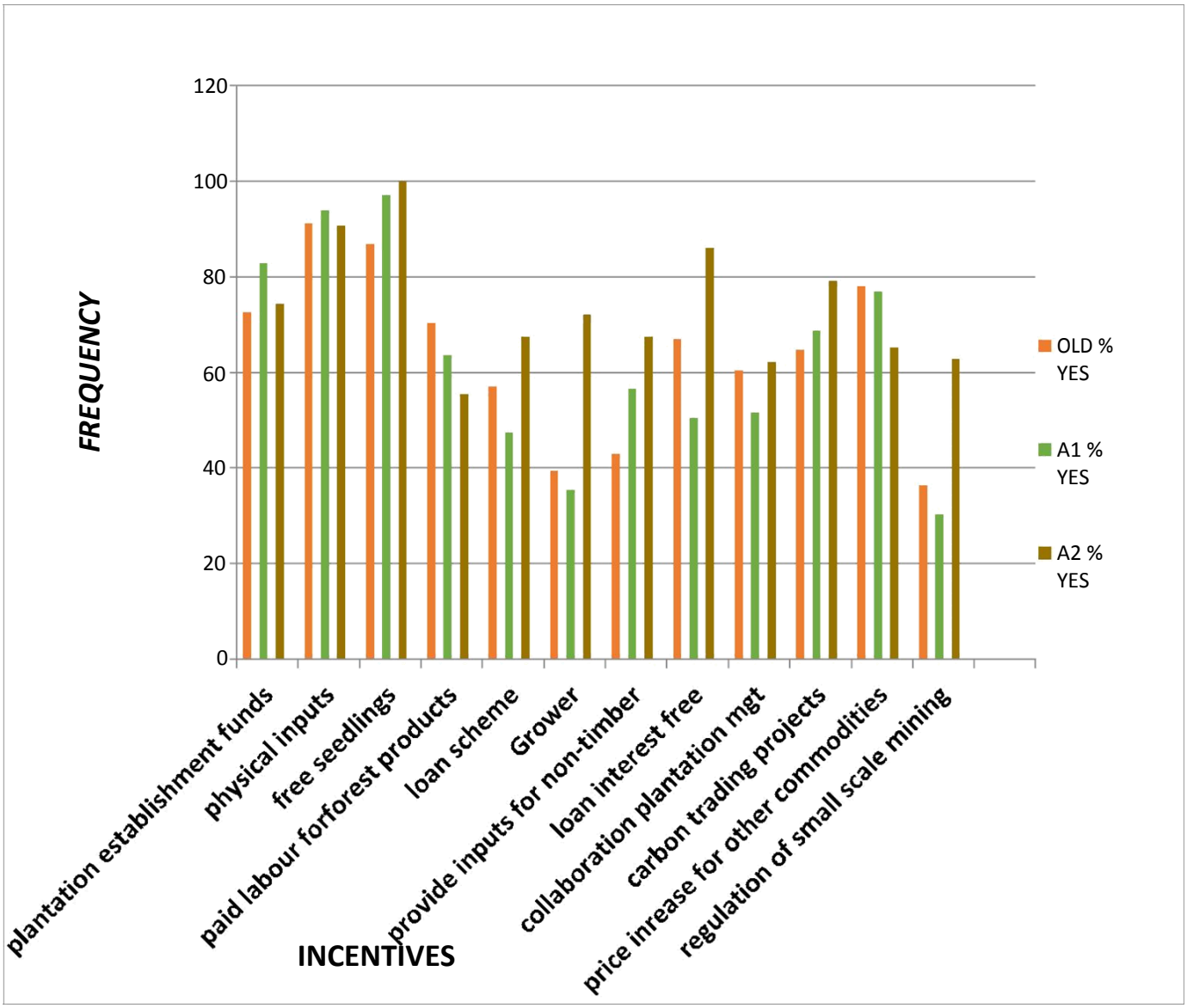
INCENTIVES FOR FOREST CONSERVATION BY RESETTLED FARMERS IN SHAMVA DISTRICT

7.1 Introduction

This section is a presentation of the results as well as the count and frequency technique on the preferred incentives by the resettled farmers for conservation of indigenous forests. The counts and frequency graph Table 7.1 show the ranking of the preferred incentives by each model of the resettled farmer.

7.2 Results

For the 3 resettlement areas, the farmers were requesting incentives related to the inputs for forest establishment such as financing, free seedlings and other physical inputs required for forest establishment. Compensation incentives such as carbon trading and increasing the price of non-tobacco commodities were also mentioned as possible incentives for forest protection across all the 3 resettlement areas. On the other hand loan schemes, out grower schemes and regulation of the activities of small miners were not prominent among the incentives mentioned by communities.



Source: Field Survey

Figure 7.1 summarises the responses provided by the farmers as to what incentives they think will enhance forest conservation.

7.3 Discussion

The discussion of these results takes the form of looking at each of the incentives that were proposed by researchers as motivators of forest conservation and compare the opinions of farmers across the 3 resettlement schemes.

7.3.1 Plantation establishment funds

Generally more than 75% of farmers in the 3 resettlement schemes mentioned the provision of funds for the establishment of forests as one of the most important incentives for forest resuscitation. This is more pronounced for the A1 farmers where 82.8% of the interviewed farmers made this request as compared to 74.4% and 72.5% for the A2 and old resettlement farmers respectively. This might be indicative of the poor financial position of these farmers. It could be that the farmers are willing to conserve their forests but do not have the financial resources to do so and hence the request, or it might also be due to the fact that poverty in this cluster of farmers makes financial incentives more enticing than for the other resettlement farmers and they might be in need of the financial resources for reasons other than forest conservation (Cavendish, 2003).

7.3.2 Physical inputs

Probably the most favoured incentive for forest conservation or rather restoration is the provision of physical inputs. This was unanimously a popular request across all the 3 resettlement areas with 93.9% for A1 farmers, 90.7% for A2 farmers and 91.2% old resettlement farmers making this request. This can be regarded as a positive outcome to forest management since the direct provision of forest inputs is better than the provision of funds which can be misappropriated and put to uses other than forest revival (Adams and Hulme, 2001) . Analogous to the provision of other physical inputs is the provision of free tree seedlings (86.8% old resettlement, 97% A1 farmers, and 100% A2). This also is a more direct intervention to forest resuscitation and is therefore expected to yield more significant gains to forest establishment.

7.3.3 Paid labour

Paying communities to conserve their forests is another of the interventions that NGOs and government are undertaking to enhance forest conservation in Shamva District. Communities are tasked to carry out a number of forest conservation activities and then marginally remunerated for it (Cavendish, 2003). This has a greater impact on willingness to conserve forests for the old resettlement farmers (70.3%), followed by A1 resettlement farmers (63.6%) and then A2 resettlement farmers (55.5%). The low impact of these paid conservation labour activities on A2 farmers is probably because of A2 farmers have a salary (39%) and pension (39%) Table 5.2.

7.3.4 Loan scheme

It is interesting to note that a greater percentage of A2 farmers (67.4%) requested loans as a motivator to forest conservation and resuscitation than for the other 2 groups of farmers (47.4% A1 farmers and 57.1% old resettlement). This could be attributed to the fact that A2 farmers are generally better off financially than the other 2 groups of farmers and hence are confident of being able to pay back the loans if advanced to them. This can also be explained using the risk function which postulates that the degree of risk aversion decreases as wealth increases. Thus, because of their wealth status, A2 farmers are less risk averse (i.e. are more willing to take up risky undertakings) than the poorer A1 and old resettlement farmers.

7.3.5 Out grower scheme

These A2 farmers were also found to be more interested in the out grower scheme than their counterparts in other resettlement schemes (72.1% for A2, 39.4% for old resettlement and 35.4% for A1). Out grower schemes are an arrangement where an external organisation provides inputs especially seedlings for reforestation to communities. These communities plant the tree and then upon maturity the communities harvest and sell the trees to the organisation. So the avidity with which A2 farmers grab the idea of out grower schemes might be because they have larger land sizes on which to plant the trees as compared to the A1 and old resettlement farmers and that they can also be able to take up long term investment.The A2 farmers are also aware of the benefits of the out grower scheme because of their higher education status Table 5.1.

7.3.6 Provision of inputs

The provision of inputs for non-timber cash crops is expected to lure farmers to the production of the non-timber crops whose inputs have been provided and thus increase the rate of deforestation as forests are cleared for the non-timber cash crops. Also if farmers are given inputs of other cash crops such as tobacco, they are going to concentrate their efforts on tobacco production and neglect forest conservation activities. Again tobacco production has a negative impact on forest conservation (see Logistic Regression results chapter 6). Thus famers across all the resettlement schemes do not think that the provision of inputs of other cash crops will have a positive impact on forest conservation. This observation is however more relevant for the A1 (56.5%) and old resettlement farmers (67.4%) than it is for A2 farmers (42.9%). This is probably because A2 farmers are already relatively well off and can afford to buy their own inputs so the provision of free inputs hardly changes their cropping decisions. This finding might also be taken to mean that A1 and old resettlement farmers are constrained from increasing their area under cash crop production by lack of inputs of these cash crops, and once the inputs are availed especially for free, they will expand their area under cash crop production and destroy more forest (Adams and Hulme, 2001).

7.3.7 Loan interest free

The provision of an interest free loan has an effect on willingness to conserve and revive forests analogous to that of the availability of a loan scheme. In relative terms, farmers in the A2 resettlement scheme were found to have a tendency of willingness to borrow and pay back latter rather than receiving inputs for free as compared to A1 and the old resettlement scheme farmers. They have a greater proclivity to borrow because as noted earlier they are less risk averse as can be explained using the risk function (Cavendish, 2003). Also, Old resettlement farmers and A1 farmers are used to free inputs from government and non-governmental organisations.

7.3.8 Collaboration plantation management

Some organisations work together with farmers to provide services for forest conservation and revival. They provide extension advise on forest conservation and core manage forest conservation activities with communities. More farmers in the A2

and old resettlement scheme are in favour of this arrangement (62.1% for A2 and 60.4% for the old resettlement) as compared to the A1 resettlement farmers (51.5%). The reason why A1 farmers are not as keen to work with other organisations in forest conservation is that they feel they are being monitored and thus being prevented from utilizing forest resources as they wish.

7.3.9 Carbon Trading

A considerable proportion (79.1%) of farmers in the A2 resettlement scheme considered carbon trading as an effective way to conserve forests. This is greater than the proportion for A1 farmers (68.7%) and the old resettlement farmers (64.8%). This result could be attributable to land size. The A2 farmers have larger land areas as compared to the A1 and old resettlement areas. They therefore have enough land to spare for carbon trading projects since most of them are not fully utilising their land in the first place. The A1 and old resettlement farmers are less likely to be willing to use parts of their land for carbon trading projects unless the payment they receive in return is greater than the opportunity cost value of utilising their land for cropping and other purposes.

7.3.10 Price increase of other commodities

According to the principles of cross price elasticity of supply, an increase in the prices of competing goods would shift resources to the production of those competing goods whose price has increased and thus reducing the production of the commodity in question (Gujarati, 2003). The same can be applied to tobacco in this study. An increase in the price of maize or cotton, for example, is expected to make tobacco production less attractive and farmers would then shift their resources to the production of maize or cotton and produce less tobacco and thus lessen the detrimental effects that tobacco production is having on forests. A greater proportion of old resettlement farmers (78%) old resettlement and A1 farmers (76.8%) agree with this assertion than for A2 farmers (65.1%). This could be because the few A2 farmers who are into tobacco farming have invested more in tobacco production infrastructure (majority established by the previous white owner) and are less flexible to changing their production systems to respond to output price changes. Thus production system rigidities limit the ability of these farmers to respond to output price changes in the short run.

7.3.11 Regulation of small scale mining

Lastly, farmers were asked to give their view on whether regulation of small scale mining activities would result in more favourable forest conservation outcomes. A smaller proportion of the old resettlement farmers (36.3%) and A1 resettlement farmers (30.3) agree with this proclamation as compared to A1 resettlement farmers (62.8%). This result can be ascribed to the fact that these farmers (A1 and old resettlement) depend so much on illegal mining activities and any regulatory mechanism on these activities would have a profound effect on their livelihoods. They are thus more reluctant to support any regulations imposed on their main income source (Wiggins *et al*., 2004). The A2 farmers on the other hand concentrate more on farming and are therefore more flexible when it comes to policies regarding the regulation of small scale mining activities (Hutton and Leader-Williams, 2003).

In addition to the factors that had been suggested by the researcher as motivators to forest conservation and resuscitation, famers themselves also suggested other factors which were captured in the questionnaire as other. These factors are as follows:

Provision of alternative sources of power such as electricity, coal and gas – electricity was suggested mainly by A2 farmers while coal and solar were suggested mainly by both A1 and A2 farmers.

The farmers themselves also suggested education as a possible solution to forest conservation.

Mostly A1 farmers suggested that the provision of more land would allow farmers to engage more in forest revitalisation programs.

A2 farmers suggested the creation of employment for women and youth through on farm and off farm projects like bee keeping and fish farming as a possible pressure release on forests probably because this would reduce forest dependence as people are engaged in other less natural resource intensive professions.

The old resettlement and A1 farmers suggested the provision of irrigation water as a possible push factor to the establishment of reforestation programs.

From these suggestions from farmers themselves, it can be concluded that farmers also have their own indigenous, locally brewed strategies for forest conservation (Wiggins *et al*., 2004; Meinzen-Dick and Gregorio, 2004). What needs to be done 138

therefore is to work together with farmers to increase what they know already and reinforce good forest practices by combining what they know with what the forest conservation organisations know (The Johari window). The above suggestions from farmers also confirm results of the Logistic Regression model presented in chapter 6.

7.4 Conclusions

Resettlement farmers in the A1, A2 and old resettlement schemes have been found to differ considerably in terms of the incentives they need in order to entice them to conserve forests. Resettlement farmers in the A2 scheme were found to be more interested in incentives that are capital and land intensive such as the provision of loans, carbon trading projects and the availability of out grower schemes for forests and forest products an outcome that can be attributable to their higher incomes and larger land sizes. On the other hand resource poor A1 and the Old resettlement farmers advocate for programs which provide free inputs for non-tobacco crops and increase the prices for the output of these crops so that they can switch from the production of tobacco to the production of other crops. The results of preferred incentives presented in this chapter can help assist stakeholders to provide the right kind of incentives to the right kind of farmers and increase the effectiveness of their activities in forest conservation.

CHAPTER 8

RESEARCH SUMMARY, CONCLUSION AND RECOMMENDATIONS

8.1 Introduction

This Chapter summarises the research proceedings and findings from Shamva District resettlement area of Mashonaland Central province, Zimbabwe. The broad objective of the study was to determine the rates of deforestation, level of dependency, willingness and factors that determine willingness to participate in conservation of indigenous forests as enunciated in the introductory chapter of the study. Descriptive and quantitative approaches which were used to analyse GIS, remote sensed data and the results from a sample of 242 A1, A2 and Old resettled farmers who were stratified and interviewed using a structured questionnaire are explained as stated in Chapter 4. This chapter also gives a brief discussion of the results and conclusions of this research as elaborately explained in Chapters 5 to 7. Finally, this chapter summarises, concludes, makes policy recommendations and looks at areas for further research.

8.2 Research Summary

Zimbabwe embarked on a Fast track land reform and resettlement program premised on equitable distribution of land. The program saw the emergence of A1, A2 and Old resettlement schemes which had varying support structures, population densities and socio-economic characteristics. Shamva District experienced a lot of land use/land cover changes and deforestation of indigenous trees induced by new inhabitants of the land reform program due to agriculture, mining and other anthropogenic activities.

The first chapter was to determine the rate of land use, land cover changes and deforestation in the A1, A2 and Old resettlement areas of Shamva District. This was achieved through the use of Geographic Information systems (GIS) and remote sensing. Data was analysed using ENVI 4.7 software for land use/land changes distribution and change detection. Rates of deforestation were calculated using Pyravaud formula, ($r = 1/ (t2-t1) \ln A2/A1$). The results show that in all the schemes, during the period 2002 to 2014 cropland, bushland and woodland moderate classes

decreased whilst woodland dense and grassland classes increased. The rate of deforestation in Old, A1 and A2 was 16.3%, 10.6% and 4.3% respectively. The rate at which the bushland and woodlands moderate is being degraded will leave these areas bare and the settlers will begin to encroach the woodlands dense forests.

After having established the extent of deforestation in the resettlement areas, the study proceeded in Chapter 5 to determine the livelihood strategies, dependency level and forest management perspectives of A1, A2 and Old resettled farmers of Shamva District in Mashonaland Province of Zimbabwe. Two hundred households from A1 (99), A2 (43) and Old (91) were stratified according to resettlement scheme and randomly selected for the cross-sectional household survey. Descriptive statistics were done using SPSS version 20 and the dependency level calculated. Agriculture was the dominant livelihood strategy among all the resettlement schemes. It also was the highest income earner in all the resettlement schemes. Firewood for domestic use was highest in Old resettlement with 21.3m3 and lowest in A2 with 11.66m3. Quantity of wood for construction purposes was highest in Old resettlement scheme 15.29m3 and lowest in the A2 model 9.4m3. Firewood was the dominant source of energy among all the resettlement schemes which was used for cooking and heating. The study demonstrates that there is luxurious use of wood for firewood and construction purposes in Old resettlement in particular which may contribute to deforestation. A study was established to determine the livelihood strategies, dependency level and forest management perspectives of A1, A2 and Old resettled farmers of Shamva District in Mashonaland Province of Zimbabwe. Two hundred households from A1 (99), A2 (43) and Old (91) were stratified according to resettlement scheme and randomly selected for the cross-sectional household survey. Descriptive statistics were done using SPSS version 20 and the dependency level calculated. Agriculture was the dominant livelihood strategy among all the resettlement schemes. It also was the highest income earner in all the resettlement schemes. Firewood for domestic use was highest in Old resettlement with 21.3m^3 and lowest in A2 with 11.66m^3. The quantity of wood for construction purposes was highest in Old resettlement scheme 15.29m^3 and lowest in the A2 model 9.4m^3. Firewood was the dominant source of energy among all the resettlement schemes which was used for cooking and heating. The study demonstrates that there is luxurious use of wood for firewood and

construction purposes in Old resettlement in particular which may contribute to deforestation. Also alternative sources of energy should be sought to replace firewood.

Chapter 6 also presents results of the knowledge, attitude and practice (KAP) assessment that was carried out to measure the degree of willingness by resettlement farmers in Shamva District of Zimbabwe, to conserve and resuscitate their forests. Generally, farmers across all resettlement schemes are knowledgeable about the need to conserve forests, the methods that can be used to conserve these forests and the rules, regulations and penalties associated with forest destruction. However, this knowledge is not translating well to farmer attitude and practice change on forest conservation especially for the A1 and Old resettlement households. For these farmers the practice of forest conservation was found to be mainly due to the fear of penalties imposed on forest offenders by EMA and traditional and local leaders rather than inherent positive disposition towards forests. Farmers in the A2 resettlement model were found to perform best based on the knowledge, attitude and practice framework followed by farmers in the resettlement model. It can be concluded that it might be useful to concentrate efforts and resources on A1 resettlement farmers in any efforts made by government and non-governmental organisations to improve forest conservation in Shamva District. The study shows a potential for improving forest conservation by resettled farmers if some of the 90 year lease agreement of the A2 resettlement scheme is adopted for the A1 schemes so as to improve the knowledge, the attitude and the practice of forest conservation.

The willingness by communities to conserve their forest resources is affected by a myriad of household demographic and socio-economic characteristics and a host of other factors related to the community's institutional environment. Binary logistic regression analysis was used in this study to unveil the factors affecting Shamva District resettlement farmers in the A1, A2 and the old resettlement schemes to conserve their forests. Willingness to conserve forests was regressed against a number of socio-economic and institutional factors, and household demographic and farming characteristics. The factors that were found to positively influence the willingness to conserve forests were: the level of education of the household head, availability and use of alternative sources of energy to firewood, penalties by EMA and local leaders on forest offenders and the cultural and spiritual values attached to forests by communities. On the other hand, tobacco production, household size and

being female had a negative impact on willingness to conserve forests. It can be concluded therefore that programs that involve community and other local leaders in forest resource management and that take cognisance of community values and cultures are more likely to result in positive forest conservation outcomes in the same manner as forest education programs that especially target women.

Lastly, chapter 7 presents the incentives that farmers considered to be the prime movers to forest conservation in the 3 resettlement areas of Shamva. The data were collected by asking farmers to indicate yes or no to whether a particular incentive would entice them to conserve forests or not and then constructing frequency tables based on the responses. Across all resettlement areas, the provision of forest revitalisation resources such as finance, tree seedlings and other physical inputs and equipment needed for forest conservation and resuscitation were considered by the farmers to be the most desirable interventions to forest management. The more affluent A2 resettlement farmers also considered the financing of forest conservation in the form of loans, the out grower scheme and carbon trading projects as desirable forest conservation incentives while the old resettlement and A1 farmers favoured projects that remunerate them for forest conservation activities and that either provide inputs for the production of non-tobacco crops or increase the output prices for non-tobacco crops. It is important therefore to properly target forest conservation initiatives by resettlement scheme if these initiatives are to be effective motivators of forest conservation.

7.3 Conclusion

Shamva resettlement area is experiencing patch dynamic vegetation change i.e. deforestation in moderate dense and bushland and afforestation in woodlands dense and grasslands. Cropland is being reduced. The reason for deforestation is luxurious dependency on the forest for firewood, tobacco production and construction whilst lack of capacity utilisation causes cropland and grassland reduction due to heavy regrowth and acacia invasion. Willingness is negatively affected by poverty, age, unavailability of substitutes for firewood for energy, unemployment, school education and female headed households. A2 resettlement farmers prefer the financing of forest conservation in the form of loans, the out grower scheme and carbon trading projects as desirable forest conservation incentives while the old resettlement and A1 farmers

favoured projects that remunerate them for forest conservation activities such as inputs for the production of non-tobacco crops or increase the output prices for non-tobacco crops so that they stop tobacco production.

7.4 Policy recommendations

Government should promote the reduction of harvesting of indigenous forest from the woodland moderate and bushland by

- Encouraging the monitoring of forests using remote sensing and GIS in all the villages, wards, Districts and provinces of Zimbabwe. Use of GIS and remote sensing has proved effective in monitoring deforestation in communities. The government should invest in GIS and remote sensing at District level. It should emphasise the training of manpower in order to effectively utilise the infrastructure and use it for monitoring forests, veld fire and crop assessment.
- Promoting use of affordable and renewable alternative energy source other than firewood such as wind energy and biogas. The government and nongovernmental organisations should promote the use of affordable alternative sources of energy so that the over dependency on firewood for cooking and heating is reduced. Examples of such alternative sources of energy are solar energy and ethanol for burning tobacco.
- Promoting the planting of woodlots of fast growing indigenous trees and use of alternative material for construction purposes.
- The promotion of the establishment of fast growing indigenous trees such as acacia should be encouraged. These trees are fast growing and have adapted to climatic and soil conditions and there will not perish in the event of adverse weather conditions being experienced. The settlers should be accorded a chance to name trees that are fast growing in their area and these should be established.
- Accelerating rural electrification programs in Shamva's resettlement areas.

  Rural electrification reduces dependency on forest and this program should be promoted country wide.
- Promoting livelihood strategies that shift from direct exploitation of forest to alternative income generating activities, such as mining and other income generating activities that provide income to the poor. The appropriate livelihood

should be identified by the people. This will enable the farmers to be less vulnerable and reduce dependency on the forest.

- Ensuring that certainties associated with the Zimbabwean government policy on land tenure should be dealt with urgently. The 90 year lease should be accelerated and another land tenure which is transferable with the bank should be encouraged across all the models.
- Promote education, culture and religion values that encourage afforestation The promotion of adult learning in resettlement areas should be encouraged. The learning curriculum should include, culture, religion and conservation of indigenous trees. Scholarships should be given to able children from each village.
- Introducing incentives as suggested in Chapter 7. Identified incentives should be promoted to reduce over dependency on forest.
- Promotion of growing exotic, fast growing trees for use in curing tobacco, construction and firewood.
- Promote conservation through traditional leaders.
- Creation of employment for the youth and women through off farm projects.
- Promotion of informal education on indigenous tree conservation in communities.

7.5 Suggestions for further research

- A study of perspectives of different demographic graphs (female headed households, child headed household) could produce different perspectives.
- This research was conducted in Zimbabwe agro-region 2 and 3 which is mountainous and wet; a study on the drier regions 4, 5 and 6 could produce different results.

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APPENDICES 1

All information provided by interviewee will be treated as STRICTLY CONFIDENTIAL for mutual benefit of both the researcher and the respondents.

Questionnaire number…… Ward number……

Enumerator name……..…..... District name...…….....

Name of respondent…….. Type of land reform…….....

Date..... Name of Community/Farm.....

A. HOUSEHOLD DEMOGRAPHIC INFORMATION				
Head of household name:				
A1. Gender	Male			
	Female			
A2. Marital status	Married	Single	Divorced	Widowed
	Other (specify)			
A3. Age of head of household (nearest year)				
A4. Highest level of education	None	Primary	Secondary	Tertiary
A5. Employment status	Unemployed	Informal	Formal	
A6. What is your religion?	Christianity	Traditional	Muslim	Other (specify)
A7. What is the size of your household?	1-3, 4-6, >6			

B.SOCIO ECONOMIC FARMING CHARACTERISTICS OF HOUSEHOLD

B1Do you own land?	Yes	No		
B2 If yes, How much land do you own (ha)?				
B3 When did you get the land?		Yes	No	
B4What is the type of land tenure of your land? 1. Owned with title deeds 2.owned without title deeds 3. Rented 4. Owned by parents 5. Communal 6.Government 7,Cooperative				
Do you need more land? If yes what do you need it for?(Rank1 as the most important)		Yes[ ]	No[ ]	Rank

	Planting trees			
	Gardening			
	Grazing			
	Cultivation of food crops			
	Cultivation of cash crops			
	Others(specify)			

B5... Are you a full time farmer?			Yes	No	
B6... When did you start farming (year)?					
	B7. What are your sources of income? (Rank 1 as the most important source)				
	Source			Approximate amount raised per year	Rank
	Crops	Yes	No		
	Livestock	Yes	No		
	Salary/wages	Yes	No		
	Pension	Yes	No		
	Remittances	Yes	No		
	Other (specify)				

B8 What types of crops do you produce.

B9. Do you keep livestock? Yes/No

B10.If Yes, specify the livestock numbers.

Class	Cattle	Goats	Sheep	Chickens	Pigs	Other (specify)
Number						

C TOBACCO PRODUCTION

C1 Do you grow tobacco? Yes [ ] No [ ]

C2. If Yes, how many hectares of tobacco did you grow last season?

C3. How many bales did you harvest?.....

C4. What did you use to cure your tobacco? Tick where applicable

Firewood (indigenous) [ ] Firewood (exotic) [ ] Coal [ ] Electricity [ ] Others (specify).....

C5 Give reasons for your answer to question C5.

C6 Do you have any intentions of expanding your area under tobacco production? Yes [ ] No [ ]

D.INSTITUTIONAL/ SUPPORT SERVICES			
D1. Are you aware of forest conservation support services in your region/area?		Yes	No
D2. From where do you get agricultural extension services?			
	None received		
	Neighbors		
	Forest commission officers		
	Private company extension workers		
	Agriculture Extension officers (AGRITEX)		
	Environmental Management Agency (EMA)		
	Other: specify		
D3. How often do extension officers visit your farm in a month?		1-Often	2-Rarely
D4 Have you ever received any training from the extension officers?			

D5. What is your opinion on the quality of service provided by extension officers who visit you?		
	Very poor	
	Poor	
	Satisfactory	
	Very good	
	Excellent	

D6. Do you belong to one or more farmers' organizations?	Yes	No

D7. If yes, state which ones?	Name	Purpose
If yes benefits are you getting from the organisation(s)?		

D8 Did you get farm credit for any indigenous conservation programme? Yes [ ] No [ ]

If yes which programme were you funded?

……

D9 How far is the nearest tarred road? km(s)

D10 How far is your nearest crop/livestock input and output market? km(s)

D11Does your village have any cultural/spiritual/aesthetic norms of forest resource management?

Cultural Yes [ ] No [ ]

If your response is Yes, list the mode of management.

i)……

ii)……
…….

Spiritual Yes [ ] No [ ]

If your response is Yes, list the mode of management.

,i)……i
i)……

Aesthetic Yes [ ] No [ ]

.If your response is Yes, list the mode of management.

i)……

ii)……

D12 Who oversees the forest regulations?

D13. Are you aware of any government/traditional penalties for breaching forest regulations? Yes [ ] No [ ]

D14. How serious is the problem of breaching forest regulations I your area (you can use a Licket Scale for the respondents)

……

E.SOURCES OF ENERGY

E1, What is the main energy used for domestic purposes by the household Answer the question by completing the table below.

Description	Purpose	Rank
1.Electricity		
2.Firewood		
3.Firewood and electricity		
4.Paraffin		
5.Gas		
6.Candles		

F. USE OF FOREST PRODUCTS WHICH AFFECT DEFORESTATION

F1.Do you ever visit the forest? Yes/No

F3 If yes which forest do you visit the most? Tick most appropriate.

Woodland dense [ ], woodland moderate [ ], wooded grassland [ ], bushland [ ]

F4 Which forest do you visit the least? Tick most appropriate

Woodland dense [ ], woodland moderate [ ], wooded grassland [ ], bushland [ ]

.F5State the reason?

F6 How far is the forest? km

Complete the table below by answering Questions F7 to F9.

F7 How many hours do you spend to travel per trip to and

fro? F8 How many trips do you do per week?

F9What items do you collect on each trip?

Firewood

Quantity in Local unit	Standard unit					Collected By								No of trips	Trips /wk	Qty/trip	Qty/ mnth	Total
	≥20	≥50	≥100	≥500	≥1500	K		W		M		E						
							N		N		N		N					
Bundle																		
W/burrow																		
S/cart																		
T/trailer																		

F 10.How much timber do you collect from the forest and use it as construction material? Answer the question by completing the table below:

Construction type		Qnty	No of poles used						volume of poles	Total quantity	Value
			Length(m)			Diameter(mm)					
			≤1	≤2.5	≤5	≤100	≤150	≤200			
Traditional house											
Traditional hut											
Liv.Pens	Cattle										
	Goat										
	Pig										
	Poultry										
Chikwere											
Ngarani											
Mutando											
dura											
Field fencing											
Garden Fencing											

F11. Are the forest products collected for subsistence, commercial or both subsistence and commercial? Tick appropriate. Subsistence [ ], commercial [ ] both subsistence and commercial [ ]

F12. How far is the market for forest products?

How many hours do you walk to the market for forest products?

G. WILLINGNESS TO PARTICIPATE IN INDIGENOUS FOREST CONSERVATION

i) Cues to action and willingness to participate in indigenous forest conservation

Cue to Action	YES	NO
Have you ever heard of indigenous forest conservation?		
Have you ever participated in any of the following conservation practices ***(agroforestry, fire guard construction, bush encroachment control, fencing, and protection against illegal cutting***)?		
Is the practice important?		
Are you a member (or any family member) of any forest conservation organization in Shamva District?		
Are you willing to convert part of your land for indigenous forest conservation?		
Do you agree with the assertion that indigenous forest conservation should be practiced as it controls the effects of climate change such as drought and floods?(*please explain climate change to respondent*)		
Are you willing to purchase indigenous tree seedlings for planting in your plot/farm?		
Are you willing to plant indigenous tree seedlings that have been donated?		

ii) Suppose an NGO or Government initiates a project of planting indigenous trees in Shamva district, what price will you be willing to purchase seedling trees for? ……

G3. Are you willing to participate in conserving indigenous forest in your area? Yes [ ] No [ ]

H. INCENTIVES.

H1Perceived Benefits

Variable description		
	True	False
Trees provide fuel for burning tobacco		
Trees provide fuel for burning bricks		
Trees provide income from trading as household fuel		
Trees provide income from wood carvings		
Trees provide income from medicinal herbs		
Trees provide income from trading collected insects		
Trees provide income from trading wild fruits		
Trees are necessary for spiritual and cultural rituals		
Trees provide household carvings(yokes spoons)		
Trees provide an aesthetic value to landscapes		
Trees are kept for future generation		
Trees improves soil and water conservation		
Trees provide eco-tourism		
Trees improve carbon sequestration		

H2.Which incentives would you prefer in exchange for the conservation of indigenous forests?

Incentives	Yes/No	Rank
Plantation establishment funds		
Physical inputs		
Free seedlings		
Paid labour for forest products		
Loan scheme		
Out Grower scheme		
Provide inputs for non timber cash crops		
Loan interest free		
Collaboration plantation management		
Carbon trading projects		

Price increase of other commodities other than tobacco		
Regulation of small scale mining		
Others (specify)		

THANK YOU.