FEASIBILITY OF INTEGRATING TRADITIONAL AND SCIENTIFIC ECOLOGICAL KNOWLEDGE SYSTEMS FOR SUSTAINABLE BIODIVERSITY CO-MANAGEMENT IN ZIMBABWE: A POLICY PERSPECTIVE

by

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DEDICATION

To my family for their love, trust and support.

DECLARATION

I Zinhiva Hardlife hereby declare that the thesis, which I hereby submit for the degree of Doctor of Philosophy in Environmental Management at the University of South Africa, is my own work and has not previously been submitted by me for a degree at this or any other institution.

I declare that the thesis does not contain any written work presented by other persons whether written, pictures, graphs or data or any other information without acknowledging the source. Note that some of the findings of the present study have been published in a peer reviewed journal. The details of the journal articles are: Zinhiva H. and Chitakira M. (*2017).* Strengthening Traditional Governance Systems For Sustainable Biodiversity Management in South-eastern Zimbabwe. *IK: Other Ways of Knowing. Volume 3, Issue 2, pg 33-52.*

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Student signature:  Date: 30 January 2019

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ABSTRACT

The renewable natural resources found on public lands outside of protected areas often face the predicament of competing and conflicting knowledge systems and management approaches. Yet, these resources are so critical for the sustainable livelihoods of the vulnerable rural populations and their management becomes a priority. The quest for a functional management approach has led to a multitude of options being drafted. This study assessed the feasibility of integrating the often competing traditional and scientific ecological knowledge systems for sustainable biodiversity co-management in Zimbabwe. The goals of the study were to characterise the perceptions of local rural communities in Masvingo Province, regarding access, use and management of natural biotic resources; to compare the duo knowledge systems; analyse opportunities and barriers to their integration and suggest an institutional and legislative framework for adaptive biotic resource co-management and environmental sustainability. The study was based on a case study of communal lands in Masvingo province of Zimbabwe. Data were gathered from traditional leaders, villagers, state resource managers and NGOs officials through interviews, questionnaire surveys, focus group discussions and direct field observations. The study documented the principle biodiversity management strategies used by local people and state natural resource managers. Although the methods differed, they shared common attributes in that they both had governing authorities and strict laws; and both seek to foster harmony between people and the environment. Opportunities for bridging the divide between traditional and Western scientific ecological knowledge systems for the sustainable co-management of biodiversity were identified. The study concluded by proposing an institutional and policy framework that seeks to foster the sharing and co-applications of the duo knowledge systems and management approaches in a pragmatic manner. We therefore envisage an environmental management approach that reminisce cultural societies whilst being progressive.

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AGRITEX	Agricultural Technical and Extension Services
CBNRM	Community Based Natural Resources Management
DA	District Administrator
DDF	District Development Fund
EMA	Environmental Management Agency
FC	Forestry Commission
IKS	Indigenous Knowledge Systems
NGO	Nongovernmental Organisation
RDC	Rural District Council
TEK	Traditional Ecological Knowledge
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Education and Scientific Organisation
VIDCO	Village Development Committee
WARDCO	Ward Development Committee
ZIMPARKS	Zimbabwe National Parks
ZIMSTAT	Zimbabwe Statistics
ZINWA	Zimbabwe National Water Authority
ZRP	Zimbabwe Republic Police

CHAPTER I

INTRODUCTION

1.0 Introduction

This chapter presents an overview of the conceptual issues in traditional and modern ecology. The central importance of natural biotic resources is the basis for the call for their conservation and wise utilisation. The chapter covers, among other items, the statement of the problem, objectives of the study, justification of the study, description of the study area as well as delimitation of the study. In the process, the information gap that the current study seeks to fill is explicitly determined and explained. It is also in this chapter that the study lays the background of the study, clearly stressing what is known and unknown about the subject being studied, the purpose of the study, what inspired it as well as the knowledge gap that the current study shall contribute to fill.

1.1 Background to the Study

Across the spatial and temporal scales, local people have relied on the landscapes that surround them and natural resources therein for survival (Richards and Little 1994, Ruheza and Kilugwe 2012). The socio-economic and ecological value of biodiversity in local rural environments of Africa cannot be overemphasised. The African environment is richly endowed with natural diversity of flora and fauna that serve social, economic and ecological functions. These biotic resources are a fundamental natural heritage that sustain a healthy planet and the livelihoods for most rural communities. Ecosystem products closely knit the social fibre of most African communities and demonstrate how much nature provides for humanity (Kessy 1998, UNESCO 2010, Department for Environment Food and Rural Affairs, 2011). Additionally, economic institutions thrive on raw materials harvested from the local landscapes whose ecological integrity is greatly enhanced by biodiversity. However, regardless of this global awareness, local communities still adopt some piecemeal and unsustainable approaches toward natural heritage conservation (Chenje, Sola and Paleczny 1998, Ramsay 2007, Pederson 2007). The world has increasingly been grappling with some life threatening environmental problems like species extinction and habitat fragmentation, pollution, climate change, invasive alien species, and other insecurities (Miller and Spoolman 2010, Hu 2014, USAID 2015, Hoagland 2016).

What is needed though is improving natural biodiversity management through adoption of ecosystem-based management approaches. Zimbabwe, alongside other countries in the African region and beyond, has ratified the United Nations Convention on Biological Diversity (UNCBD) and its Cartagena Protocol on Biosafety as well as the African Convention on the Conservation of Nature, The African Convention on the Conservation of Nature and Natural Resources and several other biodiversity related Conventions (Chenje, et al 1998, UN Economic Commission for Africa 2008, Ministry of Environment, Water and Climate 2014). This plausible undertaking though, needs to be buttressed by some functional, well-coordinated and collaborative local institutional support and policy framework in order to secure pragmatic biotic resources management. The term institution, as referred to herein, means an organisation similarly long established and respected, mainly involved with formulating and implementing laws, regulations or rules, directives, norms, mores, decrees and proclamations that can be made to control individuals or groups of people in a community and ensure natural resource protection.

Collective and effective management of local floral and faunal resources is imperative for all global communities (Richards and Little 1994, Ramsay 2007, IFAD 2012, Green Facts 2014). Biodiversity encompasses all the life forms (animals, plants, micro-organisms); their interactions in specific geographical and communities settings (species, habitats, ecosystems and the biome as a whole); the spiritual and livelihood values of nature (McNeely and Camara 2007, USAID 2015). Human beings are considered an integral part of that life supporting ecosystem, and play an active and influential management role (Kimmerer 2000; Wilfred, Madoffe and Luoga 2007; Ruheza and Kilugwe 2012). Often, there are knowledge systems and practices that guide the style and mode of local natural resource management adopted. In traditional societies, there has been use of age-old traditional ecological knowledge to manage living beings and the local environment (Ossai 2010). In contemporary societies, on the other hand, the scientific knowledge system dominates the management approaches applied.

The traditional knowledge that reflects many generations of experience and problem-solving has been a valuable national resource for local development. It represents an immensely valuable knowledgebase that provides humankind with insights on how numerous communities have interacted with their ever changing environment including its floral and faunal resources. In many parts of the world, it is increasingly realised that local-level knowledge and institutions provide the foundation for participatory approaches to development

that are both cost-effective and sustainable (Warren 1992; Mbaiwa, Stronza and Kreuter 2011; Chibhememe, Middleton and Booker 2014). Agenda 21, Chapter 26 on 'recognising and strengthening the role of indigenous people and their communities' stresses the need to recognise, accommodate, promote and strengthen the role of indigenous people and their communities (UNSD 1992). This is further reinforced by Principle 10 (*Subsidiarity Principle*) of the 1992 Earth Summit, Rio Declaration on Environment and Development which says environmental issues are best handled with the participation of all concerned citizens at the relevant levels. Again, Principle 22 states that indigenous people and local communities have a vital role in environmental management and development because of their knowledge and traditional practices (UN General Assembly 1992). Traditional ecological knowledge (TEK) provides a sophisticated understanding of local environments through local-level experimentation, innovation, and exchange of information with other societies (Berkes, Colding and Folke 2000; IFAD 2012). It involves values, beliefs, customs and ceremonies based on some clear understanding of nature and the universe (Robinson and Herbert 2001). Communities have developed customary management strategies under precise guidance and supervision of customary management institutions (Berkes 2003, Berkes 2009). It is interesting to explore how these customary management institutions and strategies have endured, transformed and adapted to both the dynamic spatial and temporal scales.

Traditional ecological knowledge is a cumulative body of knowledge; an experience-based relationship with family, spirits, animals, plants and land; an understanding and wisdom gained from direct signals from nature or culture and evolving by adaptive processes of observation and teaching (Berkes et al 2000; Ruheza and Kilungwe 2012; Parsons, Nalau and Fisher 2017). Traditional leaders rely on customary laws and principles for adaptive natural resource management in general and biodiversity utilisation and in-situ conservation in particular. The institution of traditional norms, values, avoidance rules, myths/folklores, taboos, sanctions, rituals and sacredness has guided indigenous people on how to exploit biotic and physical resources in specific local geographical areas (Mawere 2012, Michie 1999). Adherence and sincerity to these guiding principles, generally capacitated indigenous communities to live in harmony with nature. It is in this regard that the indigenous people affectionately refer to their endeared local land as 'the Earth our eternal Mother' (Yeld 2012). The advent of industrialisation and technological advancements, has however, seen the development of western knowledge system, which has claimed superiority and sought to replace or marginalise traditional ecology (Michie 1999). Modern scientific ecological knowledge systems are based

on western science and the expertise of government natural resource managers (Robinson and Herbert 2001). While traditional ecology views people as an integral part of the environment, the scientific approach, the anthropocentrism viewpoint in particular, tends to treat people as if they were separate from the environment (Berkes 2003). Apparently, this signals a point of departure for the dual knowledge systems.

In Africa and other formerly colonised continents (who have been dominated by foreign cultures), there tends to be some contests between traditional and conventional scientific knowledge systems in ecological stewardship (Ruddle 2000, IFAD 2012). It is however worth noting that the indigenous and western scientific notions of ecological conservation are fundamentally different but seek to attain a common goal. Kimmerer (2000) and Gilmour (2013) argue that although native people's traditional knowledge of the land differs from scientific knowledge, both have strengths that suggest the value of a partnership between them. Ironically, the differences in approaches to ecological conservation between indigenous population groups and new settlers has led to some controversies and conflicts. Those relying on western scientific ecology consider their theoretical framework (Newtonian science) to be superior to traditional ecology (Berkes et al 2000). The argument is that, if anything, traditional ecology should provide understanding and information complementary to scientific ecology. This conflicting relationship has been a source of continued environmental degradation, species extinction and biodiversity loss (Berkes, Colding and Folke 2003). This is also affirmed by the IFAD (2012) which asserts that continued environmental damage is due to governance failures in which ideology is premised on weakly integrated knowledge systems. The present study seeks to forge a unified approach that ensures the maintenance of the productivity and resilience of local socio-ecological systems through collaborative environmental management to secure sustainable livelihoods and wellbeing for the poor rural people.

The traditional and scientific ecological knowledge systems and practices originate from very different cultural contexts, but they both assess environmental conditions and wellness in their own way to come up with seemingly comparable findings (Berkes, et al 2003). The practical marriage of the two ecological knowledge systems and technologies becomes essential given the rate at which humans continue to drive faunal and floral species to extinction and lose immensely valuable biodiversity in the changing environment. Throughout the world now, there are collaborative efforts by scientists, natural resource conservationists and managers as well as local communities, to merge the two knowledge systems and come up with a holistic, sustainable conservation and ecosystem-based approach to contemporary natural resource

management (Pierotti and Wildcat 2000; Haggan, Neis and Baird 2007; IFAD 2012, USAID 2015). There are huge potentials for success of this effort yet the process is full of challenges that need realistic solutions if sustainable biodiversity co-management is to be lived.

The concept of natural resources co-management, as referred to in this report, means a collaborative arrangement, in fact, a partnership between natural resource stakeholders (who include but not limited to, local resource users and their communities, government agencies and other external agents). The partnership so forged seeks to share responsibility and authority for managing a specific area of natural resources (Coral Triangle Support Partnership 2013). Co-management provides a mechanism for establishing effective partnerships between various natural resource stakeholders and ensuring that local people are empowered to actively participate in decision making processes that directly affect the ways they interact with the proximate environment (Coral Triangle Support Partnership 2013). A variety of natural resource actors bring to the fore unique knowledge systems, management practices and approaches, experiences and other competences that yield shared management and successful outcomes. The various actors arrange for regular meetings where they discuss and decide on the most effective natural resource management system. The responsibilities of various stakeholders are streamlined and authority vested in key partners is clearly defined. In light of this definition of natural resources co-management, the current study notes that the Zimbabwean legal framework for biodiversity management recognises various stakeholders and spells out their legitimate roles. However, the practical application of the framework is evidently limited and the active participation as well as concrete actions by local communities or local natural resource users has been largely passive (Chibhememe et al 2015).

In order to sustainably manage the environmental resources, Zimbabwe needs to harness both traditional and scientific ecological knowledge systems and technologies because conservation and utilisation of biodiversity are knowledge-intensive activities (Gilmour 2013). The Zimbabwe National Environmental Policy (NEP) and its main piece of legislation, the Environmental Management Act (CAP 20:27 of 2002) both recognise the need for collaboration and joint application of these knowledge systems and technologies but are short of their practical execution. There is a need to practically acknowledge that both traditional and scientific knowledge and technologies play major roles in biodiversity conservation, sustainable utilisation and prospecting (Risiro, Tshuma and Basikiti 2013). The integration of traditional and scientific knowledge systems to inform contemporary environmental policy

decisions and management solutions is a growing global phenomenon (Robinson and Wallington 2013).

Some authorities report that the practical integration of the two knowledge systems and technologies is shrouded with real challenges, yet opportunities prevail for integrated conservation development programmes and co-management (Huntington, Brown-Schwalenberg, Frost, Fernandez-Gimenez, Norton and Rosenberg 2002; Haggan et al 2007; IFAD 2012). The push for the marriage of the two knowledge systems and technologies is hereby viewed as part of some adaptive ecological strategy and a pragmatic response to the challenges of the ever-changing environment. It is therefore imperative that studies are done to correlate traditional ecological knowledge and technologies to modern science and assist to explain the practical convergences and variances of the two knowledge systems. The present study considers it naive to stigmatise, ignore and malign one form of knowledge, as the tendency has been especially with colonial settlers. It is the quest of this study to establish a trading zone for mutual sharing, borrowing, collaboration and learning and refute claims of superiority of the practice of one form of knowledge system over the other.

Contemporary societies have recognised the necessity of harnessing and combining traditional and scientific knowledge systems and are tapping from both databases albeit with mixed levels of successes (Berkes 2003, Gilmour 2013 and USAID 2015). There have been some success stories of collaboration between some social actors at varied natural resource management levels, especially in Community-Areas Based Natural Resource Management (CBNRM) programmes in Namibia, Botswana, Tanzania and Zimbabwe (Mbaiwa et al 2011). Indeed, there has been much talk of integrating traditional and scientific knowledge systems to effectively manage biological diversity but the conspicuous absence of the practical integration framework and process in some countries demonstrates some implementation gap (United Nations Division for Sustainable Development 1992, Gilmour 2013, Parsons, Nalau and Fisher 2017). It is prudent that Zimbabwe as a post-colonial state, adopts strategies for integrating the two knowledge systems for the co-management of biotic resources especially in communal lands. This study seeks to argue for environmental policies and institutions that pragmatically integrate traditional and scientific ecological knowledge systems in order to sustainably co-manage biodiversity on public lands as an alternative management system which is adaptive as well as participatory in nature.

1.2 Statement of the Problem

Biodiversity co-management, involving harnessing the best of both traditional and scientific ecological knowledge systems and practices has been applauded as a precursor to the development of effective adaptive management strategies that are cost-effective, participatory and sustainable (Robinson and Herbert 2001, Berkes 2009, Haverkort 2009, IFAD 2012, Gilmour 2013, Parsons et al 2017). It is envisaged that the world in general and ecological systems in particular, stand to benefit more from both traditional and scientific ecological knowledge systems once the two are cordially married. In Zimbabwe, the Knowledge Transfer Africa Trust initiative has translated some indigenous languages as a basis for the blending of traditional knowledge with western science (Chasi 2000). The dichotomy between traditional knowledge and modern scientific knowledge is increasingly seen as a cause for underdevelopment (Lathan 2005; Roe, Nelson and Sandbrook 2009); hence, over the past three decades, research work is now under way to bridge these two knowledge systems (de Guchteneire et al 2003, Ahmad 2005, Berkes 2009, Gilmour 2013). This effort has not only captured the attention and respect of international researchers and scholars, practitioners in policy development and evaluation, but also gained the support and recognition of national governments and non-governmental organisations, corporations, and most of the United Nations supported international organisations (for example, UNESCO and UNEP) (Ossai 2010, Nwokoma 2012, Parsons et al 2017).

Drew and Henne (2006) and Berkes (2009), however, acknowledge that historically, combining different types of knowledge has major impediments and is a difficult and inherently complex process. There are few examples of the integration process and very little evidence of how these knowledge systems could be practically assimilated for sustainable biodiversity conservation and utilisation (Kimmerer 2000, Klooster 2002, Berker and Ghimire 2003, Ericksen and Woodley 2005, Bene and Nieland 2006, Zazu 2007, Berkes 2009, Ruheza and Kilugwe 2012, Parsons et al 2017). There is little critical and empirical inquiry into the feasibility and challenges surrounding the co-application of these two types of knowledge for the joint management of biotic resources and ecological systems. It becomes essential for the current study to investigate the benefits and threats to plant and animal life in communal lands of Zimbabwe, accruing from the mutual applications or non-applications of the duo knowledge systems. This study therefore seeks to establish cross-scale institutional and policy frameworks for the effective and consistent collaborative management of biotic resources, by adopting an

alternative, more holistic approach in order to create a sustainable resource management system.

1.3 Study Aim and Objectives

1.3.1 Study Aim

The study aimed to assess the feasibility of integrating traditional and scientific ecological knowledge systems in some practical way for sustainable biodiversity co-management in semi-arid communal areas of Zimbabwe such as Masvingo province.

1.3.2 Study Objectives

The specific objectives of the study were to:

i. characterise the perceptions of local rural communities in Masvingo Province, regarding access, use and management of natural biotic resources.
ii. compare key traditional and scientific management principles (approaches, concepts and methods) for sustainable biodiversity utilisation and conservation.
iii. analyse opportunities and barriers to bridging the divide between the two knowledge systems to enhance pragmatic co-management of biotic resources.
iv. suggest an institutional and legislative framework that informs contemporary environmental policy decisions for adaptive biotic resources co-management and environmental sustainability.

1.4 Research Questions

In pursuit of the above stated study aim and objectives, answers to the following research questions were sought:

i. What are the perceptions of local rural communities in Masvingo Province, regarding access, use and management of natural biotic resources?
ii. What are the fundamental similarities and differences between traditional and scientific management principles that have been used globally and locally for sustainable biodiversity conservation and utilisation?
iii. What opportunities and challenges exist for the successful integration of the duo knowledge systems?
iv. What institutional and policy framework could be designed that informs contemporary environmental policy decisions for adaptive biotic resources co-management and environmental sustainability?

1.5 Motivation for the Study

This study is motivated by the embarrassing, observed policy inconsistencies that have seen institutions supposed to cooperate towards the sustainable collaborative management of commonly owned and managed resources, antagonise, duplicate and conflict between themselves (Chasi 2000, Gilmour 2013). This has often created confusion and loopholes that have left environmental perpetrators as winners and conservationists and the environment as losers. In Zimbabwe, communally owned and managed resources are under the custodianship of traditional leaders, namely: the chief, headmen and the village heads, and the councils they head (Chasi 2000, Risiro et al 2013, Chibhemene et al 2014). It is these institutions of customary management that communal residents respect and pay tribute to, although they have been disenfranchised. However, the central government, through the Ministry of Environment and Natural Resources Management, has set an environmental watchdog, the Environmental Management Agency (EMA). Now, EMA is virtually in total control over all environmental issues, with the traditional institutions as its junior partners. The present study seeks, with in-depth analysis, to establish the best institutional arrangement that the central and local government departments and partners could adopt to variably improve the biodiversity management system on the ground.

The results of this thorough field study on the integration of the traditional and modern scientific knowledge systems and technologies for the co-management of biodiversity in semi-arid communal lands of Zimbabwe are expected to put decision- and policy-makers in a better position to propose policy updates and amendments in line with sustainable development. It has also been observed that the weak and partial integration of traditional institutions in contemporary natural resources management framework is adversely impacting on the commons (Gilmour 2013, Terralingua 2014, Parsons et al 2017). Traditional institutions seem to be playing second fiddle from central government institutions. This is however not the best institutional arrangement. The current study results shall empower local traditional leadership to rediscover their vivid voices and roles in natural resource management.

The study of mechanisms of integrating the duo knowledge systems could be fundamental in developing sound participatory management of biotic resources in the country. The study analyses the trading zones between state natural resource managers and customary ecological management plans in order to incorporate the common and useful traits into modern conservation programmes. This study seeks to generate knowledge that shall equip government

policymakers with knowledge to craft a scientific management framework and infrastructure that fosters a shared responsibility with natural resource-users. Participatory management, which this study seeks to advance, is instrumental in the formulation of better, effective, successful and sustainable biodiversity conservation programmes. It is hoped that the findings of the field study will encourage natural resource scientists and managers to practically and effectively include traditional ecological knowledge in management decisions. It is the desired outcome of the present study to mainstream and empower local institutions and traditional governance systems so as to capacitate them into assuming key roles in the management of proximate biotic resources.

1.6 Justification of the Study

The study findings shall go a long way in improving the perceptions, attitudes as well as knowledge of key stakeholders in the sustainable management of biodiversity in communal lands of Zimbabwe and other countries in the region and beyond. Firstly, the study acknowledges that local people are the custodians of customs and traditions that are richly imbued with great natural resource conservation ethics. The recognition of TEK in biodiversity management is bound to strengthen the traditional institutions to work towards the preservation and continued practice of their invaluable conservative knowledge, beliefs, spirituality, technologies and practices.

Secondly, the state natural resource managers and local government officials, who have assumed sweeping powers over the management of biotic resources in communal lands are challenged to cede the usurped authority to local institutions. That is, the study encourages a bottom-up, democratic and participatory natural resource management approach. The study results are meant to foster a shared responsibility between state agencies or central government authorities and local communities towards the sustainable management of biotic resources occurring in communal lands. Equipped with knowledge on the benefits of the co-applications of the duo knowledge systems, state natural resource managers are challenged to work more closely with local resource users, respect their customary governance systems and management approaches. The results of this study would be an insight to state agencies to respect and accept other forms of knowledge systems and use them.

Thirdly, local community members, who are the custodians and beneficiaries of wise management of proximate biotic resources, are going to be encouraged by the study results to be more proactive and participate more actively in the management of biotic resources. The

communities living next to biotic resources are better placed to manage the resources, hence the study results unequivocally call upon these communities to restore their historical record of having successfully lived in harmony with nature.

Lastly, the international organisations (mostly United Nations bodies) and nongovernmental organisations (NGOs), who are the convenient, reliable and supportive partners of both central government and local communities are bound to draw a number of benefits from the study results. The highlighted opportunities and challenges to be met in integrating the two knowledge systems and dichotomous management approaches could be the focal points for these organisations as they partner both the government and local communities for sustainable development programmes.

1.7 Study Area

The study was done in the rural areas of Masvingo Province, Zimbabwe (Figure 1.1). Masvingo Province comprises of seven districts namely; Bikita, Chiredzi, Chivi, Gutu, Masvingo, Mwenezi and Zaka (Figure 1.1). Masvingo City is the provincial administrative capital for Masvingo Province. Also Chiredzi district has Chiredzi agricultural town; Triangle, Hippo Valley and Mkwasine commercial sugar estates as well as Gonarezhou National Park. Bikita district has Devuli Ranch and Humani Nature Conservancies to its eastern side. The other four districts are largely communal lands dotted with service centres and at least a growth centre courtesy of the Government of Zimbabwe's Growth Point policy. The study area has largely a rural population totalling 1 485 090 (Zimstat 2012). More than 90% of Masvingo population lives in rural areas where they depend on the natural environment for their livelihoods and sustenance (Zimstat 2012).

The area is semi-arid to arid (agro-ecological zones 4 and 5), with an erratic, mean annual rainfall of 400mm and less, mean annual temperature of 22^0C and experiences an excess of evapo-transpiration over precipitation (GoZ 2018). The soils are largely dry, over utilised and now infertile sandy loams with some pockets of dry clay loams especially in Chiredzi and Mwenezi districts. The vegetation is mostly open grasslands punctuated by bushy thorny shrubs with pockets of miombo (a common type of moist savannah woodlands) and mopane (*colophospermum mopane)* woodlots. The terrain is mountainous and hilly in Bikita and Zaka, but gets gently sloping in the other districts. The major river systems are Mwenezi, Runde, Tokwe, Mutirikwi, Chiredzi, Dewure and Save, characterised with ephemeral surface channel

flows owing to limited rainfall and heavy sedimentation (siltation) along the river beds. This has immensely affected aquatic ecosystems and biodiversity in the study area. There is Lake Mutirikwi which happens to be the country's largest inland lake, Siya dam, Manjirenji dam, Manyuchi dam, Bangala dam and the recently completed Tokwe-Mukosi dam and other small earth dams and weirs along the major and minor drainage systems in the study area. If well managed, this rich reservoir water system could be the basis of a rich aquatic biodiversity resource base for the province and nation state at large (GoZ 2018).

In terms of socio-economic development, the area has a modest share of the nation's educational, health, marketing, transportation as well as agriculture amenities. The population derives livelihood mainly from subsistence agriculture and petty trade, though the climate is a bit harsh to dry land cropping. The average population density is 26 persons/sq. km which is below the national average of 33 persons/sq. km (Zimstat 2012). It is partly due to high population density and uncoordinated monitoring institutions (government and traditional) that the study area experiences general environmental degradation and a deteriorating ecosystem integrity.

The study was done in Masvingo Province mainly because of its proximity to the researcher. Masvingo Province is both home and employment area for the researcher and the research team. That on its own, gave the study an advantage of focusing on an area, which the research team had vast residual knowledge and competent baseline data. Also, the area is largely home to one of Zimbabwe's main indigenous ethnic groups, the Karanga people of the Shona tribe (Zimbabwe's largest tribe) (Chimhenga and Chivhanga 2014). The other minority ethnic groups in the study area include the Shangani (to the south east) and the Ndebele (to the south west), and these indigenous people, when properly sampled, give a good representation of the Zimbabwean indigenous people. Also, in Masvingo province, the communal lands are one of the densely populated in Zimbabwe and the management of natural biotic resources in the area deserves close scrutiny. Also, Masvingo Province has Zimbabwe's largest national park, Gonarezhou National Park. Its selection gave this study an opportunity to gather data relating to views of communities living next to state protected lands. Such views are critical in paving way for comparisons between the state of communal lands and state protected lands, where relevant.

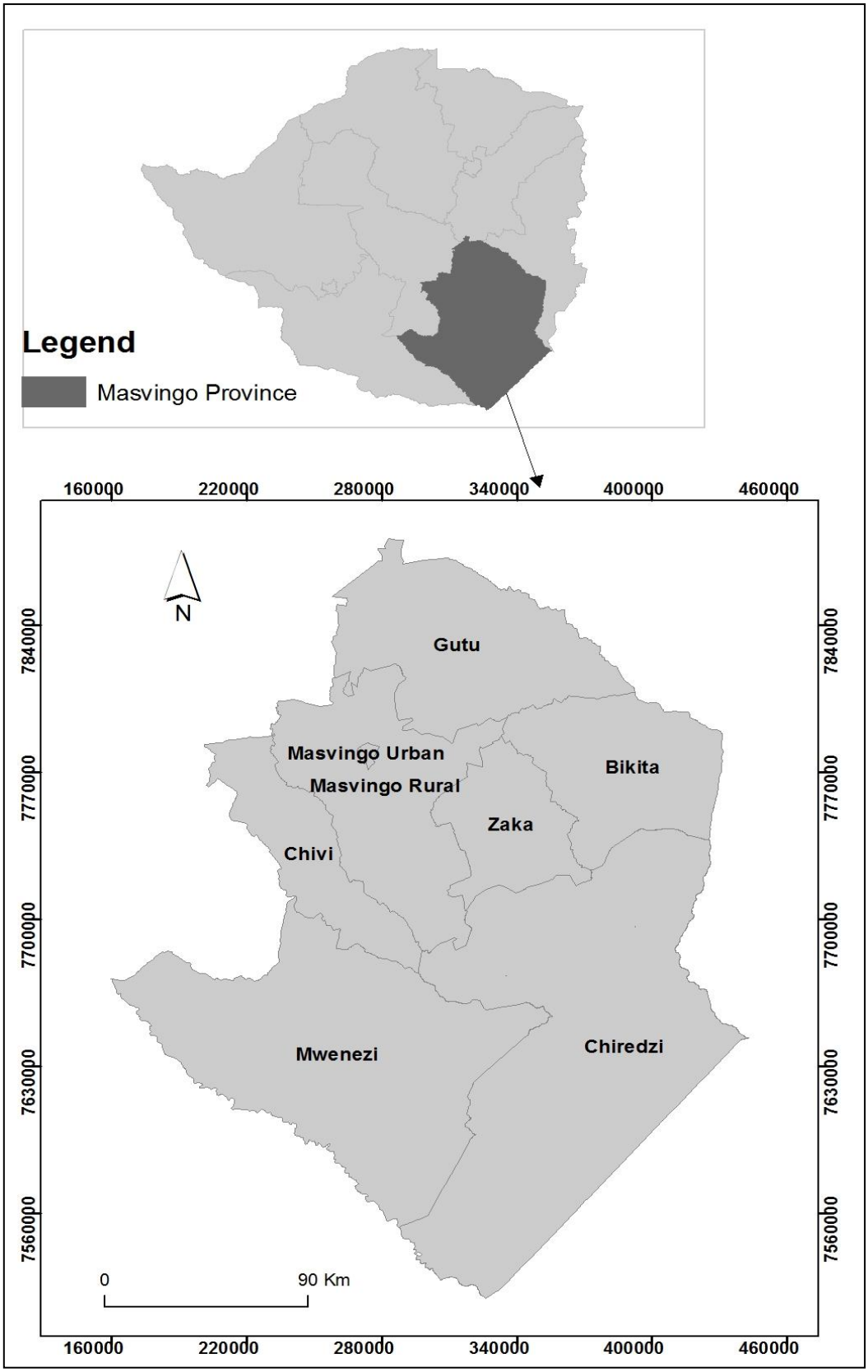

Figure 1.1: Location of Masvingo Province in Zimbabwe and the Districts Found in the Province. (Map Units are in UTM Based on the WGS 1984 Spheroid and Datum).

1.8 Delimitation of the Study

The study focuses on determining the ways in which traditional and scientific knowledge systems and technologies are used for sustainable management of proximate biotic resources within the global communities as a precursor for assessing their utility in south-eastern Zimbabwe. It considers the strengths and weaknesses of the traditional and scientific approaches to biodiversity management as the basis for finding a trading zone in which the two could be integrated for the co-management of proximate biotic resources. While considering the strengths and weaknesses of the duo knowledge systems, the study focussed on authenticity of the authorities bestowed with governance power, knowledgebase, participation and effectiveness towards natural resource management. Effort is directed towards designing an institutional and policy framework that incorporates both knowledge systems for adaptive biotic resource co-management and environmental sustainability. The study commenced in 2014 and was completed in 2018. Research data for the successful completion of the study was gathered from the communal lands (areas outside protected areas and urban centres) of the seven districts of Masvingo province, Zimbabwe.

1.9 Limitations of the Study

The study was done in the communal areas of Masvingo province, largely inhabited by the Karanga ethnic group. There are fears that dominant views came from one cultural group yet Zimbabwe has at least six major cultural groups (Zezuru, Korekore, Manyika, Ndebele, Ndau and Karanga). However, due to cultural exchange and internal migrations, there is a common Zimbabwean culture in communal lands which makes the findings from one cultural group largely applicable to the whole Zimbabwean rural society (Mawere 2012). Although TEK is location and culture specific, it is also dynamic and adaptive (Ossai 2010).

1.10 Chapter Summary

The chapter focused on the background of the study and outlined the objectives of the study. It was noted that the study investigates the feasibility of integrating traditional and scientific ecological knowledge systems, the two knowledge systems that more often compete than complement each other. It was the chapter's thrust that the renewed interest in indigenous knowledge systems should be heightened by ensuring the creation of a co-management approach that attains inclusivity, cooperation and sustainability. The next chapter, Chapter 2, reviews literature related to the current study in order to lay the conceptual framework from which research findings could be compared. Chapter 3 follows next and it describes the

research methods employed as well as the materials used for data collection, recording, manipulation and interpretation. Chapter 3 is then followed by Chapter 4 in which the gathered data is presented, analysed and meanings are generated in the discussion section of the chapter. Lastly comes Chapter 5 and in this chapter, the conclusions and recommendations of the study are presented to mark the end of the report.

CHAPTER II

LITERATURE REVIEW

2.0 Introduction

This chapter provides an overview of the theoretical and conceptual framework and reviews the literature related to the study. Empirical work on the utilisation of traditional and scientific ecological knowledge systems is critically analysed with a view to ascertain their roles in biodiversity protection and management in particular and environmental sustainability in general. Initially, the discussion focuses on the key management principles guiding each of the duo approaches to biodiversity management, as a precursor for scrutinising the benefits and challenges of utilising each of the knowledge systems, then the strengths and weaknesses are outlined. Opportunities and constraints of marrying the two approaches are discussed with a view to argue for the integration of the duo so as to reap benefits of collaborative management of proximate biotic resources. Institutional and policy frameworks for joint management of biotic resources are evaluated to pave way for an improved and holistic approach for adaptive biodiversity co-management and environmental sustainability. Reviewing literature is aimed at providing rationale and justification for doing the current study, define the knowledge gap, provide a clear focus for research questions, provide context for the study and availing empirical evidence to corroborate and buttress the findings of this study, among other benefits.

2.1 Approaches to Biotic Resources Protection and Management

Over centuries, the habitable part of the world has been dwelt by various human tribal groups who have formed distinct societies. People, in their communities, have developed and perfected specialised knowledge and belief systems, skills, technologies and practices that have allowed them to adapt to the prevailing environmental conditions. While living in the natural environment, human beings have discovered that their biophysical surroundings are the principal source of their livelihoods and improved wellbeing (McNeely and Camara 2007, USAID 2015). As such, they have learnt and developed methodologies of living in harmony with nature (a win-win approach). People have developed the knowhow of managing their natural heritage while preserving the environment. This knowledge, known as traditional ecological knowledge, is dynamic and changing, being modified by assimilating knowledge

and survival strategies from neighbouring cultures (Bendsen and Motsholapheko 2002, Berkes 2009).

The western communities (mostly Europe) have been very progressive in that they documented their knowledge systems in literature repositories. This has allowed them to readily transfer their codified knowledge systems across the globe, whose knowledge has been competitive rather than complementary to local knowledge systems of conquered lands. This knowledge system has gotten to be known as western science and has largely been imposed on invaded communities. Western science has dominated, and in most cases replaced, the indigenous knowledge systems (Berkes et al 2003, Gilmour 2013).

The world, nonetheless, possesses varied knowledge systems that assist the human communities across the globe comprehend and improve the quality of life and environment of individuals, groups and communities. Knowledge systems strive to describe, explain, predict and try to negotiate nature. Broadly, we recognise two knowledge systems grossly distinguishable on having either evolved within or outside the formal education system. Knowledge, not capital, is the key to sustainable social and economic development (1998/99 World Development Report in Ossai 2010).

2.1.1 Defining Traditional Ecological Knowledge

Traditional ecological knowledge (TEK) is a specialised part of indigenous knowledge. Indigenous knowledge systems (IKS) refers to the large body of knowledge, skills, practices and innovations of indigenous and local communities around the world; accumulated through experience, observation, experimentation, innovation, adaptation and inference from the local natural environment; evolved and transmitted orally and through shared experiences from generation to generation (Warren 1991; World bank 2004 in Ossai 2010; Boven and Morohachi 2002). It is experiential, location and culture specific, dynamic and adaptive (Ossai 2010). It concerns critical issues of and decision making in human, plant and animal life and health care, primary production, culture, education, food security, spirituality, natural resource management, and a host of other vital rural community-based activities (Boven and Morohachi 2002; Ossai 2010; Nwokoma 2012). It is embedded in community practices, institutions, relationships, and ways of using resources, beliefs, rituals and a world view (Dei 1993, Ossai 2010). Indigenous knowledge represents an important component of global knowledge on development issues especially sustainable development in Africa and developing world in general (Ossai 2010).

Traditional ecological knowledge is viewed as indigenous science. This study largely adopts the explanation by Berkes et al (2000) of what is traditional ecological knowledge. They say it is a cumulative body of knowledge, common practices and representations that describe the relationships between living beings with one another and with their physical environment, which evolved by adaptive processes and has been handed down through generations by cultural transmission (i.e. developed outside the formal education system) (Ossai 2010). That is to say, TEK is the large body of knowledge, skills, common practices and innovations of indigenous and local communities around the world that relate to the understanding, conservation, wise utilisation and ownership of the proximate natural environment and heritage. This knowledge system is holistic in outlook and adaptive in nature, gathered over generations by observers whose lives depended on this information and its use (Ossai 2010). It is based on long term empirical observations adapted to local conditions that ensure sound use and control of the environment while capacitating indigenous people to adapt to environmental changes (Muzzocchi 2006, Chinhememe et al 2014).

Traditional ecological knowledge is an attribute of societies with historical continuity in resource use common practice (Berkes et al 2000). TEK is developed through historical experience and common practice hence it is a valuable cultural and empirical knowledge (Michie 1999). It accumulates incrementally, tested by trial-and-error, shared through practical experiences and transmitted to future generations orally (Ohmagari and Berkes 1997 in Berkes et al 2000, Parsons 2017). It is based on experience, often tested over centuries of use, dynamic and changing, adapted to local culture and environment (Boven and Morohachi 2002). Local communities have holistic and elaborate knowledge about the consumptive value and ecological services provided by the biological resources in their environments (Michie 1999; Sileshi, Nyeko, Nkunika, Sekematte, Akinnifesi and Ajayi 2009). These attributes of TEK make it a functional knowledge system that guides local communities to survive in their territories. It should however be queried that since TEK is location and culture specific, how useful is it in informing other communities on living sustainably in their specific geographic areas? Again, TEK is tested through trial-and-error, how useful is it considering that the environment is dynamic and changing rapidly leading to huge problems, many of which are of global concern, for instance global warming, or genetically modified organisms, and others, which TEK has never been exposed to before. Under such circumstances, wouldn't reliance on TEK lead to maladaptation? This is one of the challenges facing TEK as a knowledge base. If TEK has evolved gradually over centuries through cumulative processes how suitable and

adaptable is it to high magnitude disruptive change that is rapidly occurring? The study draws the attention of the reader to these and other critical concerns regarding TEK as a knowledge system.

Traditional ecological knowledge is collectively owned and is stored in traditional and cultural practices and values, beliefs, taboos, myths, rituals, legends, proverbs, community laws, local language, folklore stories, folk songs and dances, folk dramas, slogans, innovations, production practices, traditional equipment, tools and in artefacts owned by indigenous communities which are imbued with cultural and ecological knowledge and codes of behaviour (Dondolo 2005; Reid et al 2006; Gadzirai et al 2006; Nwokoma 2012; Ossai 2010). The elderly and knowledgeable men and women are the principal practitioners, guardians and educators of TEK. Hence an old African saying that equates the death of a key elder to the burning and subsequent disappearance of a well-stocked library. Based on this knowledge, skills and experiences, local people make rational decisions on how to use and manage proximate biotic resources effectively and devise methods of coping with the dynamic environment (Bendsen and Motsholapheko 2002). It provides the basis for problem-solving strategies for local communities, especially the rural poor. It is an integral part of the local ecosystem. It is a key element of the 'social capital' of the poor; their main asset to invest in the struggle for survival, to exploit biodiversity for subsistence and resource-based commerce, to provide for shelter or to achieve control of their own lives (Gucheteneire et al 2003; Terralingua 2014). However, it should be noted that TEK is selectively owned by community members given that it is orally transmitted, imposing a real uncertainty on its collective ownership. Indeed, some people in society would have more of it than others. TEK is vested in the elderly members of the community, as well as specialists such as spirit mediums and traditional healers and herbalists. The skills and knowledge held by these people is not common place.

2.1.2 Traditional Ecological Knowledge Practices in Zimbabwe

Indigenous people in traditional societies in Zimbabwe, just like elsewhere, lived in harmony with nature, being well integrated with the local socio-ecological system (Risiro et at 2013, Chibhememe et al 2014). In pre-colonial Zimbabwe, indigenous people practised sustainable natural resources conservation, with mutual co-existence between mankind and the environment. Local communities relied on TEK and traditional authority systems to ensure this

mutual co-existence and ecological balance in the local environment (Parsons et al 2017). Natural resources (biotic and abiotic) were communally owned, with individual members of the community possessing usufruct rights and the stewardship of the natural resources was bestowed with the chief and his wise counsel. The chief and his counsel had authority over natural resources, this team was custodian of the local environment, the bearers of traditional values hence enforced the rules and guidelines on how to access and utilise natural resources. Traditional methods of resource utilisation were well adapted to conservation, enabling local people to survive in a balanced relation with their natural and social environment (Chibhememe et al 2014). Local people used their own locally generated knowledge, skills and practices to change and to improve, especially in natural resource management. These sets of understandings, interpretations and meanings are part of a cultural complex that encompasses language, naming and classification systems, practices for using resources, ritual, spirituality and worldview (Chigwenya and Manatsa 2007). Indigenes have widely used TEK in developing cost-effective and sustainable survival strategies for heritage protection, poverty alleviation and wealth generation. TEK is collectively owned and takes the form of stories, songs, folklore, proverbs, poetry, slogans, legends, cultural values, beliefs, rituals, community laws, local language, production practices and innovations (Berkes 2009, Ossai 2010, and Gilmour 2013).

In Zimbabwe, the knowledge and values are embedded in taboos, myths, folklore, cultural beliefs and practices. The traditional institutions govern the relationship between nature and humanity and also assist in preserving natural resources. Despite undergoing change, Indigenous Knowledge Systems (IKS) have maintained their core values which were used before and which can still deal with contemporary environmental issues. IKS, when included in the discourses and practices of development aid and environmental conservation, means locally generated knowledge, rooted to a particular place and set of experiences and generated by people living in those places for the purposes of making a living in their particular places. It includes ideas, beliefs, skills, technologies, artefacts and problem solving strategies and expertise (Warren 1991, Lanzano 2013). Most traditional Zimbabwean societies have earned sustainable livelihoods in their particular localities through prudent applications of this knowledge system. Selective harvesting, use of skills and traditional beliefs are sustainable strategies that are used to utilise and conserve natural resources (Table 2.1).

Table 2.1: Resource Management through Selective Harvesting

Method	Mechanisms of Conservation
i) Picking mature wild floral plants	When harvesting wild tubers, root plants and vegetables, nuts, fruits, flowers and leaves, gatherers pick only the mature or tender ones and the others are left behind to ensure propagation.
ii) Selective logging of timber and fruit trees	Fruit trees and large trees are selected and allowed to grow in the forests and fields so as to provide fruits, shade, poles/logs, planks, humus/manure, edible pests and fodder.
iii) Selective hunting/killing of wild game	Selective harvesting depends on the reproductive periods and age, where the young and pregnant animals are not harvested or killed to ensure future propagation of wildlife species.
iv) Selective firewood harvesting	The collection of firewood is highly selective, only dry wood that yield prolonged heat-emitting charcoal is collected and abundant species are targeted.
v) Selective harvesting periods	Due to seasonal changes in availability of resources, the age or stage in the life-cycle of some species like fish, mopane worms, means that only those that would not jeopardise continual availability are selectively collected during specified seasons.
vi) Selective livestock grazing	The movements of pastoralists and their livestock strictly follows climatic seasons and seasonal fluctuations in grazing land productivity and pasture regeneration conditions.

(Compiled from: Chigwenya and Manatsa 2007; Chibhememe et al 2014)

Resource users, such as herbalists, food gatherers and producers and hunters possess traditional ecological knowledge that is skilfully used in deriving the best from natural resources with limited harmful impacts (Table 2.2).

Table 2.2: Resource Management through Skills and Technologies

Method	Mechanisms of Conservation
i) Herbalists expert skills	The harvesting of bark, fibre, cambium and sap involves a great deal of accuracy and skill to ensure the tree does not die and no damage to the lifeline of the tree.
ii) Concealment of technical details by herbalists	Medicinal plants are concealed from non-herbalists who lack skills in extracting medicine.
iii) Gatherers expert skills	Gatherers leave a portion of tubers or roots or stem or a whole flowering plant *in situ* when they collect plants or plant parts for food. This practice in a way guarantees the regeneration of those plants.
iv) Nomadic hunters and fishers expert skills	The use of traditional weapons, such as bow and poisoned arrows, traps, snares, game pits, spears, clubs and long sticks with hooks, restricts the efficiency of their hunting and fishing activities – this achieves the resource recovery effect of defined hunting/fishing seasons.

(Compiled from: Chigwenya and Manatsa 2007; Chibhememe et al 2014)

Also, the traditional institutions and cultural practices have played some significant roles in fostering good environmental stewardship and wise resource use (Table 2.3). Examples of the renowned traditional institutions include the herbalists, hunters and gatherers, spiritualists, customary leadership and tribal family groups. The territorial residents invested unwavering support, trust and respect to the traditional institutions. Table 2.3 below summarises the varied approaches to resource management through traditional institutions and cultural practices.

Table 2.3: Resource Management through Traditional Institutions and Cultural Practices

Method	Mechanisms of Conservation
i) Resource name	The names given to prominent landform (hills/mountains, streams/rivers, pools) and biota (trees/forests, animals/birds) often link these to spirituality and highly renowned chiefdoms. This ensures no one tempers with those habitats and resources therein - purely out of full respect of traditional institutions.
ii) Resource Habitat	Some trees/forests, pools, wells, springs, hills/mountains and caves are declared homes of powerful spirits, hence could not be tempered with. This creates gene banks and preserves rare species.
iii) Totemism	A tribal group often adopts a certain plant, animal or habitat as their totem (spiritual symbol). Local people have great respect of totemic plants, animals and habitats, hence this avoids massive cuttings/killings and preserves native species. This practice is a conservation strategy that aims to create a harmonious relationship between tribal groups and the natural environment.
iv) Sacredness	Some landforms and biota are considered sacred, hence their sanctity should be preserved e.g. mountains are burial places for chiefs. This avoids harvesting of resources, allowing sacred places to remain undisturbed breeding places.
v) Sanctions and quotas	The access to, harvesting times, rates/amounts of biotic resources, are strictly regulated to safeguard resource overharvesting. E.g. hunting and fishing times and methods are strictly controlled to avoid hurting/killing pregnant animals or spawning fish.
vi) Taboos	Certain acts are completely forbidden, their commission is severely punishable either by the local traditional authority or natural spirits or by both. E.g. it is tabooed to consume or even touch the new produce during the season before the first eating ceremony. These festivals serve as cultural mechanisms to control the plucking of unripe fruits and agricultural produce. The taboos set discourage unwarranted destruction of resources such as wetlands and cultural sites.
vii) Superstition	The 'fear of the unknown and uncompromising reprimands from some supernatural powers' often restricts individuals from violating standing orders/rules. E.g. one should not shake off fruit from a tree or say anything defamatory about the taste of certain wild fruits. This avoids wastages.
viii) Rituals	These are acts performed by thankful resource beneficiaries, meant to appease the generous spirits. E.g. pre- and post-hunting rituals. The indigenes are trained to always respect and be grateful for the resources that the creator avails freely and abundantly. These are performed to guide people to practice sustainable use of resources.
ix) Customary laws	Traditional leaders (chiefs, headmen and village heads) have devised a system of saving habitats and resources therein by demarcation of areas for collection of habitats produce by acquiring clan-wise and village-wise traditional rights (clearly defined user groups to avoid tragedy of the commons and trouble from free riders).

(Compiled from: Chigwenya and Manatsa 2007; Chibhememe et al 2014)

The traditional ecological knowledge, beliefs and practices have allowed indigenous people to comprehend natural resources and environmental processes in their geographical areas (Bendsen and Motshalopheko 2002, Terralingua 2014). TEK practices refer to examples and cases that illustrate the use of local ecological knowledge in developing cost-effective, efficient and sustainable survival strategies for the conservation, utilisation and management of proximate biotic resources and their ecological communities for the general well-being of the indigenous people (Ossai 2010, Berkes 2009). These sets of understandings, interpretations and meanings are part of a cultural complex that encompasses language, naming and classification systems, practices for using resources, rituals, spirituality and worldview (Boven and Morohachi 2002).

We however, need to take note that in TEK, natural resources are not viewed as commodities for commercialization, which fairly contrasts it with western science knowledge systems which support neo-liberal approaches that tend to argue that the commercial value of wild products is an incentive for natural resources protection. In western science knowledge systems products from wild resources are viewed as tradable commodities. We can therefore conclude that TEK is the information base facilitating communication and decision making with regard to environmental conservation within a territorial community.

2.1.3 Explaining Scientific Knowledge Systems

This type of knowledge systems is known as western scientific knowledge systems that are made universal through the formal, western education which is entrenched in many world cultures (Ossai 2010). It is a body of knowledge generated within the international system of universities, research institutes and private firms (Warren 1991, Nwokoma 2012). This is usually referred to as modern science, which is basically western ways of generating, recording and transmitting knowledge. Scientific knowledge is produced through phases of experimentation through trial and error (Emeagwali 2003). International knowledge systems or western-based formal knowledge and technology is developed within predominantly western based education systems (Nwokoma 2012). It is considered formal because it tends to be supported by written documents, rules and regulations and technological infrastructure (Dei 1993b in Nwokoma 2012, Gilmour 2013). Main stream science desires to negotiate nature through sequential processes such as hypothesis formulation, experiment and prediction (Emeagwali 2003). In international knowledge systems, the process of discovery may be intuitive, accidental, conjectural or inspirational but outcomes are generally predictable and

repeatable as it explains regularity while avoiding the unique and intractable (Emeagwali 2003).

2.2 Natural Resource Management in Traditional Communities: A Historical Review

Traditional or indigenous people and their communities are the people who have an historical relationship with their lands and are generally descendents of the original inhabitants of such lands and also have an historical continuity with pre-invasion and pre-colonial societies that developed on their territories or part of them (United Nations Division for Sustainable Development 1992; Ossai 2010). Traditional societies are determined to preserve, develop, and transmit to future generations their ancestral territories and ethnic identity as the basis of their continued existence as peoples and in accordance to their cultural patterns, social institutions and legal systems. Indigenous people have developed over many generations a holistic traditional scientific knowledge of their lands, natural resources and environment (United Nations Division for Sustainable Development 1992). TEK is knowledge appropriate to local community for finding solutions to a multitude of existential problems, collective management of common property resources and guaranteed sustainability within clearly defined territories (Berkes 2009). The African TEK contain invaluable explications of the workings of ecosystems and the sustainability of ecologically sound economic production stages (Nwokoma 2012). Oral tradition is the significant information gathering method and it involves the collective testimonies and recollections of the past, inherited from earlier generations, and transmitted in various forms of verbal testimonies (Warren et al 2005, Nwokoma 2012).

It is significant to notice that, throughout history and over many centuries, human beings have been producing and practising knowledge, skills and strategies enabling them not to only survive in harmony with their social and natural environment but also ensuring resource conservation into the future. Indeed historically, many indigenous populations have relied on environmental resources for subsistence and autonomy (Muzzocchi 2006, Berkes 2009). Indigenous peoples view the world we live in as an integrated whole. Through active interactions with the natural surroundings, man has learnt that the environment is the primary source of stable livelihoods, and as such, deserve respect (should not be tempered with). Traditional ecological knowledge has been utilised in common property resource use and management for centuries or even millennia by indigenous communities around the world. According to de Guchteneire et al (2003) and Ossai (2010) it is the basis for local-level decision making in primary production, human and animal health care, food security, education, natural

resource management and most of other activities in rural communities. In biodiversity conservation, TEK is an important mechanism for ensuring the most efficient and productive use of natural resources in the short term without jeopardising the long-term capacity of nature to continue producing these resources. TEK is important in taming nature – *in situ* conservation (Berkes 1993). Terralingua (2014) weighs in by remarking that TEK advocates *in situ* biological diversity conservation within people's indigenous cultural and ecological systems.

In pre-colonial Zimbabwe, indigenous people practised sustainable natural resource conservation, with mutual co-existence between mankind and the environment. Local communities relied on TEK and traditional authority systems to ensure this mutual co-existence and ecological balance in the local environment (Berkes et al 2000). Natural resources (biotic and abiotic) were communally owned, with individual members of the community possessing usufruct rights and the stewardship of the natural resources was bestowed with the chief and his counsel. The chief and his counsel had authority over natural resources, this team was custodian of the local environment, the bearers of traditional values hence enforced the rules and guidelines on how to access and utilise natural resources. The knowledge and values embedded in taboos, myths, superstitions, folklores, legends, proverbs, chants, praise songs, cultural practices and traditional institutions govern the relationship between nature and humanity and also assist in preserving natural resources (Emeagwali 2003, Chigwenya and Manatsa 2007). TEK has been invaluable to the indigenous communities in their quest to use, nurture and sustain the ecosystems in which they live and on which they depend (Terralingua 2014).

Traditional methods of resource utilisation were well adapted to conservation, enabling local people to survive in a balanced relation with the pristine natural and social environments. Local people use their own locally generated knowledge, skills and practices to change and to improve, especially in natural resource management. These sets of understandings, interpretations and meanings are part of a cultural complex that encompasses language, naming and classification systems, practices for using resources, ritual, spirituality and worldview (Turner and Ignance 2000, Muhando 2005). Indigenes have widely used local knowledge and management experience related to the environment, in developing cost-effective, effective and sustainable survival strategies for heritage protection, poverty alleviation and wealth generation (United Nations Division for Sustainable Development 1992). TEK has been utilised to interpret, explain, and understand local social and natural worlds and has proved to be valuable for effective economic development (Nwokoma 2012). Bio-cultural diversity

management of natural resources incorporates traditional leaders, elders, herbalists and spirit mediums that possess incalculable knowledge about habits, habitants and life-cycles of plants and animals (Toms 2005). Traditional ecological knowledge is the basic component of any country's knowledge system which should be the first step to mobilise resources for proximate natural resource management (Ossai 2010, Warren et al 2005). TEK has made, and can still make, significant contributions to resolve local problems (Nwokoma 2012). TEK has value in development, environmental conservation, heritage protection, and access to information and knowledge.

2.3 Conventional Resource Management

Resource management is the process of allocating both natural and man-made resources to attain optimal use of the environment in satisfying both existing and future basic human needs (Berkes 2003). This therefore involves more than mere management of the environment but also the management of the various activities with intolerable constraints imposed by the environment itself and with full consideration of ecological factors. In most modern communities, environmental planning, conservation of resources, environmental status evaluation and environmental legislation and administration are the full responsibilities of well trained and professional government resource managers (Gilmour 2013). Thus, modern resource management is dedicated to understanding human-environment interactions and the application of science to solving problems.

The conventional approach is management of resources based on Newtonian science and expertise in government institutions and their resource managers (Berkes et al 2000). There has been bias towards mainstream science because of unhealthy imbalances, distortion, trivialisation and neglect of indigenous knowledge systems as inflicted by Eurocentric governance (Emeagwali 2003). In the 1950's and 1960's, theorists of development saw indigenous knowledge as inefficient, involves erroneous beliefs, embodies illogical thinking, inferior and an obstacle to development (Warren 1992, Zazu 2007). According to Ossai (2010) TEK systems are marginalised due to craziness for modernity and pressures of globalisation. In most global communities, traditional ways of managing natural resources are often regarded as backward and superstitious. They are considered to be absolutely incompatible with modern society and development (Ossai 2010). The United Nations notes with regret that indigenous communities' ability to participate fully in sustainable development practices on their lands has tended to be limited as a result of factors of an economic, social and historical nature (United

Nations Division for Sustainable Development 1992). It is widely accepted that IKS should complement, rather than compete with, global knowledge systems in the implementation of sustainable development projects. Western thinking and development models tend to dominate most thinking about development policy (Nwokoma 2012). TEK systems were altered and disrupted in Africa during the colonial period as a result of the dominance of the Western scientific knowledge systems (Ossai 2010).

The oral and rural nature of IKS in Africa has made them largely invisible to the development community and global science (Ossai 2010). TEK has often been dismissed by managers of state institutions bestowed with the responsibility to manage natural resources as; unsystematic and incapable of meeting rapid economic growth needs of modern world (Ossai 2010). Indigenous people and tradition have been considered less progressive, many groups of indigenous peoples, especially their younger generations, are influenced to devalue their native cultures and to adopt new lifestyles and technologies (Ossai 2010). Under this system, TEK systems have not been captured and stored in a systematic way and are therefore endangered with extinction (Berkes 2009, Ossai 2010). A good number of indigenous groups in Africa and elsewhere in the world have suffered from long-term discrimination, inequity and exclusion from planning and execution of development programmes and projects (Ossai 2010). Paradoxically, the conventional approach to natural resources management in Zimbabwe has not rid the country of her contemporary environmental challenges. This therefore is a loud call for an alternative approach to be invented. The current study's goal is to assess the feasibility of practically integrating traditional ecological and orthodox scientific knowledge systems to achieve sustainable co-management of biotic resources on communal lands.

2.4 Contemporary Resource Management

Contemporary resource management seeks to integrate natural and social science, policy making and planning, traditional and scientific knowledge systems, at both the local and global scales and across the time-scale (Richards and Little 1994; IFAD 2012). There has been growing realisation for the need to widen the scope of biodiversity management by augmenting the institutions, instruments and players directly involved in natural resource management at both spatial and temporal scales. The World Commission for the Conservation of Nature (WCED) (1998) records that the Brundtland report reaffirms ecological stability, impact of human population increase on the environment, resource use and ownership, equity and poverty, alternative indicators of progress and democratic participation in the decision making

process. These important natural resource management institutions, instruments and players include and are not limited to local governments, national government agencies, intergovernmental institutions and NGOs, civic and traditional leaders, mayors, councillors and other political leaders; national natural resource policies, bylaws, resource use regulations and customary laws.

The world over, and beginning in the 1970s through the 80s and 90s, the importance of traditional ecological knowledge for the protection of biodiversity and achieving sustainable development has been slowly recognised (Gadgil et al 1993; IFAD 2012). This drive gained momentum by the turn of the millennium drawing much support from Article 8 of the Convention on Biological Diversity which urges communities to respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity (United Nations 1992, Muzzocchi, 2006). There is growing acknowledgement that culture-specific worldviews and ways of knowing play important roles in the lives of people. If self-reliance and not dependence, as well as sustainable biological resources are to be met, then the state natural resource managers should start with and build on what people already know – TEK (Nwokoma 2012). The culture and knowledge systems of indigenous people and their institutions provide useful frameworks, ideas, guiding principles, procedures and practices that can serve as a foundation for effective endogenous development options for restoring social, economic and environmental resilience in many parts of Africa and the developing world in general (Ossai 2010). Within national institutions, TEK systems are now being regarded as an invaluable national resource (de Guchteneire et al 2003, Gilmour 2013 and Parsons et al 2017). It is therefore contemporary since it is continually revised and up-dated to deal with contemporary environmental and economic issues (it endures and adapts). However, notwithstanding the above contributions of TEK to natural resource management and development, this study remains cognisant of the challenges TEK has in contemporary biotic resources conservation efforts. Challenges in natural resource management are far more complicated than previously envisaged. The limitations of TEK become evident where complex problems arise, for example, genetic transgressions resulting from the proliferation of genetically modified organisms (GMOs) or large scale disasters from global warming or nuclear accidents or spillage of hazardous/ toxic substances, which TEK has no solutions for.

Terralingua (2014) advocates for effort to strengthen local institutions to use traditional ecological knowledge for the conservation and sustainable use of biodiversity. However, it has to be noted that traditional institutions have undergone a number of transformations due to modernity and globalisation. These changes have, more often than not, eroded the sanctity of traditional authority and consensus on the value of proximate biotic resources among traditional communities. Community based natural resource management (CBNRM) programmes adopted the people-centred approach which places people above the product. Many case studies and research projects have demonstrated that developmental projects that succeed are those with active and direct participation of local people in decision-making. The preceding views are supported by Nwokoma (2012) who notes that TEK is an important tool for the participation of local people in sustainable economic development. Participation approaches like CBNRM allow local people to define their needs from their perspective and meaningfully be part of the decision making process (Emeagwali 2003; Nwokoma 2012). It is by acknowledging and mainstreaming TEK into developmental programmes that local people are empowered and more willing to use their experiences and innovations to ensure environmental integrity. Synergetic cooperation with outside experts could lead to diffusion and further adaptation and improvements of these local technologies. Mudimbe (1998) in Nwokoma (2012) posits that scientists are often adopting TEK and re-applying it in projects of development cooperation and other contemporary contexts. Effort has been made to understand TEK which can increase responsiveness to stakeholders by building on local experiences, judgements and practices to impact development programmes and make them cost-effective in delivery (Ossai 2010).

Haverkort (2009) advanced some reasons why science may disappoint: the ecological conditions could be inappropriate for its applications, the inputs could be unavailable, maintenance and follow up systems could be lacking, and it may not fit the social and cultural conditions and situations of the local people. This is supported by de Guchteneire et al (2003) who note that new insights reveal that development interventions have failed to induce people to participate because of the absence of instruments and mechanisms that enable them to use their own knowledge. TEK systems are often ignored, under-valued or replaced by colonial, state practices (Ossai 2010). There is increasing realisation that development interventions have often failed and may sometimes have a detrimental effect on people's livelihoods (Nwokoma 2012). It is therefore essential that traditional ecological knowledge systems in the continent should not be subsumed by the domination of cultures that notoriously foster

inequality and materialism (Ossai 2010). TEK continues to prove its viability and strength – it plays essential and practical roles in the formulation, implementation, assessment and evaluation of development programmes aimed at natural heritage preservation and environmental sustainability. TEK may have a better response to local challenges than western solutions that are preferred. However, it should be emphasised that TEK does not offer sustainable solutions to all of today's pressing problems and most local solutions are context-specific (Nwokoma 2012).

This study, while acknowledging the fundamental roles of TEK in natural resource management, notes with concern that TEK has some limitations as a knowledge system in guiding local natural resources conservation, utilisation and community development. Ossai (2010) fears that TEK risks being irrelevant and might even stifle local conservation and development efforts when outside its original cultural context. It needs to be contextualised, adapted and utilised to benefit local communities and cultural groups. Therefore, as a knowledge system, TEK is localised to specific geographic areas and rooted in particular cultural groups, and this renders it useless once exchanged across communities. This weakness defeats the ideals of global knowledge partnership which seeks to disseminate generated and accepted knowledge for the benefit of all development oriented communities.

There is need to encourage researchers and policy-makers to incorporate TEK into their project proposals, feasibility studies, implementation plans and project assessments, and to take TEK and practices into account in all activities affecting local communities (Boven and Morohachi 2002; IFAD 2012). Recent research has given valuable insights into how people use their own locally generated knowledge to change and improve, for example, natural resource management (de Guchteneire et al 2003). Within the development community, TEK provides opportunities for designing development projects that emerge from priority problems identified within a community, and which build upon and strengthen community-level knowledge systems and organisation (de Guchteneire et al 2003).

2.5 Zimbabwe National Environmental Policy and Legislations

Zimbabwe National Environmental Policy of 2009 broadly embraces the Convention on Biological Diversity (CBD)'s provisions for the respect, preservation and maintenance of knowledge innovations and practices of indigenous and local communities who are following traditional lifestyles that uphold the conservation and sustainable use of biotic resources (GoZ 2009). Indigenous knowledge systems is also treated as a capital asset within the sustainable

livelihoods framework which urges countries to allow local communities to be custodians of both their culture and the environment. Zimbabwe National Environment Policy has three guiding principle on indigenous technical knowledge.

The first is Guiding Principle 27 which states that:

- *'Indigenous technical knowledge and traditional practices have a valuable contribution to make to the management and sustainable use of natural resources'* (GoZ 2009: 16).

The strategic direction to meet this guiding principle is for the Government of Zimbabwe to:

- *'promote wide application of indigenous knowledge and practice in managing and using natural resources sustainably, particularly where they are integrated to local culture'*; and to
- '*encourage the documentation, dissemination and use of indigenous technical knowledge on management and sustainable use of natural resources'.*

The Guiding Principle 28 of the same policy document reaffirms that:

- '*Communities and individuals have the sovereign right to retain or share their indigenous technical knowledge and practices concerning the properties and uses of resources, and should therefore benefit equitably from any use of that knowledge'* (GoZ 2009:16).

In its strategic management, the government has three (3) goals:

- '*Develop and implement adequate measures, including codes of practice, for the protection of indigenous and intellectual property rights of local communities';*
- *'Promote the equitable sharing of benefits arising from the use of indigenous technical knowledge and practices'*; and
- *'Establish the means to monitor and enforce equitable sharing of benefits'*.

Then, Guiding Principle 29 states that:

- *'Individuals or communities with unique indigenous technical knowledge or practices concerning natural resources should be fully informed beforehand, and understand, the economic or other implications of granting consent for the use of such information'* (Goz 2009: 16). The objectives to operationalise this guiding principle are:
  - *'Establishing requirements and procedures for enforcing the principle of Prior Informed Consent';*
  - *'Empowering local people to request the necessary information about the intended uses and likely benefits of the collection of genetic or other biological resources from their lands, thereby enabling them to give their consent in the full knowledge and understanding of the implications';* and

- *Encouraging full disclosure of information about new products or knowledge developed from the collected materials'.*

2.6 Comparing Traditional and Scientific Knowledge Systems

The two knowledge systems are often considered to be different and incompatible especially in the formulation and implementation of development projects. Traditional ecological knowledge is considered a contrast to, or at least as different from, western ways of generating, recording and transmitting knowledge. TEK has been considered as primitive, pre-logical, illogical, irrational, and incoherent when compared to western scientific knowledge (Berkes 2003). The differences between indigenous knowledge and modern scientific knowledge is increasingly seen as a cause for underdevelopment, and this justifies efforts to bridge the divide (Gilmour 2013). It is widely accepted that IK should complement, rather than compete with, global knowledge systems in the implementation of development projects.

Table 2.4: Comparison of TEK and Western Scientific Knowledge Systems

Attributes	Indigenous Knowledge	Western Scientific Knowledge
Relationship	Subordinate	Dominant
Dominant mode of thinking	Intuitive	Analytical
Characteristics	Holistic Subjective – lacks scientific rigour Experiential Non-formal knowledge	Reductionistic Objective – facts are tested and retested for conformity Positivist Formal knowledge
Data creation	Slow/Inclusive	Fast/Selective
Prediction	Short time cycles Recognises the onset of long-term cycles	Short-term linear Poor long-term prediction
Explanation	Spiritual - includes the inexplicable	Scientific Hypotheses Theory and Laws
Biological classification	Ecological Inclusive-internally differentiating	Genetic and Hierarchical Differentiating
Utility	Largely ignored and neglected, Underutilised/Suppressed resource in the Development Process.	Highly regarded, widely accepted and used in most Development Programmes
Outlook	Focuses on local practices	Draws from International Practices
Storage	Social Memory	Documented
Transmission	Orally	Written/Well Documented
Spatial Extent	Confined to specific areas/societies/cultures	Universal

(Compiled from: Kolawole 2001; Berkes 2003; Emeagwali 2003; Ossai 2010; Nwokoma 2012)

Table 2.4 demonstrates that TEK contrasts with the international knowledge system generated by universities, research institutions and private firms quite significantly. TEK has proprietary systems which are often more flexible and negotiable, though it is less transferrable than its western counterpart (Emeagwali 2003). TEK is weak in that it relies and over depends on demographic stability and morality of the indigenes (Emeagwali 2003). The other weakness is that it is confined to specific geographical areas and cultures and its practice is being suppressed in most parts of the world (Ossai 2010). Some TEK cannot be codified and recorded, and hence cannot be exchanged across communities and cultures (Ossai 2010). It is developed outside formal education, therefore it is not systematically documented. TEK is in danger of disappearing not only under the influence of global processes of rapid change, but also because

the capacity and facilities needed to document, evaluate, validate, protect and disseminate such knowledge are lacking in African countries (Nwokoma 2012). Again, TEK is weak since it is generated and rooted within a particular community and geographic area, transferring it to other places has potential risk of dislocating it, rendering it irrelevant, inappropriate or even harmful (Ossai 2010). The content and development of TEK in Africa are not adequately researched and documented (Kolawole 2001, Chibhememe et al 2014). TEK is stored in traditional institutions (elderly and knowledgeable men and women) and their death may be equated to a library burnt (Ossai 2010). Secrecy of some TEK practices does not help matters due to cultural taboos tied to cultic matters and cultural rites of passage as means of bringing the uninitiated into union with society (Ossai 2010). Traditional societies have failed to develop conservation knowledge and awareness among societies because people avoided harvesting resources from sacred areas out of fear rather than with a declared purpose and interest in conservation. On the other hand, institutional science is administered in the context of a Eurocentric paradigm that carries with it, disdain, disrespect and arrogance (Emeagwali 2003).

After noting the weaknesses of TEK compared to orthodox science, it is critical that this study also assesses the weaknesses of Western science as well. Modern science is widely criticised for ignoring other important aspects of many people's lives such as spirituality, intuition and feelings (Masemula 2013). The rigid scientific approach that involves the following steps; systematic observation, thoughtful questioning, hypothesising, testing of generated hypotheses and application of the generalised explanation, is not only too complicated but too abstract for those outside science. For failing to comprehend and apply the scientific method, the knowledge of people outside the scientific circle is considered inadequate and lacking. Science tends to put little emphasis on environmental issues that permeate contemporary life of local resource users. This is because science is premised on some discrete ideas which lack relevance to traditional territories facing peculiar environmental challenges.

Science generate knowledge through rigorous testing of hypotheses. A hypothesis must be testable and falsifiable and the experiments and observations must be repeatable. This becomes a major weakness in that science cannot prove or refute some aspects of life, for instance, beliefs among indigenous people of the existence of a supernatural entity with powers to reward good environmental stewardship and punish offenders. Attempts to use scientific theory or principles on certain aspects of life like morality encourages the creation of pseudoscience which legitimises an idea without through testing.

2.7 The Concept of Resource Co-management

There has been dominance of state resource managers, private firms, international and nongovernmental organisations in the participation and management of natural resources and the environment. This has resulted in the absence and silence of the indigenous populations, on whose landscapes these institutions strive to introduce environmental sustainability. Such an institutional arrangement is flawed, as noted by de Guchteneire et al (2003) who submit that current development models have proven not too successful as they use a top-down development model, with the maximisation of productivity as its major target. Confronted with this predicament therefore, we can safely call for government and indigenous institutions for sustainable natural resource management to collaborate.

Collaborative management is a pluralist approach to managing relationships, handling different types of knowledge and participation of different social actors in negotiating, defining and sharing responsibilities and resource-related entitlements (Borrin-Feyerabend, Farvar, Nguinguiri and Ndangang 2007). Co-management has been widely embraced as an effective approach to environmental governance. It has sought to empower and entrench local communities into decision-making and active participation in local resource management (Ross et al 2009, Hill et al 2012, Coral Triangle Support Partnership 2013). Traditional ecological knowledge is being more highly valued by researchers, development experts and environmental scientists who have taken enough time to understand its invaluable contributions to biodiversity protection (Michie 1999). A clearer and deeper understanding of traditional ecological knowledge facilitate natural resource scientists and managers to effectively include it in management decisions (Prober, O'Connor and Walsh 2011). Government policy-makers and development practitioners need to respect local people and their traditional cultures, to improve on their developmental planning and strategies so as to ensure environmental sustainability. The development partners need to recognise the role of TEK, understand its workings in the context of the local communities, and integrate systematically the most effective and promising of such practices into the development programmes they support (Borrin-Feyerabend et al 2007). Despite undergoing change, TEK systems have maintained their core values which were used before and which can still deal with contemporary environmental issues. However, in current development discourse, formulations about traditional ecological knowledge recognise that derogatory characterisation of the knowledge of the poor and marginalised populations may be hasty and naive. The dichotomy between indigenous knowledge and modern scientific knowledge is increasingly seen as a cause for

underdevelopment; hence, work is now under way to bridge these two systems. Effort is underway to understand the nature of intersection between traditional knowledge and mainstream science. Resource managers need to seek complementarities between TEK and mainstream science. Efforts are made to combine the best of both traditional and scientific ecological knowledge (Haverkost 2009).

One perspective suggests that TEK should be integrated into the mainstream science whilst another implies that IK is science – separate from the mainstream, but equal (Emeagwali 2003). Notwithstanding the aforesaid, Ossai (2010) is of the opinion that TEK systems are far from being anachronistic in the contemporary world, these knowledge systems have much to offer to policymakers, environmental managers, administrators, and stakeholders in the natural resource management. This line of thinking is supported by Ahmad (2005) who notes that over the last two decades researchers have established links between TEK and science, and acknowledged the relevance of TEK to education systems (especially in the curriculum of resource management institutes) and development issues. The aforementioned observations are further qualified by de Guchteneire et al (2003) when they report that many case studies and research projects have shown that there are no simple technical Western solutions that can be easily diffused and adopted by people on the margins. This implies that indigenous resource custodians and users should combine efforts with state resource managers and other key stakeholders in natural resource management and environmental protection, to attain environmental conservation, development and sustainability.

2.8 Opportunities and Barriers for Integration of the two Knowledge Systems

The integration of TEK into the development process is essentially a process of exchange of information from one community to another (Ossai 2010). The process of knowledge exchange involves six (6) steps:

1. Recognition and identification. According to Champika, Taha, Tabarak and Qiuping (2009) and World Bank Group (2017) knowledge generated by a society is useful experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. The two knowledge systems need to be identified in as far as they define the legal frameworks, stakeholder roles, consultation procedures and governance for communal lands.
2. Knowledge validation. This involves assessing both knowledge systems in terms of their contribution to our present stock of information. Knowledge is valid when it is free from

doubt and true. This step involves assessment of TEK and western science significance and relevance, reliability, effectiveness, functionality and transferability in the context of natural resource management and sustainable socio-economic development.

3. Knowledge recording and documentation. TEK was transferred orally, that is, by word of mouth from the elderly persons to young generations. There is now an outcry for TEK to be recorded in manuscripts, audio recordings, video footages, transcriptions and digitisation. Western science is already recorded and sufficiently documented in library repositories. Knowledge documentation includes all activities of identification, fixation and classification aimed at facilitating retrieval from an organised data set, such as paper files, digital databases, archives or libraries. The following are benefits that knowledge documentation can have: it can help impede further loss of TEK, maintain TEK over time, support benefit sharing between holders TEK and those who use it, and ultimately protect TEK from unwanted uses (World Intellectual Property Organisation 2017).
4. Knowledge storage in retrievable repositories such as paper files, digital databases, archives or libraries. Knowledge that has been documented should be accessible to potential users and authorities should be able to manage access to and use of the documented knowledge through licences and other contractual arrangements.
5. Knowledge transfer. This is a process by which knowledge, ideas and experience move from the source of the knowledge to the recipient of that knowledge.
6. Dissemination. This step involves distributing knowledge and ensuring its availability for future users.

Drew and Henne (2006) and Parsons et al (2017) postulate that bringing these two knowledge systems together enables nations to forge synergistic and more robust conservation programmes capable of protecting the vivid splendour of life on Earth. Kimmerer (2000) acknowledges that although native people's traditional knowledge of the land differs from scientific knowledge, both have strengths that suggest the value of a partnership between them. Drew and Henne (2006) weigh in by stressing that both the traditional and state institutions are concerned with the identification and preservation of biological diversity, culturally and biologically respectively. The rediscovery and campaign for the resurgence of traditional knowledge as a model for a healthy interaction with, and use of, the environment, is clear testimony that if this rich source is systematically tapped into and integrated with scientific knowledge, new perspectives about the relationship between humans and nature are gained

(Muzzocchi 2006). Both knowledge systems subscribe to the notion that natural resource management is based on shared meanings and knowledge (Berkes 1993, Lertzman 2010).

On the part of TEK, Ossai (2010) highlights an opportunity for integration based on its strength that it can and is adaptable to other forms of knowledge used in contemporary natural resource management regimes. Interestingly, de Guchteneire et al (2003) support the notion by adding that TEK has the capacity to blend with knowledge based on science and technology, and should therefore be considered complementary to scientific and technological efforts to solve problems in social and economic development. Not to be out done in this effort, Berkes et al (1998) are of the view that TEK may complement scientific knowledge by providing practical experience in living within ecosystem and responding to ecosystem change. The Science Agenda of the World Conference on Science (Budapest, 28 June – 1 July 1999) urged that Governments should support cooperation between holders of traditional knowledge and scientists to explore the relationship between different knowledge systems, and to foster inter-linkages of mutual benefit (de Guchteneire et al 2003).

Both knowledge forms are limited in their ability to inform social practise of biodiversity management (Klooster 2002). Inadequate cross-cultural means to organise and communicate traditional ecological knowledge can limit its effective inclusion in management decisions (Prober et al 2011). Drew and Henne (2006) identify linguistic, cultural, and epistemological barriers between the two knowledge systems. They argue that the two disciplines are uniquely positioned to inform each other and to provide critical insights and new perspectives on the way these sciences are practised. However, there is a difficulty in approaching the knowledge from indigenous cultures as reflected in the way in which it is described and named; indeed traditional ecological knowledge is referred to differently by varied societies, scholars, researchers, resource managers and other groups of people (Berkes et al 2000, Muzzocchi 2006). Indeed the language of TEK usually includes metaphorical imagery and spiritual expressions which mark differences in context, motive and conceptual underpinnings (Berkes et al 1998, Berkes 2009). Again, and even worsening the situation, government officials and resource managers seem to be privileging scientific knowledge over local knowledge (Terralingua 2014). Greater efforts therefore should be undertaken to strengthen the capacity of local people to develop their own knowledge base and to develop methodologies to promote activities at the interface of scientific disciplines and indigenous knowledge (de Guchteneire et al 2003).

2. 9 Institutional and Policy Frameworks for Biodiversity Co-management

What is needed is an institutional arrangement where all powers over land, environment-based biotic resources and their management is placed in the hands of an inclusive and accountable public institution capable of integrating land allocation, resource management and civil development fully and more effectively (Bennet et al 2012). A management programme has to be drafted, which is a combination of operational policies, procedures and practices that provide a programme of mitigation and performance improvement measures and actions that address the social and environmental risks and impacts identified in the assessment and resulting from consultation with affected communities. There is genuine call for some mechanisms by which policy, government and corporate stakeholders could marry TEK and western science for sustainable biodiversity management and sustainable development in Zimbabwe (Chigwenya and Manatsa 2007; Chibhememe et al 2014). This should involve marrying government and indigenous institutions for environmental protection for the benefit of larger scale populations.

The governments should encourage researchers and policy-makers to incorporate indigenous knowledge into their project proposals, feasibility studies, implementation plans and project assessments. Also, development planners should take TEK and practices into account in all activities affecting local communities (de Guchteneire et al 2003). We need some deliberate effort to build a bridge between empirical solutions, research and policy. It needs instruments, facilities, research, moral support, political will, financial resources (Nwokoma 2012). For capacity building and intellectual development, train youths, indigenous people, corporate, state natural resource managers, to better equip them with knowledge, skills, attitudes and experiences of utilising both traditional ecological and scientific know-how of managing proximate biotic resources.

The United Nations Division for Sustainable Development (1992) in its Agenda 21 Chapter 26 advocates for the strengthening of national arrangements to consult with indigenous people and their communities with a view to reflecting their needs and incorporating their values and traditional and other knowledge and practices in national policies and programmes in the field of natural resource management and conservation and other development programmes affecting them. This simply calls for the establishment of an institutional and policy framework that ensure vital knowledge systems interface between policy development, research and development cooperation. Buttressing on these feasible suggestions, Terralingua (2014) further

advocates for the creation of space of local discretionary power over local resources and in which people can make decisions on their own behalf. Ossai (2010) further observes that despite serious erosion of TEK over the decades in many communities in Africa, they are still relevant and appropriate for promoting sustainable development of the continent. According to Terralingua (2014), this leads to the formulation of strategies for better management of natural resources according to their own needs and objectives.

The challenge is to develop a framework that has the potential to be a source of inspiration to others i.e. serve as a model for generating policies and initiatives elsewhere. Also to create new democratic institutions for self-governance, decentralised decision making and for enhancing local livelihoods (Terralingua 2014). According to de Guchteneire et al (2003), the institutional and policy framework that should be developed for integration of two management approaches should be: innovative; make a difference; have a sustainable effect and have the potential for replication. Haverkort (2009) cites an example of a worldwide effort to understand traditional knowledge and to develop an approach for development that takes the best of both traditional and scientific knowledge as ILEIA (the information centre on Low External Inputs and Sustainable Agriculture) in Asia. In general terms, the current study supports effort towards establishment of a policy and institutional framework which is adaptive and participatory in its outlook.

2.10 Chapter Summary

The chapter has reviewed principal ideas expressed by authorities on the ecological knowledge and practices for both traditional and scientific communities. Each of the duo knowledge system has a unique set of principles, practices and technologies that allow for effective biodiversity management. The institutional and policy framework that enhances sustainable biodiversity co-management were also critically reviewed with a view of adapting the underlying progressive principles in the study area. The literature reviewed laid the foundation against which the findings of this study were compared. The next chapter describes the research methods and materials that were employed to facilitate the gathering of primary data necessary for finding answers to the research questions posed in this study.

CHAPTER III

RESEARCH METHODS AND MATERIALS

3.0 Introduction

This Chapter describes and justifies the research methodology adopted in the current study to systematically solve the research problem defined. It includes the design, data gathering and data analysis techniques employed to sufficiently address the research questions. The study's total, targeted and sampled populations are described and the sampling approach is qualified. The data gathering strategies and instruments used in this study are discussed. The Chapter also presents the data collection procedures, presentation and analysis.

3.1 Research Design

A research design is the overall strategy and logical plan that the researcher chooses to integrate the different components of the study for obtaining answers to the research questions (Burns and Grove 2001; Yin 2003). It is vital at this juncture to reaffirm the research questions. The study addressed the following research questions: What are the perceptions of local rural communities in Masvingo Province, regarding access, use and management of natural biotic resources? What traditional and scientific management principles have been used globally and locally for sustainable biodiversity utilisation and conservation? What benefits and challenges have been encountered in utilising each of the approaches to manage proximate biotic resources? What are the fundamental similarities and differences between traditional and scientific ecological knowledge systems, practices and technologies? What opportunities and challenges exist for the cordial marriage between the duo knowledge systems? What value does the conscious and deliberate integration of the two approaches add to biodiversity co-management practice? Can some institutional and policy frameworks be designed that inform contemporary environmental policy decisions for adaptive biotic resources co-management and environmental sustainability?

The research design serves to indicate how the research questions guiding the study were examined. It defines the study type, research questions, variables, and data collection methods.

Thus, research design aims at the employment of the correct procedures to obtain raw data that could be associated with the real situation (Burns and Grove 2001; McGregor and Murname 2010; Sampson 2012, Yeasmin and Rahman 2012). By its nature, this study used a complementary combination of quantitative and qualitative design types and mixed research methods. Quantitative approaches are seen as more scientific and objective as they mostly yield numeric data whilst the qualitative one mainly yields information in non-numeric data form and allows for in-depth study of individual cases. However, it needs to be noted that quantitative methods can also yield non-numeric data for example when open-ended responses allow for in-depth study of individual cases. On the other hand, qualitative approaches can also generate numeric data that can be analysed quantitatively, for example, structured interview responses or coded responses or the Likert scale (Burn 2000). As such, Borland (2001) and Leedy and Ormrod (2005) argue that quantitative and qualitative research are not mutually exclusive approaches, but the most useful research findings typically result from appropriately applying both paradigms. The study therefore adopted a descriptive research design that involves observations, case studies and surveys. A descriptive study was adopted since it attempts to describe, explain and interpret conditions of the present, and is primarily concerned with finding out what is, in this case, what is involved in integrating two knowledge systems to achieve sustainable natural resource co-management in Zimbabwe. Descriptive research utilises elements of both quantitative and qualitative approaches, often in the same study. This research framework better defines and accurately portrays an opinion, attitude, belief, behaviour, situation or thought process held by a group of people on a given subject and the frequency with which certain phenomena occur. It involves gathering data that describes events and then organises, tabulates, depicts, and describes the data collection (The Association for Educational Communications and Technology 2001). It seeks to observe and describe variables in an effort to understand their relationships better and then make inferences into their similarities and differences. It groups responses into predetermined choices that will provide statistically inferable data. The researcher can measure the significance of the results on the overall population being studied, as well as the changes of the respondents' opinions, attitudes and behaviours overtime. In general, quantitative methods are designed to provide summaries of data that support generalisations about the phenomenon under study.

A case study research is based on any mix of qualitative and quantitative evidence. According to Yin (2003), when a case study is used, a wide variety of people and activities are invariably examined. It is used when the focus of the empirical enquiry is on contemporary phenomenon

within some real life context. It also entails assessing or evaluating the situation as it is on the ground and also allows respondents to express their opinions, perceptions, attitudes, emotions, behaviours and experiences pertaining to a common problem. Thus a case study focuses on a bounded system usually under natural conditions so that the system can be understood in its own habitat. A multiple case study design was used as it offers robust analytical conclusions. Communal areas in the seven districts of Masvingo province were the sites to be visited for collection of empirical data. In this study area, natural biotic resources are evidently degrading ironically under the watch of professional public natural resource managers and traditional leaders. However, a case study approach does not allow the researcher to have full control over certain variables and events and therefore does not control them and was highly labour intensive for the research team.

A survey research on the other hand, as used in this study, is both a quantitative and qualitative approach that attempts to document current conditions or attitudes (Nachimias and Nachimias 1999, Hussein 2009, Saunders, Lewis and Thornhill 2012). A qualitative research design involves the use of semi-structured question interviews, focus group discussions and unobstructed observations. The broadly stated questions about human experiences and realities studied through contact with people in their natural environment generates rich descriptive data that helps to understand their experiences and attitudes. The survey research was appropriate for the study as it only selects a few participants for data collection. After analysing the gathered data from the sampled population, results could be generalised to the entire population. In this case, the researcher sought to gather data that describes the observed applications of the two knowledge systems in the management of biotic resources in the communal areas of Zimbabwean general, and Masvingo Province in particular.

3.2 Study Population

The term population in research or sampling is defined as the whole group (under study) the researcher has interest in and desires to obtain conclusions from (McGregor and Murname, 2010). This is the population size of the group the research sample represents. In this study, population is all the individuals living within the communal lands of Masvingo province. According to the national census results of 2012, there were 1 366 756 people living in the communal areas of the seven districts of Masvingo province (Zimstat 2012). This represents the total population of the study. Total population is the sampling frame, that is, the list of all the individuals in a population. Suffice to say, the universe to which research results are to be

generalised. The total population value for this research therefore tallies with the study population referred to above.

3.2.1 Target Population

Target population refers to individuals who are accessible to the research and are the population of interest because they harbour data required by the study. This study specifically targeted the adult population (18^{+} years) in the study area (1 059 144) (Table 3.1). The adults are active residents and they have gained experiences in the management of proximate biotic resources using either traditional or scientific knowledge or both. It is this subgroup that directly participated in the study as questionnaire respondents, interviewees, observable subjects, focus group discussants and resource persons. The target population comprised ordinary villagers, traditional leaders, natural resource managers with different government agencies (EMA, ZFC, ZINWA, National Parks Authority, AGRITEX), administrative staff (councillors, district administrators, RDC executive officers) and NGOs officials.

Table 3.1: Target Population (N=1 059 144)

District	**Males**	**%**	**Females**	**%**	**Total**	**%**
Bikita	57 123	5.4	68 717	6.5	**125 840**	**11.9**
Chiredzi	102 879	9.7	110 875	10. 5	**213 754**	**20.2**
Chivi	58 730	5.5	69 972	6.6	**128 702**	**12.1**
Gutu	73 128	6.9	84 059	7.9	**157 187**	**14.8**
Masvingo	76 836	7.3	86 868	8.2	**163 704**	**15.5**
Mwenezi	59 886	5.7	69 546	6.6	**129 432**	**12.3**
Zaka	63 741	6.0	76 784	7.2	**140 525**	**13.2**
Totals	**492 323**	**46. 5**	**566 821**	**53. 5**	**1 059 144**	**100.0**

(Source: Zimstat 2012)

The target population was split into two subgroups, namely district of origin and gender. This paved way for proportionate stratified random sampling. Due to the large target population, not every individual could participate in the study thereby necessitating sampling.

3.2.2 Sample Size and Sampling Techniques

Sampling is a process of selecting a number of individuals for a study in such a way that the individual represents a large group (total population) from which they are selected (Monette et

al 2011). It is then, a selection of respondents chosen in such a way that it accurately represents the population from which it was drawn. This study had to come up with a correct sample size, that is, the number of participants that accurately represents the entire population. Care was taken to avoid too large a sample size as it wastes resources (financial, human and time) while a sample that is too small would deprive the research of valuable insights.

In this study, stratified random sampling and purposive non-probability sampling were used. Stratified random sampling is a probability sampling technique wherein the researcher divides the entire population into different sub groups or strata then randomly selects the final subjects proportionately from the different strata (Nauman 2000). Apparently the sample was not homogenous, hence stratified random sampling was used since it involves subdividing a sample that is not homogenous into smaller homogenous groups to get more accurate representations (Monette et al 2011). The study first divided the population according to the district of origin, and seven strata emerged. In each district, the study further divided the population in each of the seven districts into males and females. Each stratum in itself then is more homogenous than the target population as a whole. This is appropriate to use if one wishes to obtain information about an entire population consisting of different strata by means of sampling. To obtain study participants, simple random samples were then drawn proportionately and independently from all strata. The stratification was based on district of origin and one's gender. In order to ensure fair and accurate representation, proportionate stratified random samples were drawn from each district to get questionnaire respondents (Table 3.3). The study used the household as the unit of measurement. Table 3.2 which shows the required sample size for a given population, a specific margin error and a desired confidence level, was used to determine the appropriate sample size for this study. The Research Advisors (2006) posit that many researchers (and research texts) suggest that the first column with the table should suffice (Confidence Level=95%, Margin of Error=5%). Accordingly, with a target population of 1 059 144, the required sample size (for questionnaire respondents) to generate a 95% confidence interval and a 5% margin of error, was 384 villagers.

Table 3.2: Sample Size Table

	Confidence Level = 95%			Confidence Level = 99%		
	Margin of error			Margin of error		
Population size	5%	2,5%	1%	5%	2,5%	1%
100	80	94	99	87	96	99
500	217	377	475	285	421	485
1.000	278	606	906	399	727	943
10.000	370	1.332	4.899	622	2.098	6.239
100.000	383	1.513	8.762	659	2.585	14.227
500.000	384	1.532	9.423	663	2.640	16.055
1.000.000	**384**	1.534	9.512	663	2.647	16.317

(Sources: The Research Advisors 2006)

Table 3.3: Sampled Population (N=384)

District	**Males**	**%**	**Females**	**%**	**Total**	**%**
Bikita	21	5.4	25	6.5	**46**	**11.9**
Chiredzi	37	9.7	40	10. 5	**77**	**20.2**
Chivi	21	5.5	25	6.6	**46**	**12.1**
Gutu	27	6.9	30	7.9	**57**	**14.8**
Masvingo	28	7.3	32	8.2	**60**	**15.5**
Mwenezi	22	5.7	25	6.6	**47**	**12.3**
Zaka	23	6.0	28	7.2	**51**	**13.2**
Totals	**179**	**46. 5**	**205**	**53. 5**	**384**	**100.0**

3.3 Data Collection Instruments

In order to collect both primary and secondary data, the following tools were employed: interviews, questionnaire survey, focus group discussions, direct field observations and document interrogations.

3.3.1 Interviews

Key informant (KI) interviews – In order to get an expert view of the issues under investigation, the study contacted KI interviews with: 7 Environmental Management Agency (EMA) district officials (Appendix C); 21 traditional leaders (targeted were chiefs, headmen

and village heads) (Appendix D); 7 councillors (Appendix E); 7 District Administrators (Appendix E) and 7 Agricultural Extension Services (Agritex) and Zimbabwe Forestry Commission (ZFC) district officials (Appendix E); one from each of the 7 districts. It may be noted that for the state natural resource agencies, they have one district official and these were the targets for this study. The study used convenience sampling to select three traditional leaders (a chief, headman and village head) from each district. The interviews were administered concurrently with the household questionnaire surveys.

3.3.2 Questionnaire

Household questionnaire survey: A questionnaire is a formalised list of questions and has guiding answers used to solicit valuable data from respondents (Haralambos and Holborn 1990, Hendricks 2006). A questionnaire (Appendix A) was administered to 384 household heads. The research team randomly selected the household heads that suited the specifications of the sampled population for each administrative unit (district). If a targeted homestead had an absent household head at the time of the survey, the research team opted for the neighbouring homesteads and replaced the initially selected respondent while respecting the gender stipulations. The questionnaire had questions covering the objectives and research questions of the study. The questionnaire was coded and yielded numerical data on household heads' perceptions on and experiences with all the local institutions involved in natural biotic resource management in their communities.

The questionnaire survey allowed the research team to gather data from a large sample over a larger geographical area within a relatively short space of time (August 2016 to January 2017). In addition, a questionnaire survey is not entirely influenced by the researcher's personal attributes when respondents answer questions on their own and anonymity is also assured.

3.3.3 Focus Group Discussions

Focus group discussions - The study was also informed by data gathered from seven (7) focus group discussions (Appendix B) whose results were triangulated with responses from the questionnaire survey and key informant interviews. One focus group discussion, comprising eight (8) members was convened in each of the seven (7) districts involved in the study. Again, the focus group discussions were organised concurrently with the other surveys.

3.3.4 Direct Field Observations

Direct field (participant) observations – the researcher sought permission from traditional authority to attend village meetings and special meetings arranged by the headmen and/or chiefs. The free interactions with villagers engender perfect ties between the researcher and the research subjects which facilitates identification of key informants for in-depth and formal interviews as well as collection of valid data.

3.3.5 Document Interrogation

Desk studies of articles and environmental policy briefs (documents interrogations) - The study commenced with a lot of in-depth document interrogation to trace the historical governance of natural biotic resources globally in general and Zimbabwe in particular. This approach seeks to acquaint the research with the general dynamisms in the local institutional framework for proximate natural biotic resource management. The literature on some studies on roles of traditional institutions in natural resource management, traditional ecological knowledge systems, state organs in natural resource management, statutory bodies and legislative instruments, and other related issues were critically interrogated. This exercise shapes the epistemology of the study and directs the research into real issues that would fill the information gap.

3.4 Data Collection Procedure

This section gives details of the steps taken in administering instruments and collecting data from subjects under study. The research was carried out by a research team comprising the principal researcher and three assistants. The research assistants were briefly trained to enhance their understanding of the research objectives and key research instruments. The primary data was collected directly from the study area during the period August 2016 and January 2017. Permission was granted by the Ministry of Local Government through the Provincial Administration office.

3.4.1 Pilot Study

A pre-survey was done in Wards 9 and 18 of Zaka district on 12 June 2016 to assess the feasibility of the study, questionnaire survey time required, clarity of questions, adverse events, test the validity of the instruments and statistical variability. Pre-testing helped to clarify ambiguous and difficult questions by either refining them or rephrasing them. The flaws noted were rectified prior to performance of a full scale research.

3.4.2 Data Collection

It took the research team the period August 2016 to January 2017 to administer 384 questionnaires, conduct 49 interviews with key informants, do field reconnaissance and direct observations and hold 7 focus group discussions. The questionnaire survey involved visiting the respondents at their homes, securing their consent to participate and going through the items together. This gave a guaranteed 100% retrieval rate of completed questionnaire sets. Interview dates were booked in advance with the key informants who included traditional leaders, state resource managers at district level and district administrators. The interviews were tape recorded where interviewees consented to it or written records were obtained and at times both voice and written records were obtained. The focus group discussions were pre-arranged to coincide with local communities scheduled meetings. Proceedings were tap recorded and written records complemented too. In the process of effecting these surveys, the research team made valuable direct field observations about the socio-ecological statuses of the entire landscapes of the study area.

3.5 Data Presentation, Analysis and Interpretation

Data presentation and analysis procedures spell out the steps followed to present, organise, describe, analyse and draw out meanings from the collected data. Use of statistics, tables and graphs, make data presentation suit research themes and tends data reaching for interpretation. According to Stein (1988) and Denzin and Lincoln (2013), analysis is the separation of any material or an abstract entity into its constituent elements for easiness of close scrutiny. Therefore, data analysis would mean the process or a method of studying the nature of discrete information gotten from different research instruments. It is through this process that researched data becomes meaningful information and the researcher can draw up conclusions and generate new knowledge. The data obtained through the use of questionnaires, interviews, field visits methods during data collection were analysed using appropriate statistical data processing packages to allow for trends, patterns and relationships to clearly emerge. The data was entered into the Statistical Package for Social Scientists for descriptive statistical analysis and then copied to excel for graphical representations. Therefore, when individual units are brought together, they reveal the exact picture of the complexity of the issue. Analysis of the data was done through synthesis and commenting on findings in light of reaching meaningful conclusions on the benefits of biotic resource co-management in the study area and beyond.

3.6 Chapter Summary

The chapter focused on describing in detail the main research approach and its subsequent study plan. The procedure for sampling and identifying the research participants in the study area was described and explained. Data collection tools namely, interview guides, questionnaire surveys, focus group discussions and observation methodologies were discussed with particular reference to this research and how the research team collected data using these instruments. The chapter ended by outlining the data collection procedures, presentation, analysis and interpretation plan. These steps are critical for obtaining useful data and manipulating the same data to yield invaluable information thus the basis of generation of meaning and knowledge. The following chapter looks at the presentation of the collected data in varied forms and analyses the emerging trends and patterns. The chapter raises answers to the research questions posed in Chapter I. Also, comparisons are made to the current study findings with the already published knowledge to allow for basic knowledge synchronisation.

CHAPTER IV

DATA PRESENTATION AND ANALYSIS

4.0 Introduction

In this chapter, the data collected from the study area using varied instruments are presented in form of tables, graphs, statistics and prose and then analysed. The trends and patterns that emerge from data manipulations are critically analysed, compared and interpreted to generate valuable information that informs local people as beneficiaries, policymakers and environmental practitioners on sustainable management of natural resources. The study results are discussed so as to deduce meanings and generate information vital for policy formulation and rational decision making. The study results are compared with existent literature to show areas of convergences and divergences. It is critical that the study results be interpreted in the light of established facts. Such effort leads to acceptance, rejection or revision of existing facts and drawing of new insights.

4.1 Local Resource Users' Perceptions of Natural Biodiversity

The study sought to establish the indigenous communities' knowledge of natural resources available in their locality, environmental stewardship, resource ownership and access rights. This information is critical for understanding the contributions of different stakeholders in the contemporary natural resource management matrix.

4.1.1 Endowments of Biotic Resources in the Study Area

The study documented the main biotic resources occurring in the study area (Figure 4.1) from questionnaire responses. In order to identify as many biotic resource endowments as possible the respondents were allowed to provide multiple responses. Most respondents (87%) identified woody and non-woody vegetative species, birds, fish and animals as the abundant resources. Insects such as bees, pests and microorganisms were also reported to be present in area. The endowments of these biotic resources were confirmed in interviews with traditional leaders, FC and EMA officials and environmental NGOs as well as field observations. The participants appreciated the abundance and diversity of the floral and faunal species.

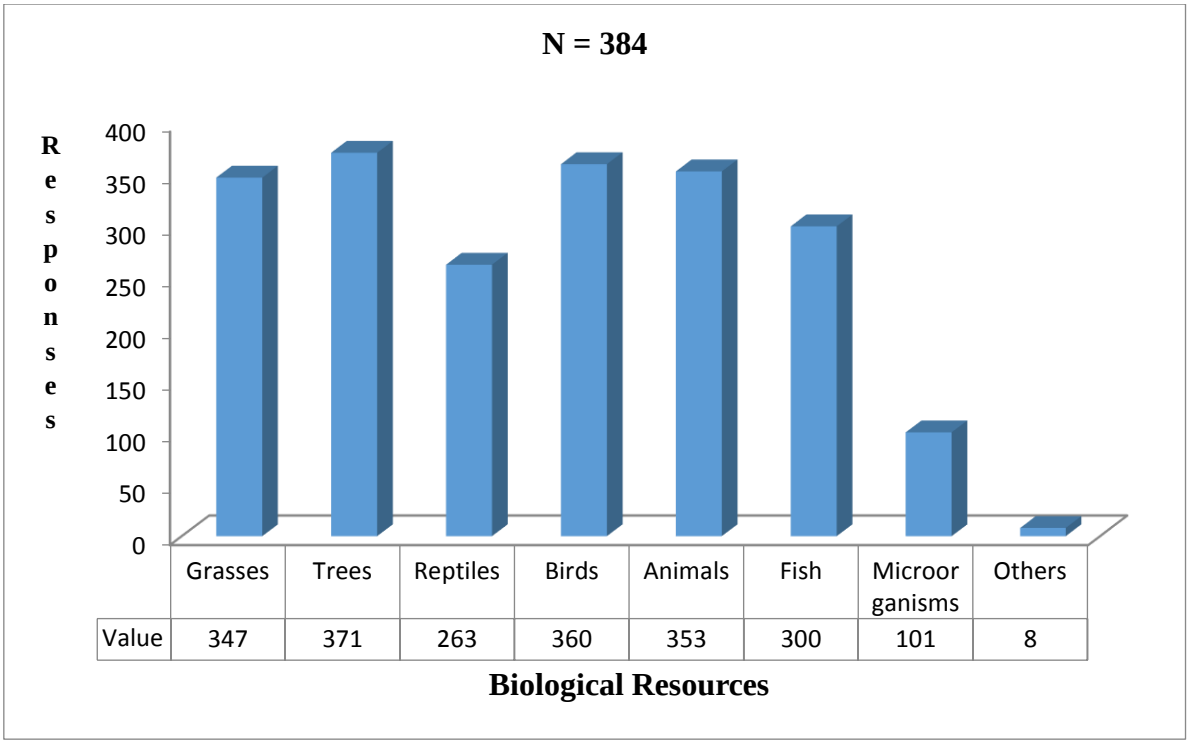

Figure 4.1: Biotic Resources Endowments in the Study Area

4.1.2 Benefits Derived by Residents from Proximate Biotic Resources

The questionnaire respondents were asked to identify benefits derived from proximate biotic resources. The biotic resources that were most popular with residents are those that yielded some consumptive value at domestic level (Figure 4.2). Residents noted building materials, food, income, fresh air and aesthetics as the most valuable benefits that biodiversity brings to them. The other benefits reported are manure from decomposing vegetation (humus), medicines from herbal plants and animal products, fibre and wood fuel from woody vegetation.

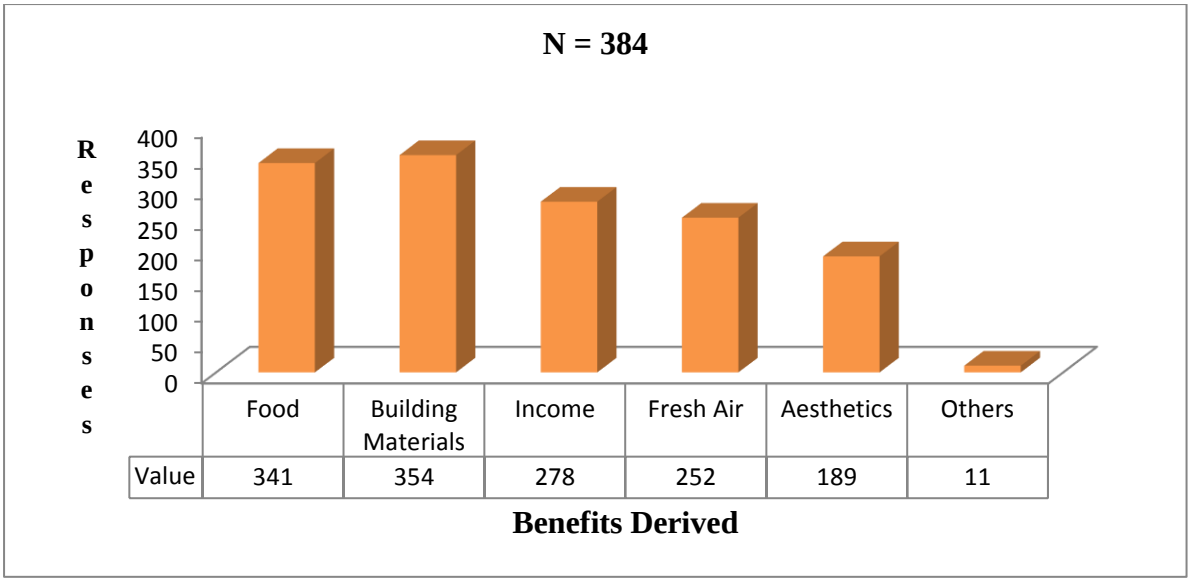

Figure 4.2: Benefits Derived from Proximate Biotic Resources

In the case of focus group discussions, though the participants were not directly asked to identify the biotic resources in their areas, they also referred to the same resources identified by questionnaire respondents when discussing the biodiversity management methods in use.

4.1.3 Authority to Proximate Biotic Resources

The study established some key players in the stewardship of biotic resources in the respondents' locality. Item 12a of the questionnaire asked respondents to select the institutions that authorised the use of natural resources in their areas. The respondents were instructed to list the institutions in descending order, starting with the most active ones in their locality. Traditional leadership was rated the most powerful authority or institution in the use of proximate biodiversity, with 90.4% of the respondents identifying it. The other key players were the Environmental Management Agency of Zimbabwe (EMA), identified by 76.8% of the respondents and Forestry Commission which was cited by 56.3% of the respondents. In descending order of authority regarding the access to biotic resources, the following were also identified: Agritex, ward councillor, Rural District Council (RDC), Zimbabwe Water Authority (ZINWA), District Administrator (DA) and Zimbabwe Republic Police (ZRP) (Figure 4.3).

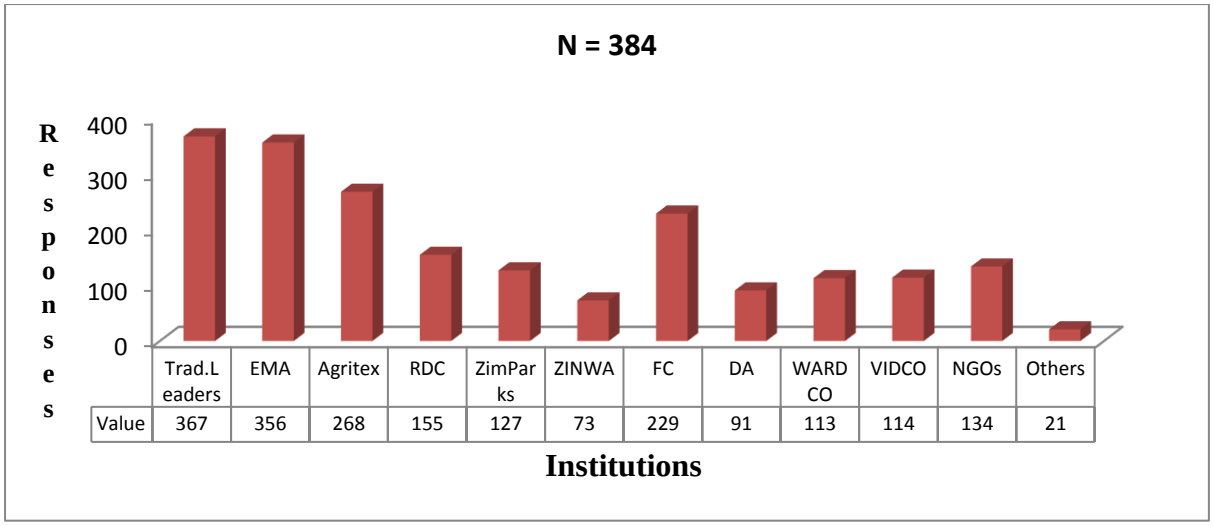

Figure 4.3: Institutions that Controlled Use of Local Resources

The other authorities include environmental ward committees, Zimbabwe National Parks and Wildlife Authority (ZimParks), village chairpersons, education district officials and generally, individual residents. Indeed the traditional leaders and state agencies workers confirmed the roles of these players in environmental management. Although the EMA was convinced that it played a leading role in the management of biotic resources, it nonetheless came second best after traditional leaders following submission from focus group discussions.

4.1.4 Access to Local Biotic Resources

The study sought to assess the experiences of the local people with regard to ownership, access and utility of proximate biotic resources. Most of the questionnaire respondents (75.8%) approved the suitability of the nature of existing authority over access to; and utilisation of proximate biodiversity (Figure 4.4). However, 22.9% of the respondents disapproved the current set up while 1.3% were unsure about the best institutional and legal arrangements for biotic resource management in the communal lands. The participants in focus group discussions were unanimous that traditional leaders should retain sole stewardship over biotic resources.

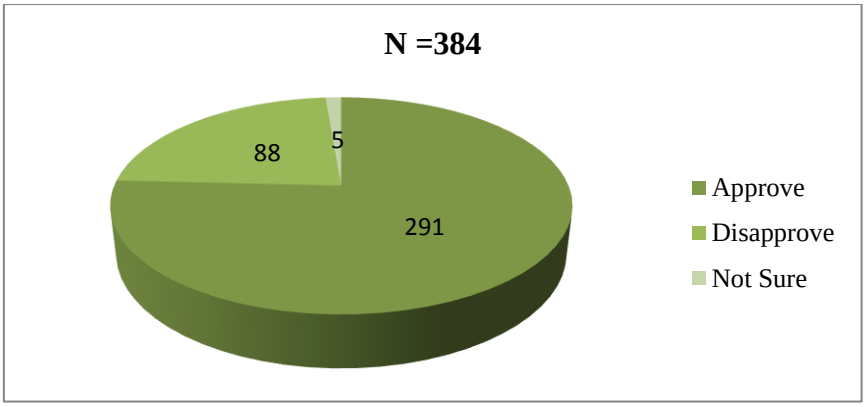

Figure 4.4: Attitude towards Community Access to Local Resources

4.1.5 Reasons for Approving the Contemporary Arrangement to Access Proximate Biodiversity

The majority of the respondents approved an arrangement where the traditional leaders were the most powerful stewards of proximate biotic resources. In its quest to unveil the appropriateness of the overwhelming response, a number of reasons were cited in support of the choice (Figure 4.5).

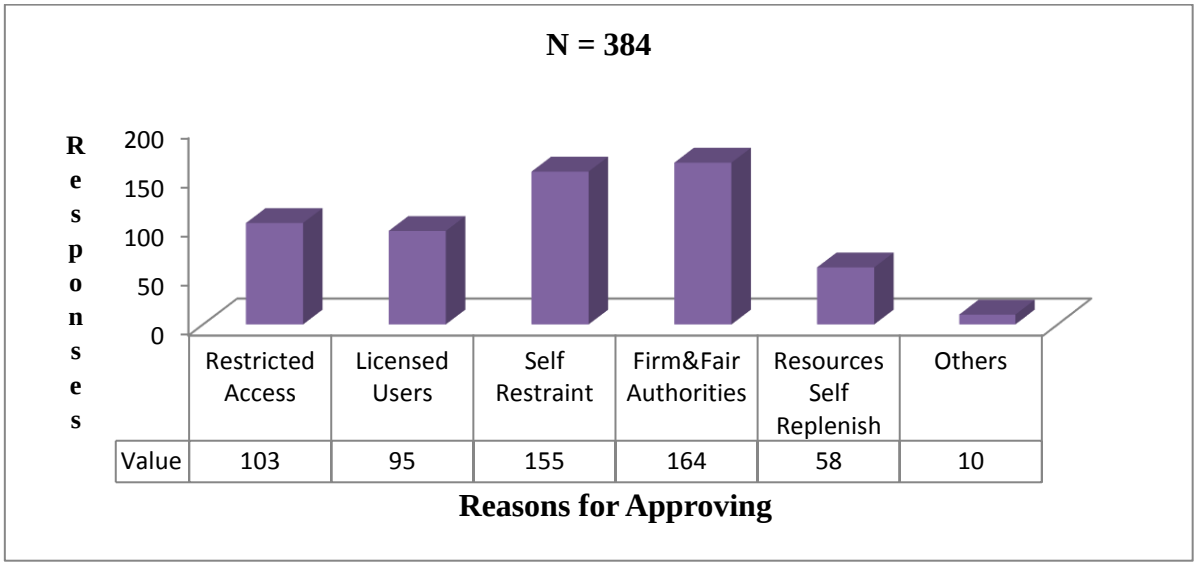

Figure 4.5: Reasons for Satisfaction with Arrangements to Access Resources

It was noted that traditional leaders were firm and fair. Under traditional leadership, villagers exercised self-restraint; users were restricted (existence of a clear user-group); users were strictly licensed and resources were accorded self-replenishment periods. The other reasons that were given less significance were that the current management arrangement guarantees sustainable livelihoods for villagers and everyone has some opportunity to get all they need for survival from the surrounding environment. The traditional leaders also weighed in adding that

they have in-depth knowledge of both the residents and endowments in their areas of jurisdiction.

4.1.6 Reservations over Access to Biotic Resources

The villagers who disapproved the existing arrangement regarding access to and utilisation of biodiversity gave the reasons summarised in Figure 4.6.

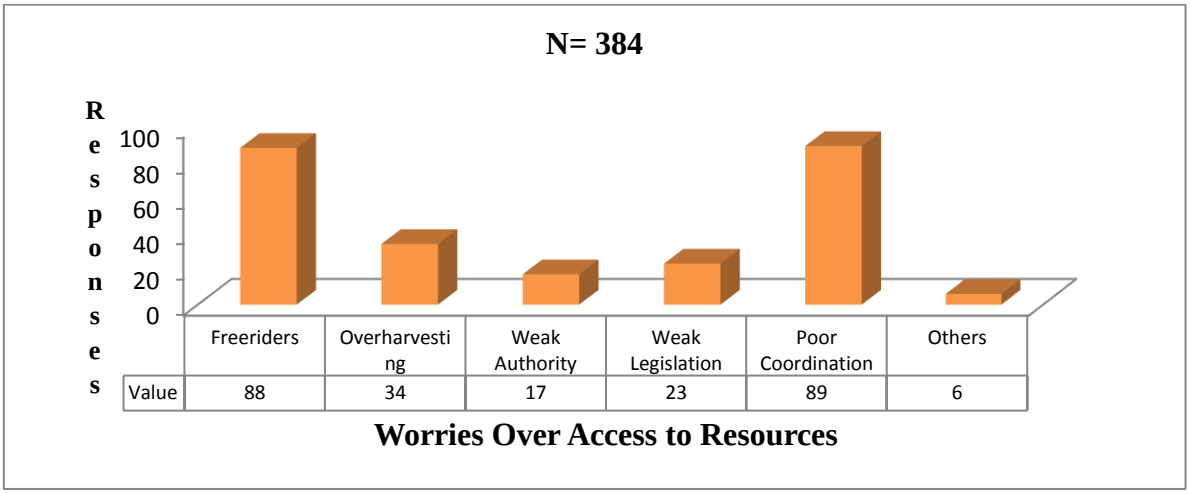

Figure 4.6: Worries over Access to Biotic Resources

Most respondents (23%) complained about poor coordination of control efforts between authorities and local residents and among authorities themselves. The prevalence of free riders who accessed and plundered resources also worried the villagers while overharvesting by users, weak laws and/or regulations and weak institutional authority, received notable concerns. The other reasons included the exclusion of traditional leaders from most conservation efforts, human-wildlife conflicts and too strict regulations by some authorities like Zimbabwe Parks and Wildlife Authority. The traditional leaders conceded that they had indeed lost considerable power during colonial rule and this has been sustained even by the post-colonial governments. The focus group discussants revealed the weakling positions of the local traditional leadership that had been reduced to mere endorsers of 'commands' coming from the national government structures.

4.1.7 Local Residents Participation in the Management of Proximate Biodiversity

The majority of questionnaire respondents (88.8%) confirmed taking an active role in the day-to-day management of biodiversity in their localities. Only 9.6% of the respondents did not participate and 1.6% were not confident on whether their efforts amounted to biodiversity management or not (Figure 4.7).

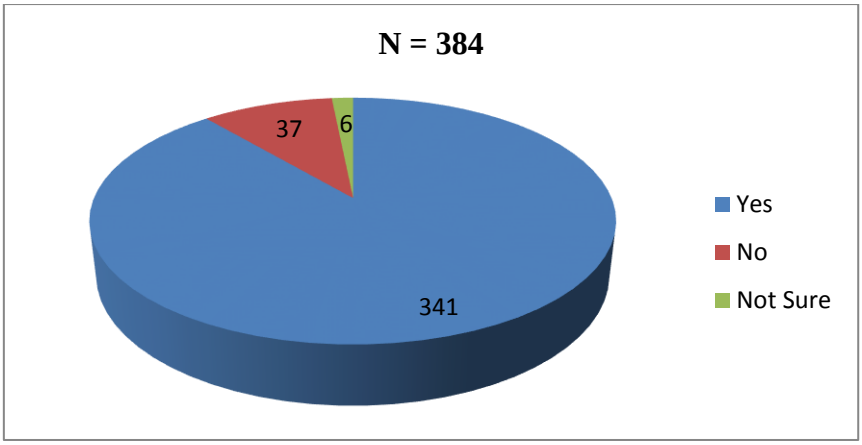

Figure 4.7: Levels of Participation by Residents

These observations by the survey respondents were endorsed by the interviewed state resource managers who reiterated their quest for community engagements through meetings, workshops, conferences, trainings and formation of natural resource subcommittees.

4.1.8 Roles Played by Residents in Managing Proximate Biodiversity

There were several roles that villagers played towards the sustainable management of biotic resources in their localities. The major roles were identified as reporting offenders to authorities, teaming up with others to monitor the local environment and practicing safe harvesting. The minor roles included keeping free riders abay, apprehend offenders, partner authorities and facitiltate replenishment (Figure 4.8). Interviews with traditional leaders and state natural resource managers overwhelmingly acceded to what the villagers had raised. Largely through natural resource subcommittees run by EMA, Agritex, RDCs, FC and NGOs, local people were catapulted to centre positions where they played exceedingly active roles in the management of proximate biotic resources.

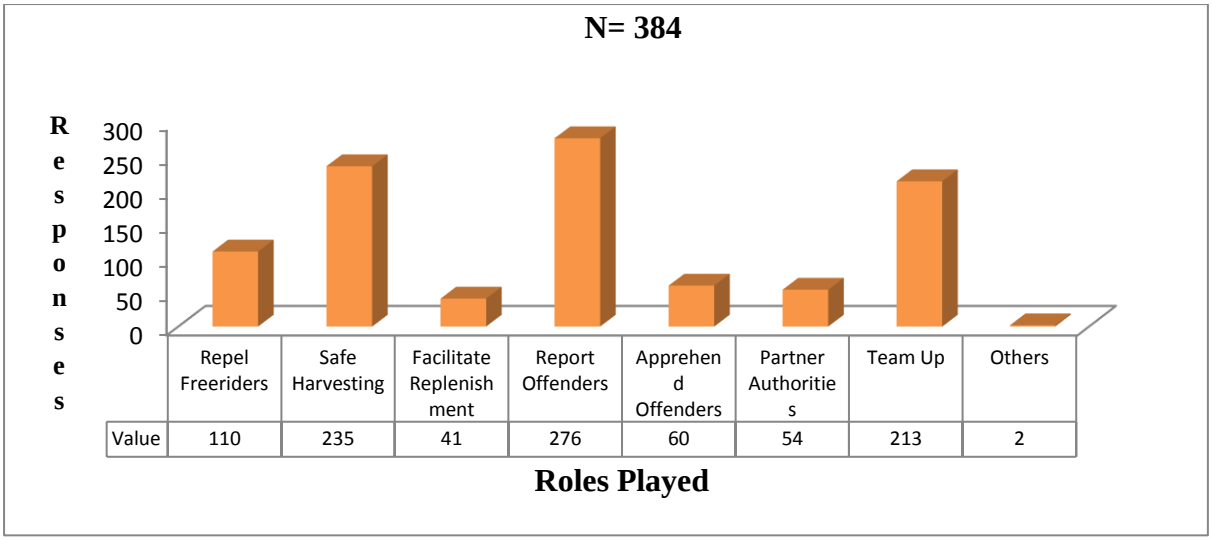

Figure 4.8: Roles Played by Residents in Managing Proximate Biodiversity

4.1.9 Barriers to Active Participation

Very few respondents (12.2%) indicated that they were not actively involved in biotic resource management. Table 4.1 summarises the barriers that stopped some villagers from active participation.

Table 4.1: Barriers to Active Participation

Barrier	Responses	Explanation
Lack of expertise	17 (4.4%)	Villagers conceded that they lacked basic skills and knowledge on biodiversity management.
Exclusion	15 (3.9%)	These villagers were left out of committees or arrangements for biodiversity management.
Not interested	7 (1.8%)	Naturally, some villagers lack interest in participation.
Ignorance	6 (1.6%)	They were ignorant about methods of involvement.
Others	2 (0.5%)	These believed participation was a preserve for the elderly people and influential societal members.

(Source: Survey Results)

The officials from EMA, Agritex and FC who were interviewed pointed out that some residents were taking a backstage in the management of biodiversity. Those who were inactive usually lacked knowledge, experience and resources. The interviewed officials also noted that women, youths, elderly people and extremely poor villagers missed out of most conservation initiatives in communal areas. The women were reported to be mostly marginalised because of the patriarchal nature of rural societies, also the adults tended to crowd out the youths and elderly age cohorts and the poor generally lacked confidence.

4.1.10 Institutions for the Management of Biotic Resources and Levels of Involvement

The study identified the institutions that were directly involved in the management of biotic resources in the communal areas. Table 4.2 summarises the active institutions, which were working closely with locals. The presentation also shows the villagers' preferences of the institution that should take some leading role. The institutions are arranged in descending order, in accordance to the significance attributed to each institution by the local people (the most important is at the top, and the least important, is at the bottom in each of the three columns).

Table 4.2: Institutional Involvement in Biodiversity Management

Active institutions	**Responses**	**Institutions close to locals**	**Responses**	**Locals' Preference**	**Responses**
Traditional leaders	367 (95.6%)	Traditional leaders	288 (75%)	Traditional leaders	233 (60.7%)
EMA	356 (92.7%)	EMA	37 (9.6%)	State institutions	111 (28.9%)
AGRITEX	268 (69.8%)	National Parks	15 (3.9%)	Local residents	18 (4.7%)
Forestry Commission	229 (59.6%)	Environmental NGOs	11 (2.9%)	NGOs	9 (2.3%)
RDC	155 (40.4%)	DA	9 (2.3%)	RDC	5 (1.3%)
Environmental NGOs	134 (34.9%)	Agritex	5 (1.3%)	-	-
National Parks	127 (33.1%)	Forestry Commission	4 (1%)	-	-
VIDCO	114 (29.7%)	Vidco	2 (0.5%)	-	-
WARDCO	113 (29.4%)	Others	2 (0.5%)	-	-
ZINWA	73 (19%)	-	-	-	-
DA	91 (23.7%)	-	-	-	-
Others	21 (5.5%)	-	-	-	-

(Source: Survey Results)

The traditional leadership institution was highly regarded in all the three categories. It was the most active institution, the one with closest ties with the indigenous people and most popular to lead in natural biotic resource management. State natural resource institutions (EMA, AGRITEX, Forestry Commission, ZimParks and ZINWA) came second while local people initiatives (VIDCO and WARDCO), local authorities (RDC and DA) and environmental NGOs, in that descending order, were lowly rated (Table 4.2). The respondents forwarded some reasons for their ranking of institutions involved in biodiversity management. Amongst the reasons given were the following: first, the institution should have some proven track record (experience) coupled with undoubted knowledge about the local environment and management of biodiversity. Secondly, the institution should work more closely with local people; thirdly it should have strict control mechanisms. The other considerations were that it should derive its authority naturally and also command the respect and trust of the indigenes.

4.2 Comparison of Management Principles (Approaches, Concepts and Methods) for Sustainable Biodiversity Conservation and Utilisation

The traditional ecological knowledge systems can be contrasted with modern scientific knowledge systems (Nwokoma 2012). It is critical to begin by clearly considering the nature, authority and effectiveness of each of these management principles.

4.2.1 The Traditional Principles used to Manage Biotic Resources in Pre-colonial Zimbabwe

There were some traditional ecological concepts, technologies, beliefs and practices that indigenes in Zimbabwe nurtured from generation to generation (Chigwenya and Manatsa 2007; Mawere 2012). It is significant that we break the Zimbabwean communal communities into three namely; the pre-colonial, colonial and post-independence eras. Figure 4.9 summaries the observed management practices used in pre-colonial Zimbabwe to manage the biophysical environment. The commonly adopted practices were firstly sacredness. Once labelled sacred; faunal, floral as well as their habitats were considered to be spiritually valuable, pure and inviolable. No resident would be allowed to touch or access, harvest and utilise such a resource or habitat resulting in the environment remaining in its pristine state. Secondly, taboos which are social customs in which sacred phenomena are not touched, used or even talked about unless one wishes some bad omen on themselves. Taboos helped in preserving the environment in its pristine state. Thirdly, totems in which the indigenes assumed certain floral, faunal and habitats as emblems of their families and tribes; a totemic symbol would never be tempered with thereby ensuring the conservation of specific natural biotic resources and habitats. Fourthly, customary laws, that is, any regulations pronounced by a traditional leader, especially the chief, would be regarded as inviolable law. The customary laws regulated ownership, access and usage of proximate biotic resources and this ensured controlled utilisation of environmental resources. Fifthly, rituals which are the repeatedly performed rites to appease ancestral spirits before or after harvesting a natural resource served to inculcate a deep sense of appreciation towards the supply, access and utility of specific biotic resources. Once the value of a biotic resource is celebrated, the resource would then be conserved. Lastly, selective harvesting in which elders and specialists helped societal members on the selection of biotic resources ripe for harvesting. The practice ensured safe harvesting and no wastage of resources. There were also other methods that include folklore stories whereby elderly people narrated stories in which legends and nonhuman biota were exalted into super creations always to be respected. Out of respect of biotic resources there would be conservation of the biophysical

environment. Again, folklore songs, a practice in which indigenes composed songs that exalted certain creatures or indicated what should and should not be done to biotic and abiotic resources led to wise utilisation of the environmental resources. Also some harvesting quotas were stipulated by traditional leaders. These were some physical-quantity limit placed on the amount of resources to be harvested from a certain species, habitat or in a season. It was a significant practice as it restricted the amounts of biotic resources harvested or used, always ensuring the reproductive potential of these resources was maintained.

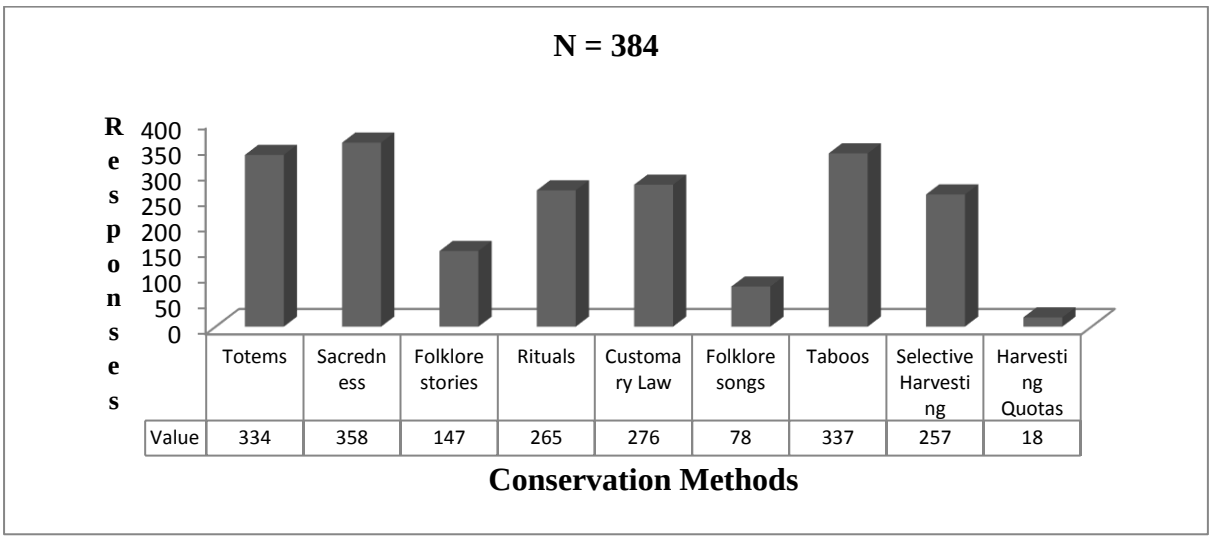

Figure 4.9: Methods used to Manage Biotic Resources in Pre-colonial Zimbabwe

The traditional methods have endured and the local people continue to apply them to conserve proximate biotic resources to date. Though the significance of these methods has remarkably plummeted, they are still in practice. This was discerned from the subdued number of respondents who still recognise the applications of TEK in biodiversity management in south eastern Zimbabwe. The state natural resource managers interviewed had knowledge and some respect to these methods though they remarked that in their programmes, they do not consciously get informed by these nor do they impart them to villagers. However, the traditional leaders largely proclaimed that the traditional methods have remained intact and were the drivers of sound environmental stewardship being exhibited in the areas under their jurisdictions. An elderly chief from Zaka district was even boastful when he remarked that as African indigenes, they could not afford discarding any of their customary methods of natural resource management as they risked evoking anger in the ancestors and spirits.

4.2.2 Factors Influencing the Continued Use of TEK in the Study Area

The study noted that despite the limited use of TEK in the study area, there are some factors that influence the continued use of traditional ecological knowledge. These factors include respect for traditional leadership, strong beliefs in ancestral spirits, long duration of residing in the same traditional territories and strong social cohesion. The other factors are government support, strong influences from civic elders, well documentation and popularising of TEK and NGOs support (Figure 4.10).

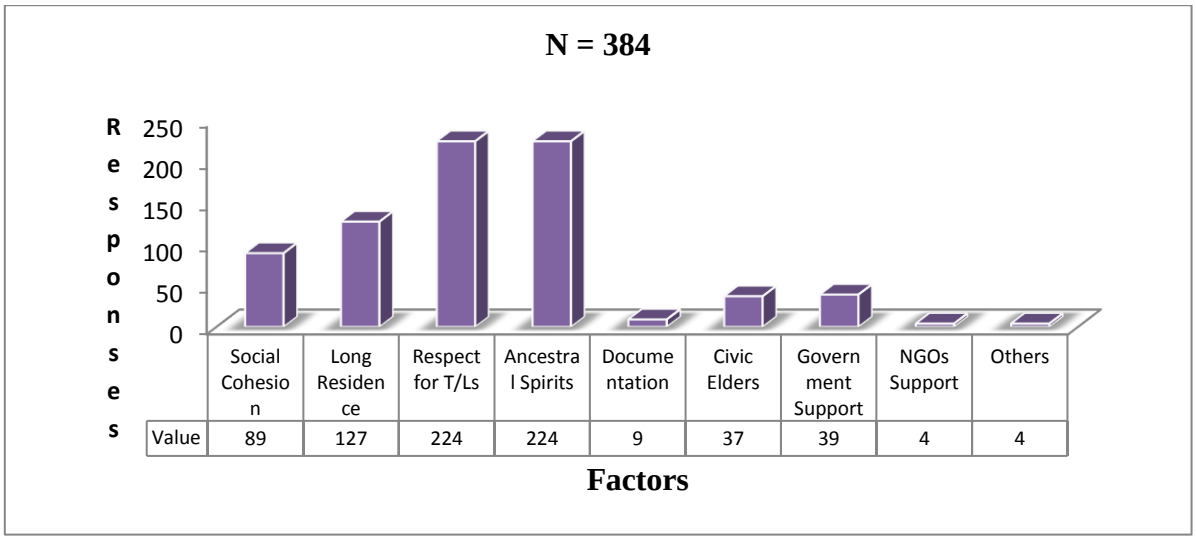

Figure 4.10: Factors Promoting Continued Use of TEK

4.2.3 Factors Limiting Continued Use of TEK in the Study Area

Some questionnaire respondents had some reservations and feared that TEK was no longer widely in use. The factors limiting continued use were firstly modernisation, meaning that societies today utilise modern or western knowledge systems and despise TEK as primitive. Secondly there is demystification of beliefs held by members of a society. Once someone losses their belief system; the values, morals and respect are also lost along the way. Thirdly, Christianity has replaced the African Traditional Religion (ATR) and traditional practices are derogatorily labelled pagan, despised and should be stopped. Fourthly, weak traditional authority as a result of erosion by the state of traditional authority or lack of authenticity of traditional leaders. Weakening societal cohesion due to urbanisation, resettlements and globalisation has resulted in divisions and loss of shared values, aspirations and vision among rural communities. Again, TEK has suffered denigration from western science and is slowly being lost. The other factors were death of knowledgeable elders who used to be the foundation of TEK and the educators. Resettlement has resulted in dispersal of residents from their

traditional territories and once TEK is dislocated, it loses its usefulness. Lastly, climate change has meant that age-old TEK loses its relevance in helping local communities coping up with dramatic changes being introduced or in coming up with smart climate change mitigation strategies (Figure 4.11).

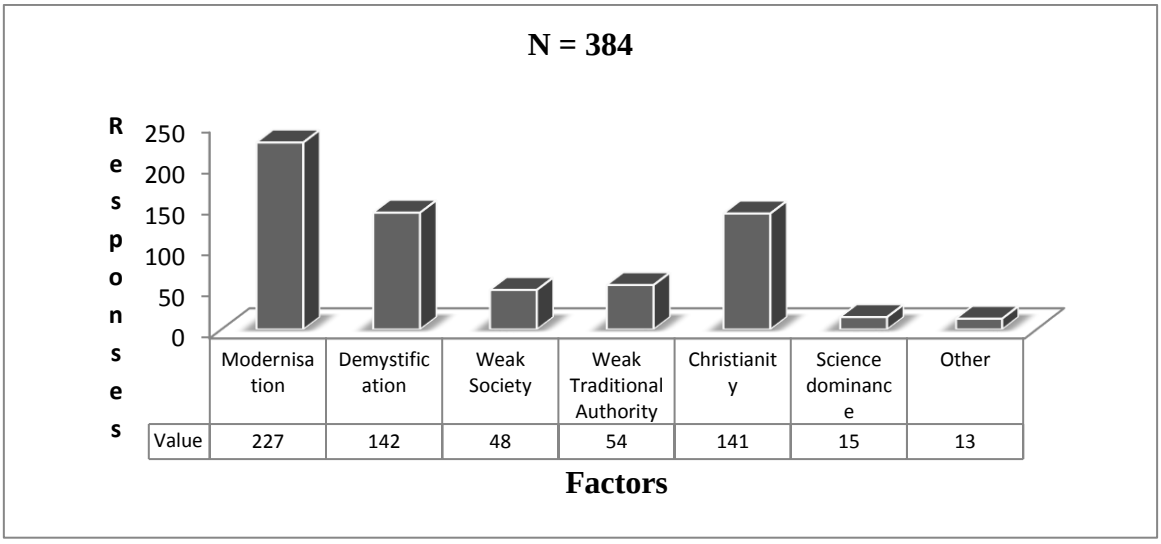

Figure 4.11: Factors Limiting Continued Use of TEK

It was interesting to note that both the traditional leaders and state resource managers ascribed the limited practice of TEK to the same factors raised in the surveys and focus group discussions.

4.2.4 Effectiveness of Traditional Methods used in the Management of biodiversity

The effectiveness of TEK in the management of proximate biodiversity was rated variedly by the ordinary villagers who participated in the study as questionnaire respondents. It is important to note that 78.1% of the respondents rated TEK as effective while 21.9% were sceptical (Figure 4.12). The questionnaire respondents who rated TEK as effective were supported by focus group discussants who also abhorred that with some authentic traditional leaders in positions of authority (those who are from the correct lineage of the ruling families), villagers respected and religiously believed in TEK as ancestral knowledge and wisdom guiding them to sustainability.

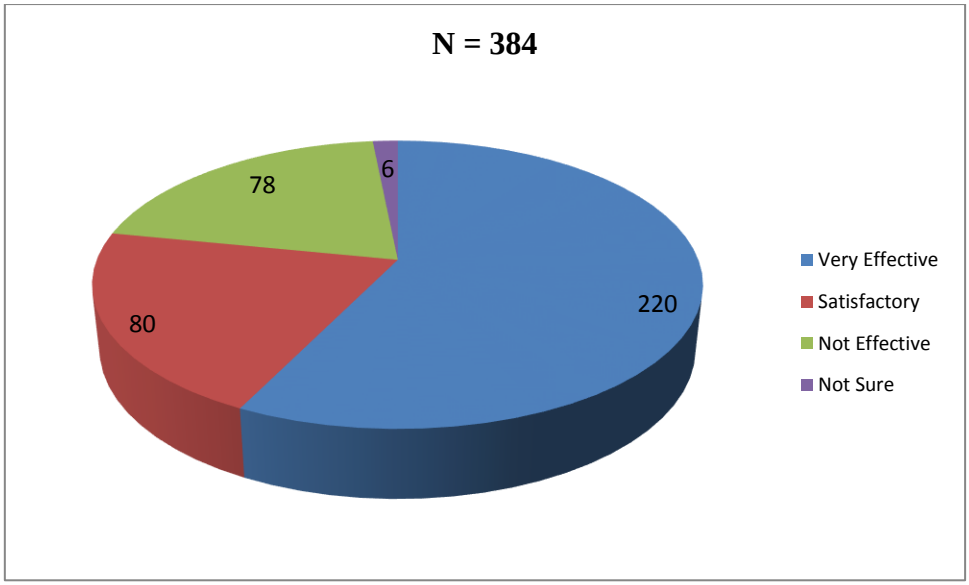

Figure 4.12: Effectiveness of TEK in Biodiversity Management

The respondents who ascribed the effectiveness of TEK to biodiversity management vehemently believed in the authority of traditional leaders and civic society. The state institutions were poorly rated in their contributions to the continued practice of TEK in south eastern communal lands of Zimbabwe. The traditional leaders noted that TEK was responsible for controlled harvesting of biotic resources, stopping extinctions and generally regulated local people's behaviour towards the environment. However, some respondents thought that TEK was no longer effective in biodiversity management because the traditional leaders were no longer commanding as much respect from their subjects as they used to do in the precolonial era. During focus group discussions, one elderly man sarcastically scorned today's traditional leaders were political appointees who do not have any royal blood in their veins hence are so detached from ancestral spirits. The ancestral spirits are believed to reside in the sacred parts of the environment (forests, perennial pools along rivers, mountains), they control and guide local residents to live harmoniously in their traditional territories.

4.2.5 Modern Management Strategies for Enforcing Good Environmental Stewardship

There are some scientific management principles in use globally and locally that contribute towards responsible environmental stewardship (Folke, Hahn, Olsson and Norberge 2005, Mawere 2012). The questionnaire respondents identified fines, environmental awareness campaigns, the jailing of offenders, participation and environmental education, among others, as key management strategies commonly applied by the modern management system (Figure 4.13).

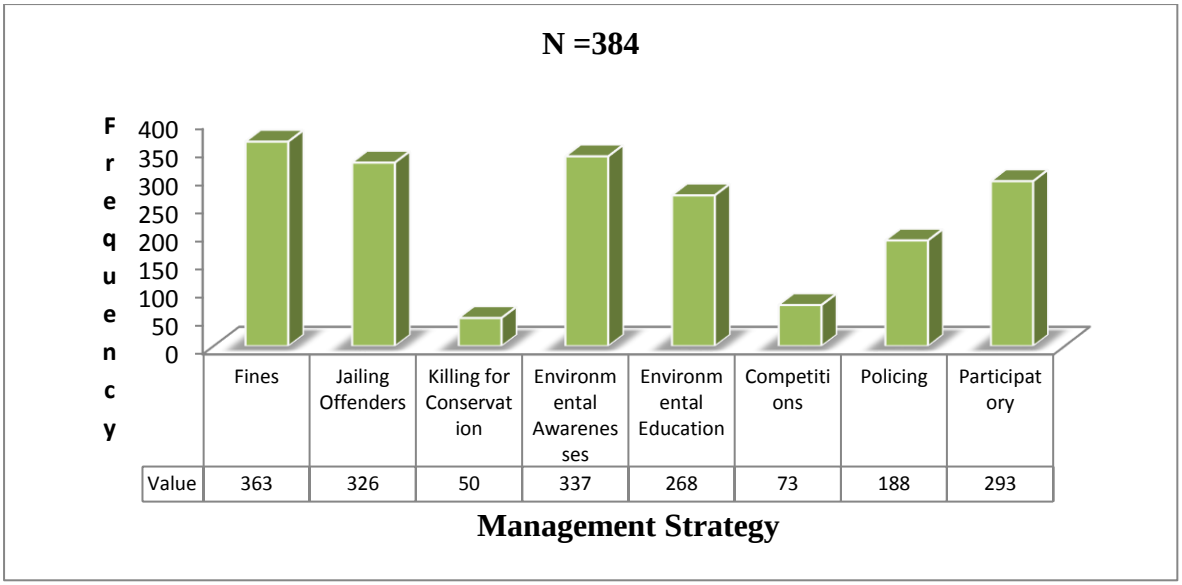

Figure 4.13: Modern Management Strategies implemented in South Eastern Zimbabwe

The state resource managers were identified by 92.2% of the respondents as the dominant authority in crafting and implementing the modern management strategies. The traditional leaders and environmental committees (comprising members from state natural resource managers and local people) were also rated important players, among others.

4.2.6 Effectiveness of Modern Strategies in Managing Biodiversity on Communal Lands

About 90.4% of the respondents rated the scientific approaches towards the management of biodiversity as quite effective while a few (9.6%) either dismissed or doubted the efforts (Figure 4.14). It was clarified during focus group discussions that the effectiveness of western science was due to the massive support by the government. At a focus group discussion in Bikita district, one lady aptly stated that state natural resource managers relied on strict, command and control strategies which however alienated local resource users from the environment. She feared that most conservation initiatives are bound to fail in the long term due to sabotage by local communities. This was vividly supported by another Chiredzi district male focus group discussant who complained that state resource managers descended on local communities with packaged management tools that are prescriptive. He went on to say, although that achieved compliance in the short to medium term, such an approach would eventually be resisted, fought and doomed.

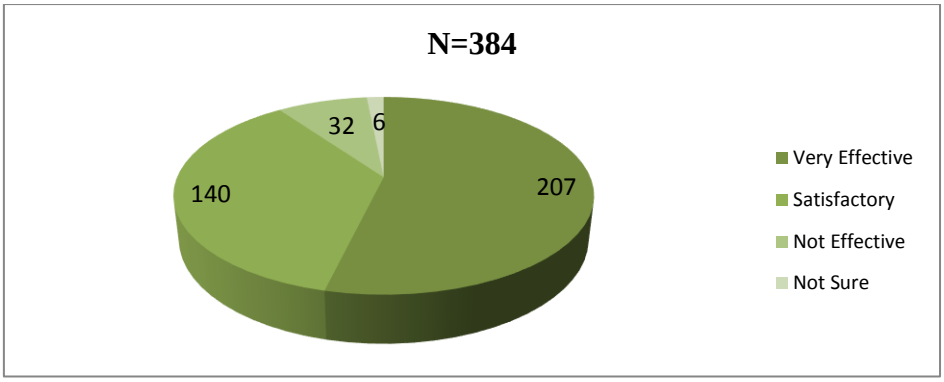

Figure 4.14: Effectiveness of the Management Strategies

4.2.7 Factors Influencing the Popularity of Modern Management Strategies on Communal Lands

There are several factors critical for the success of modern strategies in the management of biodiversity in communal lands. The respondents identified the following factors: first, cooperating local residents who would support the initiatives imposed by experts. Secondly, powerful state natural resource managers who actively implement government conservation programmes. Thirdly, well-meaning environmental policies and laws that ensure a balance between conservation and utilisation of biotic resources. Fourthly, strong and influential traditional authorities are critical for mobilising local support. These factors, among others, are key for the popularity of Western science in the study area (Figure 4.15).

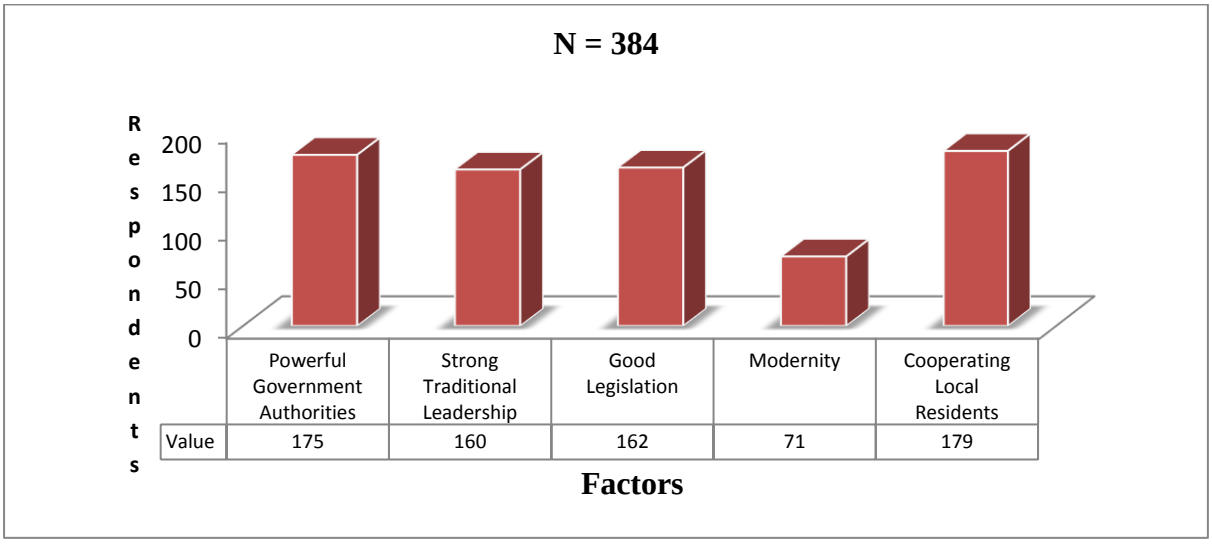

Figure 4.15: Factors Influencing the Wide Usage of Modern Management Strategies

However, the wide usage of the scientific knowledge systems was largely limited by rigid state natural resource managers, resistance of the top-down approach by the local people, the

exclusion of the local leadership in decision-making positions, sabotage of state initiatives by the local people, among other factors.

4.3 Opportunities and Constraints for Co-application of Traditional and Scientific Management Strategies

The study assessed the opportunities and challenges perceived by the local people (questionnaire respondents) for bridging the divide between the two knowledge systems to enhance the practical co-management of proximate biotic resources.

4.3.1 Co-application of Traditional and Scientific Management Strategies

Most of the respondents (71.4%) confirmed that there was co-application of traditional and scientific management strategies in the management of biotic resources in the study area. In Zaka district, during a focus group discussion, an elderly woman narrated a story in which she remembered officials from the ZimParks receiving useful ideas from the community members which they went on to effectively use to control problem-wild animals that terrorised villagers. However, a relatively large number (27.6%) of the respondents refuted the practice of co-management and only 1% were not sure of its practice (Figure 4.16).

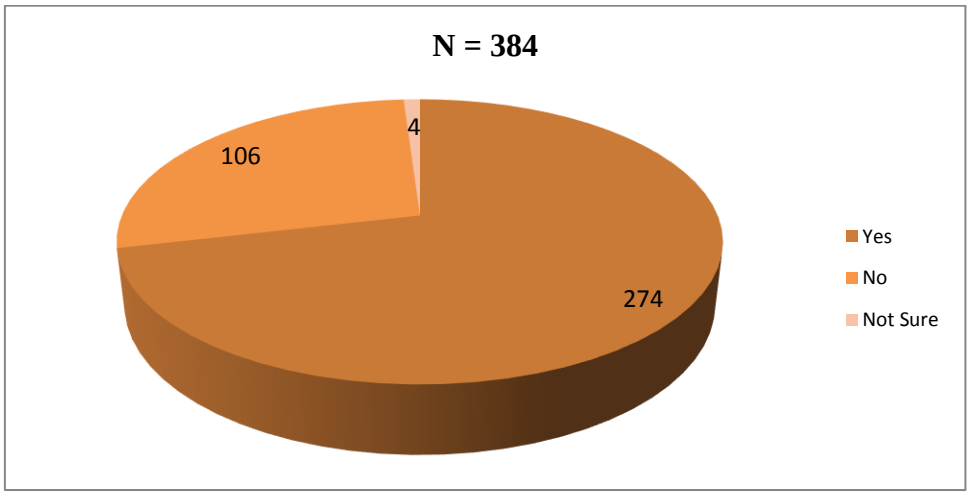

Figure 4.16: Co-application of Traditional and Scientific Management Strategies

4.3.2 Perceptions of Respondents on the Frequency of Co-management

The co-application of the two approaches was assessed differently by the indigenes. The respondents were asked to analyse the rate of collaborations between the local people and state natural resource managers in managing biotic resources in communal lands. The majority of the respondents (42.2%) viewed the co-application as being done at times. Only 22.4% of them observed co-management as done always while 5.2% of the respondents rated the frequency of

co-application as rarely and 30.2% did not know whether there was such an arrangement altogether (Figure 4.17). These submissions were echoed in the focus group discussions in which the participants unanimously said there were uncoordinated conservation efforts in their areas. Again, the EMA, FC and ZINWA officials conceded in interviews that because of the limited number of field staff and work pressure (set work plans with timelines), they usually impose their conservation programmes on the local communities and do not dialogue much. As a result, most programmes are not community owned but viewed as externally imposed.

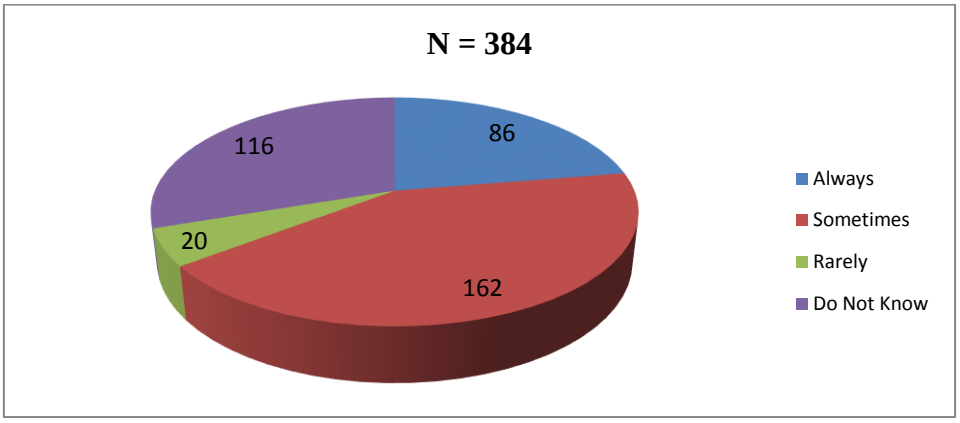

Figure 4.17: The Frequencies of Co-applications of the Two Approaches

4.3.3 Barriers to Co-application of the two Approaches

A number of constraints were put forward as militating against the co-application of the two approaches (Figure 4.18). Firstly, most of the respondents blamed the non-documentation of TEK as the main reason for its infrequent use. The fact that TEK is stored in the minds of elderly people, who are seldom actively involved contemporary natural resources management programmes, TEK is often neglected during decision making and formulation of courses of action. These were the remarks of an official of an environmental NGO operating in Mwenezi district. Secondly, 69% of the respondents averred that there was preference for science by implementing authorities over TEK. This was echoed by a ZINWA official based in Masvingo district who noted that during training at colleges, most natural resource managers are only taught scientific principles, concepts and case studies and little to nothing on TEK. Thirdly, the inferiority of TEK and superiority of science was attributed to the infrequent use of TEK in contemporary natural resource management. TEK is considered an informal knowledge system and its use plays second fiddle to western science, remarked one young adult man during a focus group discussion in Gutu district. Fourthly, science was regarded as prescribed by the government that champion formal education and heralded science in most of its national

programmes. Fifthly, the prevalence of many different cultures meant that TEK is varied as each cultural group has its own TEK. Such a scenario means that a different form of knowledge would need to be combined with western science and this may prove to be cumbersome for some state natural resource managers.

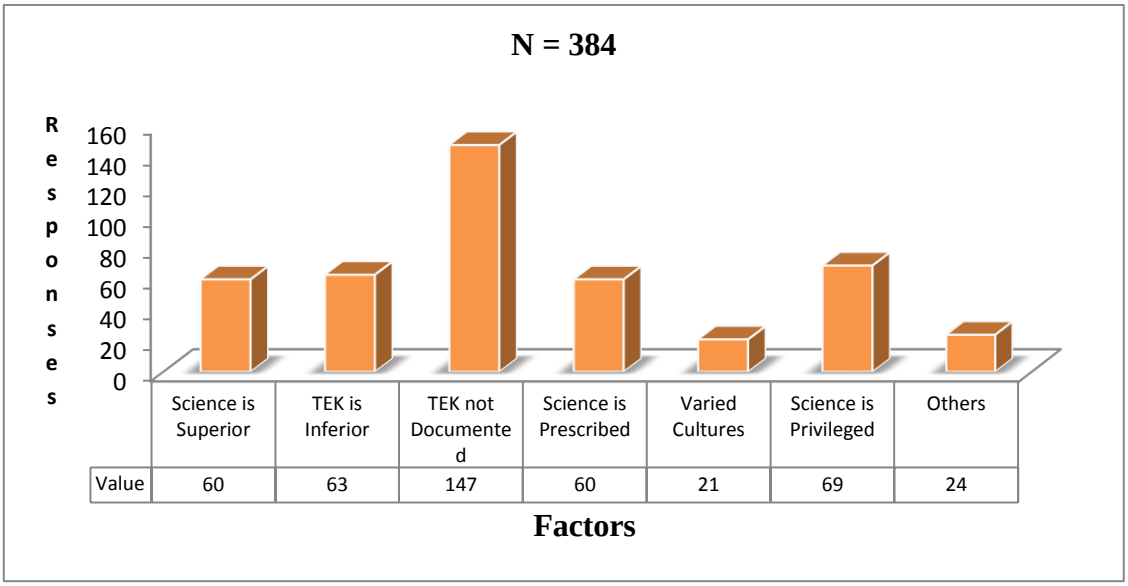

Figure 4.18: Barriers to Collaboration

Traditional leaders admitted that they were uncomfortable with an arrangement where they were always treated as junior partners. One chief was defiant, while bemoaning their powerlessness, he remarked that "as a chief, I cannot call state resource managers to a meeting as and when I want, rather it is myself (and other chiefs too) who is always asked to grace a meeting the state resource manager would have arranged for". Indeed, the state resource managers affirmed that position while referring to the terms and conditions of their formal appointments as dictating such an arrangement.

4.3.4 Collaboration between Local People and State Natural Resource Managers in Enforcing Environmental Conservation Programmes

The study inquired on the frequency of collaboration between local people and civil servants in managing biotic resources in communal lands. The majority of the respondents (82%) rated the frequency of collaboration as "frequently" while quite a few (18%) did not have confidence in the collaboration efforts (Figure 4.19). This was confirmed during a focus group discussion in Chivi district where the discussants unanimously agreed to the view that state natural resource managers only met and listened to local people when they seek support for implementing some conservation programmes. The state resource managers did not, however consult with local people to promote sharing of ideas during the decision-making stages. An official with EMA in Zaka district seemed to admit to the preceding view when she said they

have ‘key-result areas’ to content with, hence they sometimes, single-handedly, formulate conservation programmes for communities and hope to sell these to the concerned communities and win support for the successful implementation of the conservation programmes.

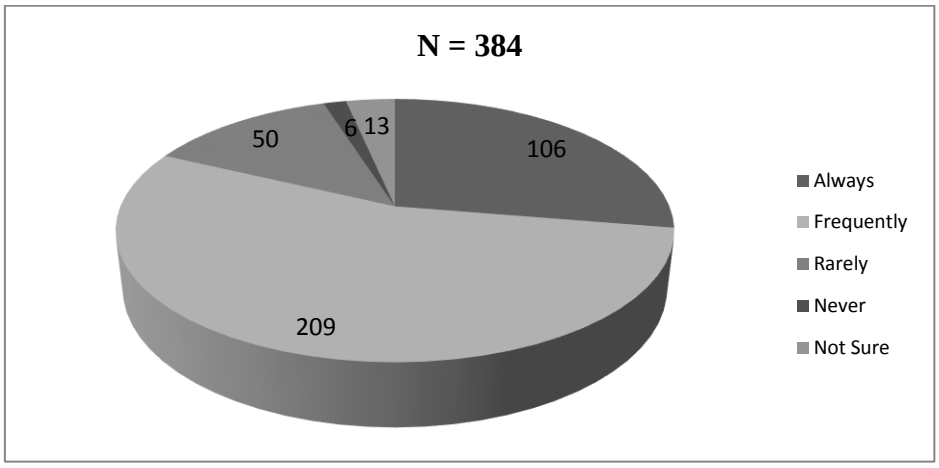

Figure 4.19: Frequency of Co-management

4.3.5 Factors Facilitating Co-management of Biotic Resources

The study came up with a number of factors that account for the co-management of biotic resources in the study area. These factors included, firstly the empowerment of traditional leaders which involves their correct appointment, restoring traditional authority (as outlined in the Traditional Leaders Act (CAP20:17 of 2001) and capacitating their institutions. Secondly, public participation in decision-making and benefits sharing should be facilitated at varied levels. Thirdly, better coordination of institutions should be promoted to ensure developmental ideas and information circulates to all and feedback reaches rightful offices. Fourthly, training of participants in environmental management disseminates vital knowledge, skills and experiences critical for the successful co-management of biotic resources and environmental sustainability. Fifthly, there should be capacity building among key stakeholder institutions to guarantee competence and fulfilment of institutional mandates. Lastly, a committed budget among others, should be set aside to financially support the programme of actions lined up by different development partners (Figure 4.20).

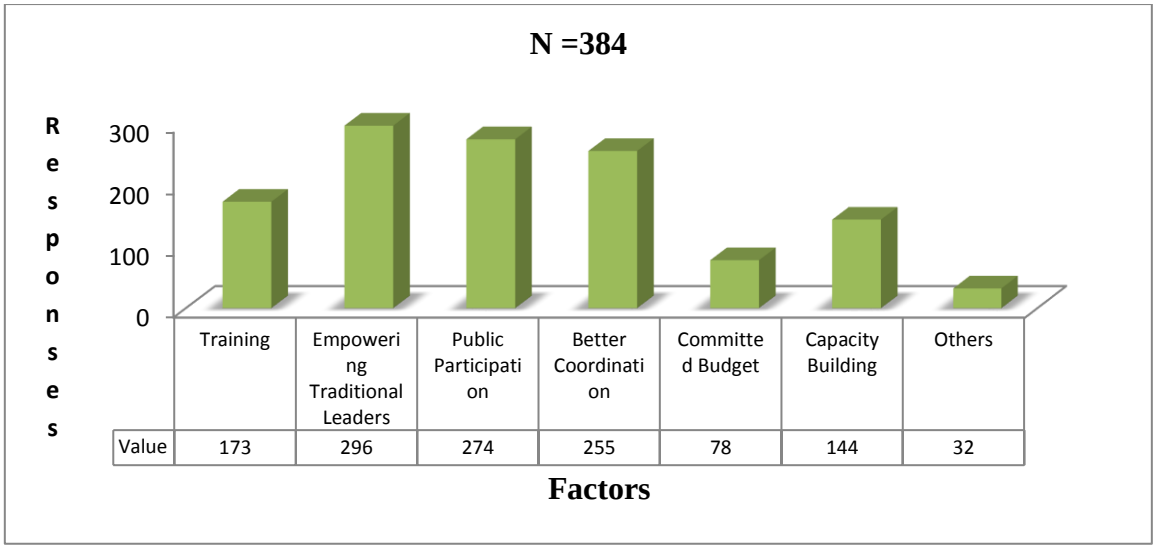

Figure 4.20: Factors Facilitating Co-management of Biotic Resources

The other factors alluded to are documentation of TEK, recruiting local natural resource monitors, and environmental education and awareness campaigns targeting specifically the local people. The traditional leaders disclosed that they were open to collaboration with state resource managers. They however insisted that they only require a fair, honest and win-win arrangement. The traditional leaders applauded the various village meetings, workshops, conferences, trainings and environmental awareness campaigns periodically arranged for by state resource managers within the communities. They reckoned that such efforts forge partnerships and shared vision between the outsiders and local people.

4.3.6 Resource Management Committees Operational in the Study Area

The study identified a number of environmental committees operational in the study area. Table 4.3 shows the nature of these committees. The other initiatives missing from the table include environmental management committees being spearheaded by the RDCs, ZRP, the DDF and the neighbourhood watch.

Table 4.3: Resource Management Committees

Name of committee	Respondents	Responsibilities
EMA initiated Environmental Management Committees	360 (93.8%)	Coordinate the management of all natural resources at different administrative units
WARDCO Environmental Management Committee	198 (51.6%)	Coordinate the management of environmental resources at ward level
VIDCO Environmental Management Committees	177 (46.1%)	Coordinate the management of environmental resources at village level
AGRITEX initiated Environmental Management Committees	155 (40.4%)	Coordinate the management of natural resources occurring on agricultural lands (both arable and pasture)
Parks initiated Environmental Management Committees	112 (29.2%)	Manage human-wildlife conflicts in communities neighbouring wildlife parks
ZINWA initiated Environmental Management Committees	58 (15.1%)	Manage natural resources occurring within catchments and water resources
NGO initiated Environmental Management Committees	52 (13.5%)	Manage natural resources at varied administrative scales
FC initiated Environmental Management Committees	50 (13%)	Manage floral resources both on state and communal lands.

(Source: Survey Results)

The civil servants from EMA, FC, RDCs, ZINWA, ZIMPARKS and AGRITEX intimated that their organisations-initiated natural resources or environmental subcommittees were making some differences within the communities. They hoped that the committee members, equipped with knowledge acquired during special trainings targeted at some specific components of the environment, furthered their cause. An EMA officer based in Gutu district was confident that the training and deployment of committee members back into the communities they reside, was a formidable move to ensure effective and continuous environmental monitoring.

4.3.7 Empowerment Programmes to Mainstream TEK in the Conservation of Biotic Resources

The study unveiled a number of initiatives that sought to mainstream TEK in the conventional management of biotic resources at the grassroots level. Different authorities and organisations committed to the sustainable management of biotic resources have partnered with local communities to equip them with vital scientific knowledge and skills to effectively participate in the management of proximate biodiversity (Figure 4.21). These programmes include but not limited to, firstly, participatory appraisals whereby stakeholders engage and share ideas, progressive reports and encourage collective action. Secondly, community based natural resource management (CBNRM) in which local resource users are organised to regulate the use and protection of natural resources occurring within communal areas. Thirdly, local

resource users are encouraged to partner state natural resource managers in decision-making, implementation of conservation programmes and sharing of benefits. Fourthly, the local people should attend well-structured natural resource management short courses for capacity building. Fifthly, participating stakeholders should guarantee equitable sharing of benefits from successful conservation initiatives. Such a gesture instils a sense of collective ownership and attracts local support. Sixthly, competitions in proximate natural resource management initiatives need to be organised, varied interest groups or individuals allowed to openly enrol and participate and winners of such competitions should clearly be recognised and rewarded. The other programmes include community based woodlots management, community gardens and rehabilitation of degraded land and water resources.

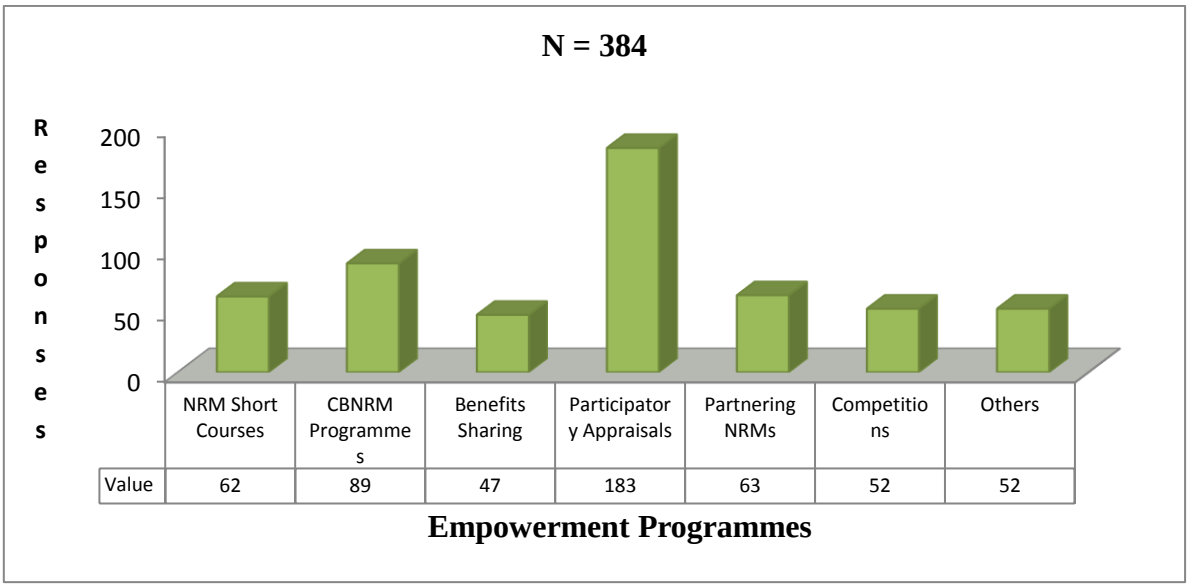

Figure 4.21: Empowerment Programmes

4.3.8 Convergence of the Two Management Approaches

The questionnaire respondents came up with at least four common ground areas which should be capitalised upon to achieve integration of the traditional and conventional management approaches. About 55% of the study participants noted that both approaches advocated for safe harvesting rates for biodiversity. Also 42% indicated that both had strict legislative frameworks for access and use of biodiversity. Again, 33% noted that both approaches have unique authorities that direct management activities at different geographic scales and about 18% indicated that both approaches deal with contemporary environmental issues (Figure 4.22).

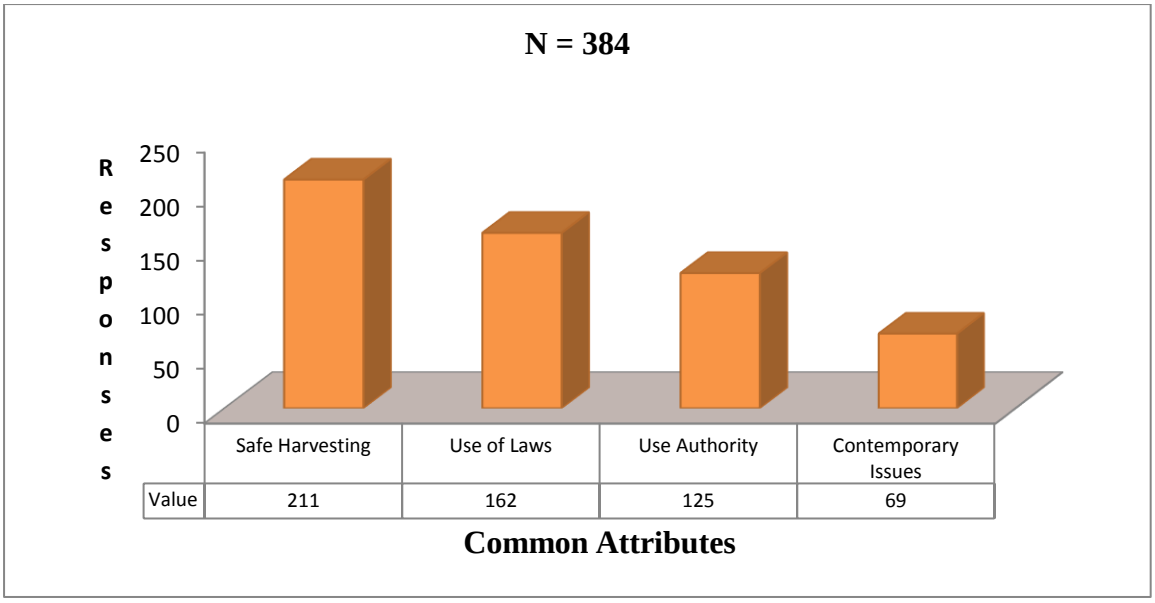

Figure 4.22: Convergence of the Two Management Approaches

4.3.9 Challenges of Integrating the Two Management Approaches.

The study noted that the process of integrating traditional and scientific management approaches to biodiversity management was riddled with a number of real challenges. These constraints ranged from differences on how the two approaches cope with environmental changes, weaknesses of each knowledge type and preferential differences for the two approaches by implementing authorities. Apart from the challenges, some threats as well tend to militate against contemporary efforts toward sustainable biodiversity management. The threats include, firstly, climate change which cripples TEK from equipping local communities with the mitigation measures and coming up with smart climate change solutions. Secondly, free riders who are community members not in any way incurring conservation costs but are drawing benefits from conservation efforts by others. Such elements resist to participate in consultative decision making and prefer reaping where they never sowed. Thirdly, resource poaching, a practice whereby outsiders, without harvesting permits, illegally access and use local resources. Such a practice introduces confusion in approaches to enforcing formidable solutions. Fourthly, corruption is a vice that paves way to environmental perpetrators to go unpunished and its existence brings division among participants. Fifthly, population growth results in increased demand for natural resources and growing tendencies of individualism. Sixthly, commercialisation of biotic resources has forced local communities to lose collectivism, an ingredient critical in passing on TEK to next generations. Also, uncoordinated management approaches and sabotaging impose real threat to integrating the two knowledge

systems. The other threats identified are poverty, ignorance, urban sprawl, and environmental pollution and veld fires.

4.3.10 Strategies to Mitigate the Challenges against Biotic Resource Management

The authorities to biodiversity in the country have adopted some pragmatic strategies to ameliorate the challenges to sustainable biodiversity management (Figure 4.23).

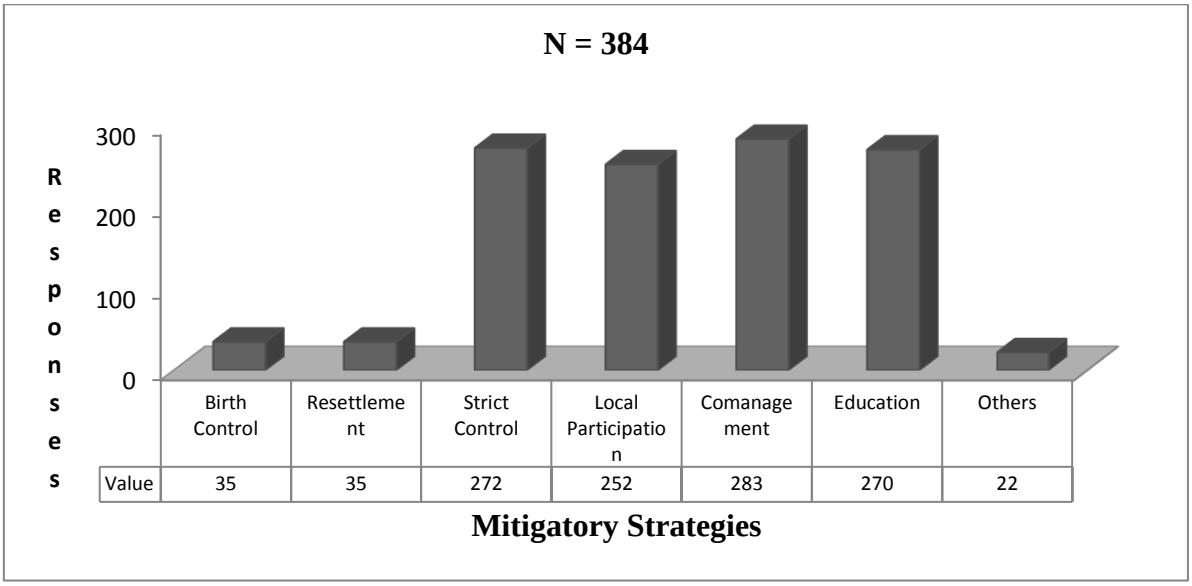

Figure 4.23: Strategies to Mitigate the Challenges against Biotic Resource Management

The questionnaire respondents identified the strategies put forward as including: firstly, collaborative management involving bringing together different stakeholders, and allocating responsibilities and roles to ensure concerted effort towards sustainable management of biotic resources. Secondly, strict control by the authorities by way of enforcing laws and regulations would ensure regulated use and conservation of natural resources. Thirdly, environmental education imparts valuable knowledge to stakeholders to guarantee informed and rational decision making in natural resource management. Fourthly, local participation involving consultative decision making with local resource users ensures everyone is taken on board and no one is left behind. Fifthly, birth control would slow down population growth and reduce pressure on available resources. Lastly, resettlement relieves overcrowded communal lands and allows effective applications of TEK since it thrives where populations are low and mobility is low again. The other strategies are a committed financial budget, establishing fireguards, climate change mitigation, CBNRM initiatives, employment creation and the jailing of environmental offenders.

4.3.11 Weaknesses of the Traditional Governance System

The questionnaire survey revealed that the traditional governance system had some weaknesses that limited its effectiveness in sustainable biodiversity management (Figure 4.24).

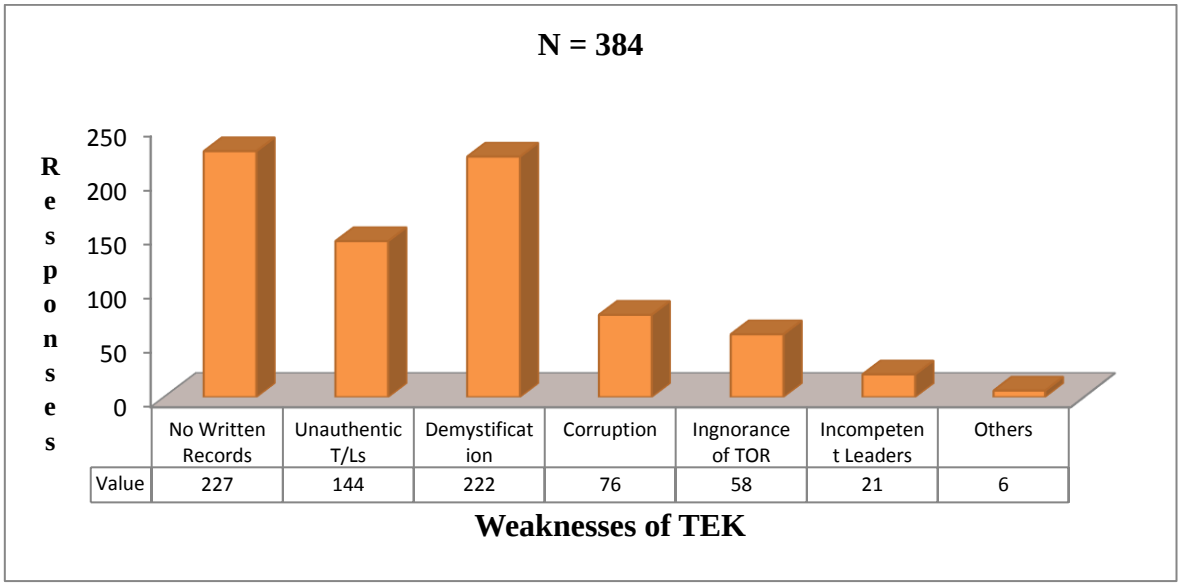

Figure 4.24: Weaknesses of Traditional Ecological Knowledge

The questionnaire respondents pointed out that, firstly, TEK had no written records and this made it difficult for it to be introduced in the formal curriculum of training institutions. Secondly, it had been demystified mainly by modernity and Christianity hence had lost its roles. Thirdly, its custodians (traditional leaders) were unauthentic because most of them were now political appointees and not hereditary descendants of the royal families. Such traditional leadership is despised and does not command respect and authority. Fourthly, there was corruption in the management system which allowed environmental perpetrators to go scot free without the necessary corrective measures exercised on them, simply because they have paid some bribery price to the arresting authorities or their agents. Fifthly, the participants were ignorant of the terms of reference hence could not exercise appropriate actions nor could they question certain processes and procedures. Sixthly, the traditional leaders were grossly incompetent in biodiversity management as they felt their powers were usurped by the government and their towering social stature among their subjects was no more imposing. The other weaknesses included TEK's inferiority complex, traditional leaders fearing alienation from their subjects, dominance of the young generation and traditional leaders who were ignorant of TEK. These weaknesses were echoed by the state resource managers and civil servants who work closely with local communities. Be that as it may, traditional leaders

remained strong believers in the customary governance of biodiversity as they mildly conceded to these weaknesses.

4.3.12 Factors Adversely Influencing the Utility of TEK

The study subjects came up with some factors that adversely influenced the contemporary use of TEK in proximate biotic resource management. These factors included wide adoption of Christian values and beliefs, dying local cultural practices, urbanisation, globalisation, and absence of TEK records, weak traditional institutions and TEK's limited spatial and temporal scales. The other factor is lack of empowerment of traditional institutions (Figure 4.25).

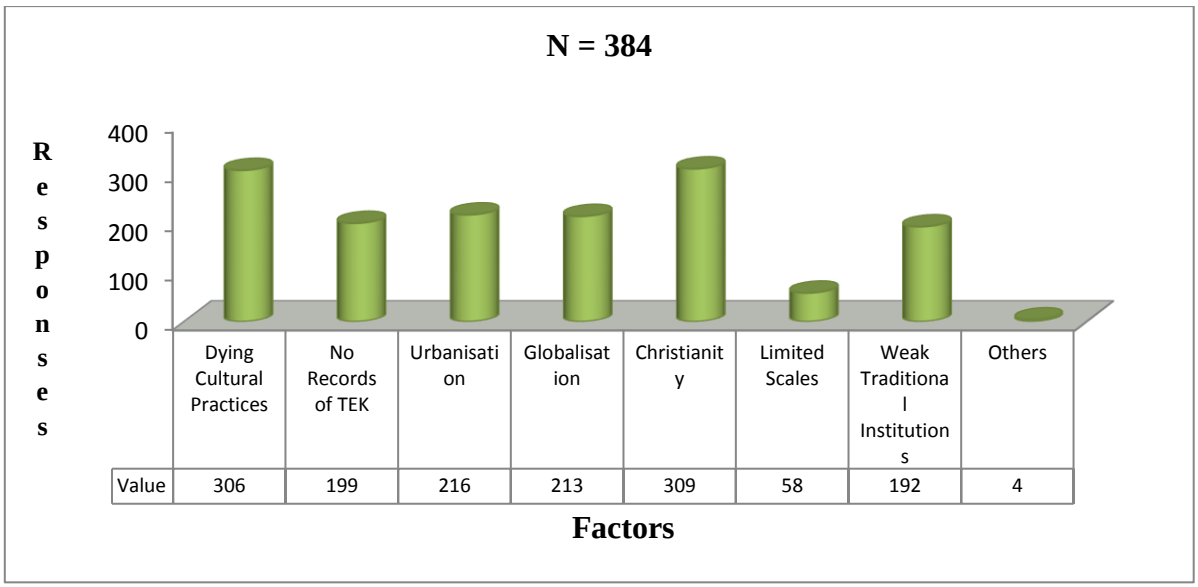

Figure 4.25: Factors Influencing the Utility of TEK

4.3.13 Weaknesses of the Modern Governance System

While reflecting on the contemporary biotic resource governance system, that is, the existing conventional natural resource management system, the respondents noted some glaring weaknesses of the management system in practice with regards to sustainable management of biotic resources in communal lands. The following weaknesses were recorded: poorly equipped state natural resource managers and work stations, corruption, weak policies and laws, few government officials, exclusive use of Western science and multiple government agencies. Also, there were some minor weaknesses noted that included: lack of capacity building among traditional leaders and local people, mismatch between system in place and local cultures, poor coordination of institutions and exclusion of some traditional players (Figure 4.26).

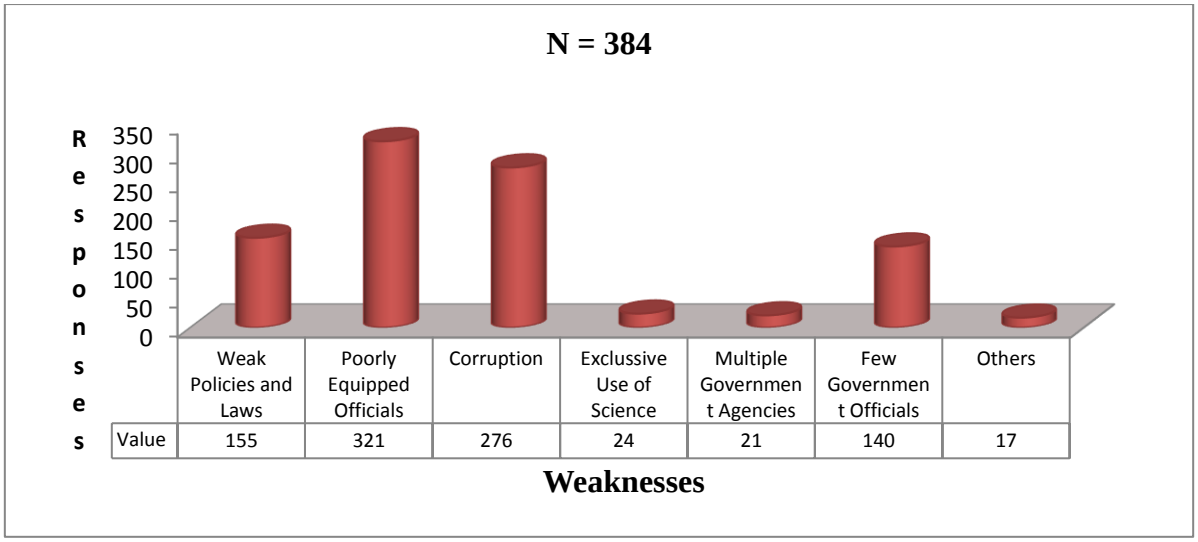

Figure 4.26: Weaknesses of the Modern Governance System

4.3.14 Factors Determining Choice of Conservation Strategies Adopted by State Natural Resource Managers

The state natural resource managers had a wide array of management strategies to choose from. Figure 4.27 shows the factors that were identified by the questionnaire respondents as influencing the choices. These factors included the curriculum given to state resource managers during their training, the availability of policy and legislation, sources of knowledge, local culture and institutional arrangement.

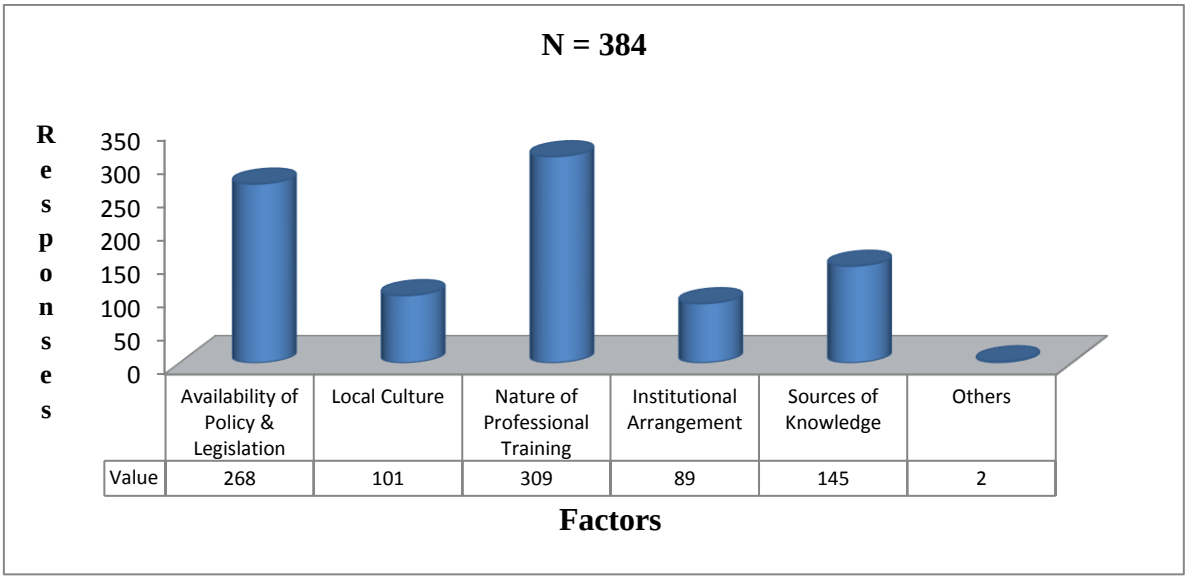

Figure 4.27: Factors Determining Choice of Governance System

4.4 Evaluation of the Contemporary Natural Resource Management Framework

The questionnaire respondents were tasked to make an evaluation of the natural resource management framework currently in place. Biotic resources in communal lands are collectively

managed by state agencies, traditional and political leadership and ordinary villagers. Some conflicting conclusions were recorded. The study noted that 41.1% of the respondents perceived that there was dominance of Western science while 32% of the respondents contented that the contemporary set up exhibited some perfect collaboration between the traditional and modern governance systems. The other sentiments from 15.1% of the respondents expressed worries that there was imperfect collaboration between the duos, whereas 3.9% criticised the system in place as being weak, with 3.4% concluding that the traditional system dominates and 1.6% were convinced that the two systems were far from collaboration, rather they conflicted (Figure 4.28). The traditional leaders sorrowfully conceded that they had lost the firm grip on their subjects and lands hence played second fiddle from state natural resource managers as well as senior civil servants responsible for development affairs in the communal areas. Submissions by focus group discussants largely colluded with those by questionnaire respondents and traditional leaders.

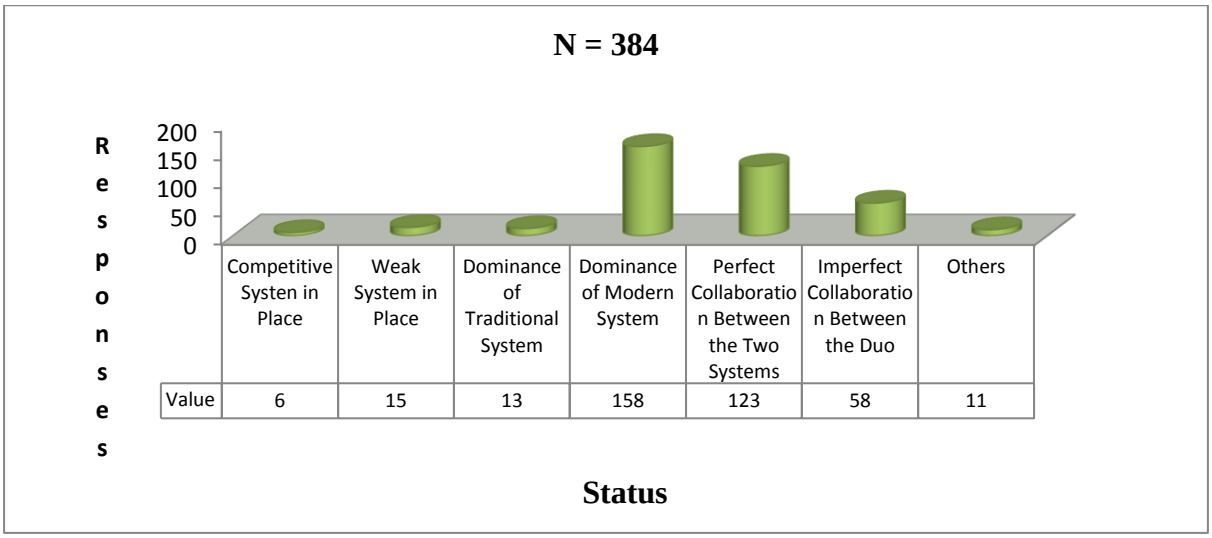

Figure 4.28: Status of the Contemporary Natural Resource Management Framework

4.4.1 Weaknesses of the Contemporary Natural Resource Management Framework

The respondents noted with concerns some weaknesses of the contemporary governance framework. The popular opinion from the respondents was that the institutions entrusted with the responsibilities of managing biotic resources were incapacitated. Also, they expressed that the work stations of state agencies were poorly manned. The other weaknesses cited were that the numerous institutions involved are uncoordinated, the legislation in place seem to contradict and the governance systems seem to be parallel (Figure 4.29).

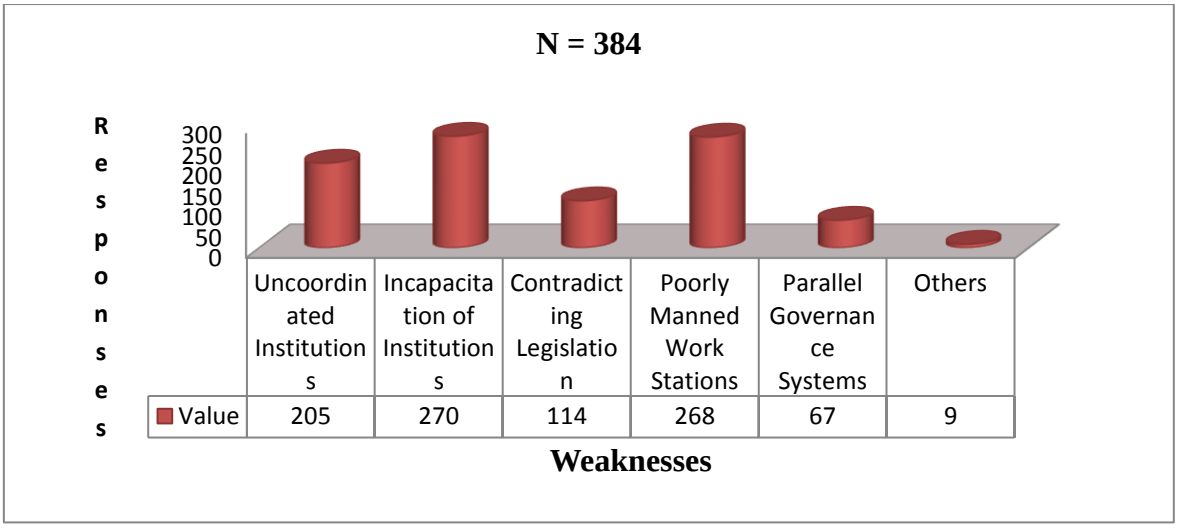

Figure 4.29: Weaknesses of the Contemporary Management Framework

4.4.2 Strategies for Ensuring Sustainable Management of Biotic Resources in Communal Lands of South Eastern Zimbabwe

The respondents suggested a number of useful strategies that would ensure effective management of proximate biotic resources. A large number of the respondents (85.9%) proposed for closer coordination of institutions involved in natural resources management. These institutions include the state, traditional leadership and non-governmental. Also, 55.7% of the respondents wanted some overarching environmental policies which are in place to be practically implemented, a move that would result in most stakeholders participate actively in natural resource management. An equally similar number proposed capacitating institutions, that is, natural resource management institutions should be adequately resourced, empowered and granted full mandates to legally exercise their responsibilities and roles. Other suggestions were that there should be allowance for community involvement in the management of proximate natural resources (CBNRM) and ensuring that there are adequately resourced work stations and staff (Figure 4.30).

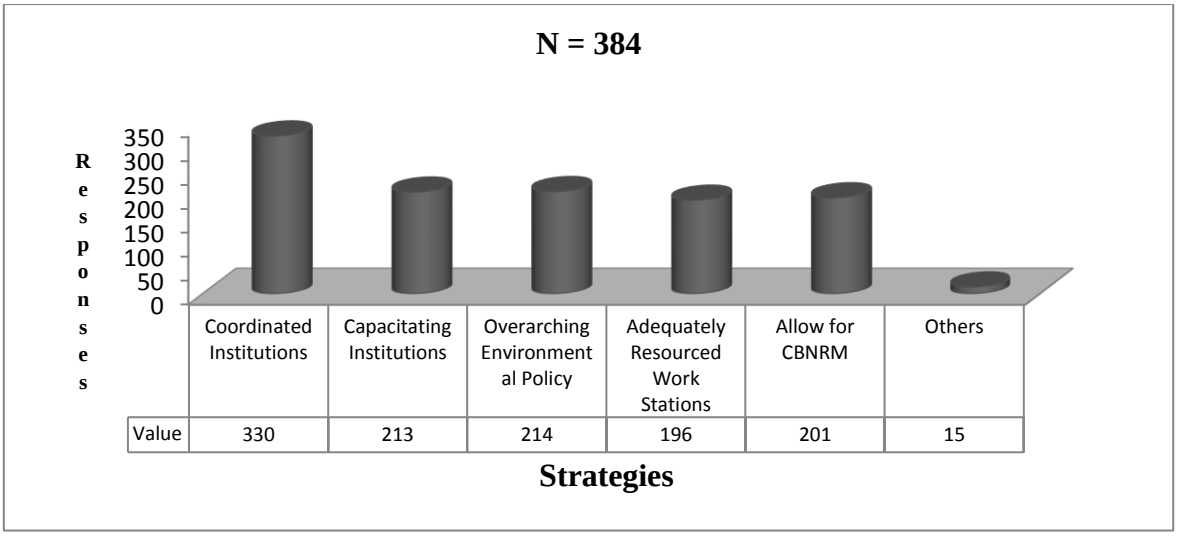

Figure 4.30: Strategies to Ensure Sustainable Management of Biotic Resources

4.4.3 Institutional and Policy Framework for Long Term Conservation and Environmental Sustainability

After noting that there were some challenges with the contemporary governance system, the respondents were challenged to draft the major components of the institutional and policy framework for ensuring long term conservation and environmental sustainability (Figure 4.31).

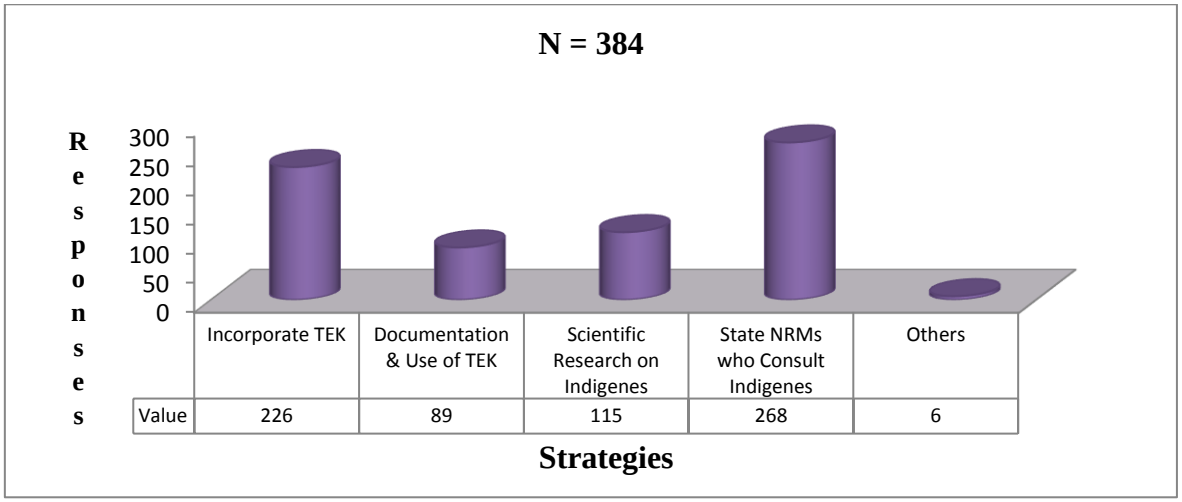

Figure 4.31: Institutional and Policy Initiatives for Long Term Conservation and Environmental Sustainability

In focus group discussions done in the seven districts of the study area, a common response that emerged was that the local people may not be formally educated to high levels, but they were nonetheless quite intelligent and intuitively aware of their immediate environments. What this clearly meant is that, the local people possess enough knowledge to make high sounding decisions regarding conservation of natural resources and attainment of environmental

sustainability. An elderly woman at a focus group discussion in Chiredzi district remarked that though she was not learned or did not receive sufficient formal education, she however had abundant common-sense and wisdom which she claimed operationally surpassed 'bookish knowledge'. To buttress these views, the questionnaire respondents suggested that state natural resources managers should respect and consult local resource users and custodians before crafting conservation programmes. They emphasised that, though they may not know the modern scientific concepts and theories, they had in-depth knowledge of the environment and socio-ecological interactions going on in the biophysical environment. Again, it was emphasised that the policies, though they have incorporated traditional knowledge, practices and technologies, they should have mechanisms for the practical involvement of local people in conservation programmes on communal lands. Also the government should encourage scientific research that reflects on attitudes and experiences of indigenous people. Such researches were encouraged as the local people thought the government had little details regarding the in-depth TEK possessed by local people. Lastly, the respondents encouraged documentation and use of traditional ecological methods. If recorded in literature, TEK stood a better chance to be learned by state natural resource managers during training at colleges and better still, even get to be learnt by primary, secondary and high school students as part of their formal curriculum.

4.5 Discussion

It has become imperative for researchers, environmental scientists, conservationists, policymakers, environmental practitioners and environmentally literate indigenous communities to establish an alternative to the contemporary, largely discredited 'top-down' natural resource management regimes. In order for such efforts to yield transformative results, it requires in-depth understanding of the two knowledge systems used in approaches for conservation and sustainable utilisation of renewable natural resources. The traditional and scientific ecological knowledge systems are the key approaches into contemporary frameworks for conservation efforts. The study therefore sought to comprehend and document the contributions of both these knowledge systems as a way of finding alternatives to overcome their combined weaknesses.

The similarities and differences of the management approaches and principles of traditional and modern natural resource governance systems may be categorised/viewed under authority,

knowledgebase, local participation and effectiveness in the conservation of natural biodiversity.

4.5.1 **Authority** – The present study revealed that the traditional leadership played a critical role in the management of biotic resources in communal lands. This observation colludes with Risiro et al (2013) who espoused that in customary resource management systems, the traditional leaders are the custodians of the local landscapes and the natural heritage endowed. Traditional leaders are the natural and authentic authority with the anointment of ancestral spirits. The traditional institutions comprise traditional leaders and their counsels (knowledgeable, experienced and elderly residents). The present study results have strongly confirmed that the traditional leaders wield natural authority and their pronouncements translate into regulatory rules that local people rigidly observe. This differs from the modern governance system in which the state natural resource managers, backed by statutory environmental legislation, have authority over *in situ* conservation of indigenous biotic resources. These civil servants derive their authority from some acts of parliament and statutory laws. Their 'command and control' approach, more often than not, face fierce resistance from local people who regard these government agencies unwelcome intruders whose missions should fail.

4.5.2 **Knowledgebase** – the findings of the present study are that the traditional leaders utilise traditional ecological knowledge, principles, practices and age-old laws and regulatory rules to control ownership, access and utilisation of natural biotic resources. The indigenous knowledge systems are generated over generations of continued practical interactions with the traditional tribes' lands hence have both empirical and practical components. This according to Robinson and Wallington (2013) and Risiro et al (2013) allows for scientific adaptive management of biodiversity on communal lands. It is stored in local old people's rich memories and transferred orally to the next generations through practice, the traditional belief systems and imbued in culture. It is collectively owned and there is general consensus in its utilisation among indigenous communities (Mawere 2012). On the contrary, the modern scientific approach is informed from scientific research, international agreements and local state gazetted legislation. The scientific knowledge is generated through research, testing of ideas and modelling of systems. The generated knowledge is carefully recorded in books, journals and scientific reports that are safely stored in library repositories of state and academic institutions. Only the educated and professionally trained scientific resource managers command undoubted scientific ecological knowledge.

4.5.3 **Local participation** – we have been informed from the present study findings that the traditional leaders and their counsels are the custodians of the local biodiversity while their people retain environmental stewardship. This is supported by Ramsay (2007) who noted that the traditional governance system is an inclusive approach towards sustainable biodiversity management. The indigenes have collective ownership, equal access and regulated utilisation of proximate biodiversity. The local people are aware of the available biotic resources, they are integrated in the daily management of these resources and are part of the governance system. This is supported by Rao and Ramana (2007) who note that the use of traditional knowledge is a valuable natural resource for development which is cost effective, participatory and sustainable. Traditional institutions offer flexible community-based systems of resource management. The system achieves public awareness, integration and coordination, sustainable resource use and balanced development (Ramsay 2007). This achieves ability to deliver rapid responses against new threats to sustainable biological diversity management. The traditional ecological knowledge is generally acceptable and utilised among local people because it is easily understood and applicable to their local situations (Gwenzi et al 2016).

The modern governance system has state resource managers who are outsiders and considered distant by local people. They however reach out to local communities through establishment of natural resources and environmental committees. They are guided by the Subsidiarity Principle that encourages the participation of locals in decision making and benefits sharing. However, there is a challenge of excluding some groups like women, youths and minority ethnic groups. The western scientific knowledge systems that inform state resource managers is associated with top-down natural resource management regimes.

4.5.4 **Effectiveness in conservation of natural biodiversity –** both the traditional and Scientific management approaches were considered relevant for the sustainable management of proximate biological resources on communal lands of south eastern Zimbabwe. This account for the continued use of both approaches albeit as distinct from each other. Despite the forces that degrade the use of traditional approach as inferior, inefficient and an obstacle to development, the decision to rely singly on the scientific approach has generally proven unsustainable. For example, a study carried out in Xishuangbanna, Southwest China from 1993 to 1999 revealed that reduction of taboos

practices resulted in decline in revered plant species, despite the legislations for their conservation (Hongmao et al; 2003 cited by Nganje, 2009).

The present study noted that there are both opportunities and challenges for the collaborative management of natural biodiversity. After some careful study of the present legal and institutional frameworks for sustainable biodiversity management, it was noted that development practitioners and conservationists adopted a segmented approach. This study however identified some realistic opportunities and challenges for co-management.

The opportunities for co-management are discussed first. The central goal of environmental management is to utilise natural resources without degrading the resource base. It is vital to note that both approaches strive for harmony between humans and their environment. The two approaches have clear authorities in place to implement the strategies and these conservation practitioners have policy and institutional frameworks to collaborate. Again, both use regulatory laws or rules. The duo knowledge systems are based on empirical evidence and on generalisations deriving from those observations. The study established that the local people, who live side by side with natural resources hence become key stakeholders in resource management, are convinced that either contemporary management framework is collaborative already or advocated for close coordination of institutions involved in biodiversity management. They noted that indigenous resource custodians and local resource users, on one end, and state resource managers and other key stakeholders in natural resource management and environmental protection, on the other end, could effectively combine efforts to attain environmental sustainability. The principles of TEK can be applied to modern production systems in a bid to utilise all available sources of information and knowledge. This is supported by Folke et al (2005) and Haverkost (2009) who attest that efforts are made to combine the best of both traditional and scientific ecological knowledge systems as riding on the strengths of the two would contribute towards sustainable biodiversity management.

The country has adopted most of the international environmental principles and conventions that seek to attain sustainable development like the 1992 Rio Declaration on Development and Environment, Agenda 21 and UN Charter on Universal Human Rights. The provisions of these fair environmental principles have informed the national environmental policy and most of the environmental laws. If these environmental laws are effectively implemented, they would benefit from co-application of the duo knowledge systems and secure environmental

sustainability. The policy and institutional framework is theoretically in place with practical execution the very next serious move awaiting.

Now turning to the challenges, the present study hastens to note that the two approaches are driven by systems that are currently incapacitated, uncoordinated, parallel and weak institutions. This removes confidence in either approach's capacity to deal with environmental changes. In the study area, it was learnt that the traditional and state institutions often collaborated in implementing conservation initiatives but unequal ownership and control of conservation programmes often generate resentment and negative feedback from indigenous communities and their leadership. Also, each of the governance systems has some inherent weaknesses. For example, TEK is weak because it over depends on demographic stability and morality. It is however distressing that population increase, modernisation, urbanisation, Christianity, globalisation and individualism, among others, combine to undermine the endurance of the customary management systems.

On the other hand, Western science used in conventional management systems is expert-driven, undemocratic and autocratic as it simply gets local people on board existing strategies. This constraint is expressed by Klooster (2002) who notes that conventional science lacks the institutional flexibility to ensure the just and effective implementation of restrictions and prescriptions. Western science is further criticised for claiming to provide a 'one-size-fits-all' solution to environmental problems occurring on diverse ecological landscapes whose attributes may vary considerably. Often, local resource users resist and sabotage conservation programmes initiated and implemented by scientific resource managers. They cite exclusion from participation in decision making, environmental monitoring and benefit sharing as factors barring the sense of ownership of conservation initiatives.

The authorities responsible for implementing the two approaches have preferential choices. Western science is preferred ahead of TEK by most state resource managers. This observation supports Ruheza and Kilungwe (2012), who noted that TEK is not yet widely applied in natural biodiversity monitoring and management decision-making. The indigenous people in the present study area chronicled a number of barriers hindering co-applications of the two ecological knowledge systems. These include non-documentation of TEK, superiority of Western science over TEK and prescription of science by training institutions. It is due to these constraints that there is inconsistent and ineffective collaboration between traditional and state institutions in biodiversity management.

The present study concludes by crafting a robust institutional and policy framework for the adaptive biotic resource co-management and environmental sustainability. This framework provides a broad overview, outline of interlinked components which support an adaptive co-management approach towards environmental sustainability. Once such a framework has been carefully designed, it is reusable at varied temporal-spatial scales and allows for monitoring and evaluation of both activities and results (Fabre et al 2012; Mwanza and Phiri 2013). The process of developing the framework was broken down in six phases: general considerations, status part, planning part, consultation process, implementation and plan revision (Figure 4.38). It provides a programme-level framework for managers to physically monitor the achievement of results and to periodically adjust relevant monitoring and activities when necessary. It should however be noted that the proposed framework is building on and strengthening the existing national institutional and policy framework (GoZ 2009).

Goal: to forge partnerships among state, local, nongovernmental and international players for collaborative management of natural resources and environmental sustainability.

Purpose: to integrate traditional and scientific knowledge systems as well as customary and modern governance systems for sustainable natural resource management.

Output: Improved natural resource management and environmental sustainability on communal lands.

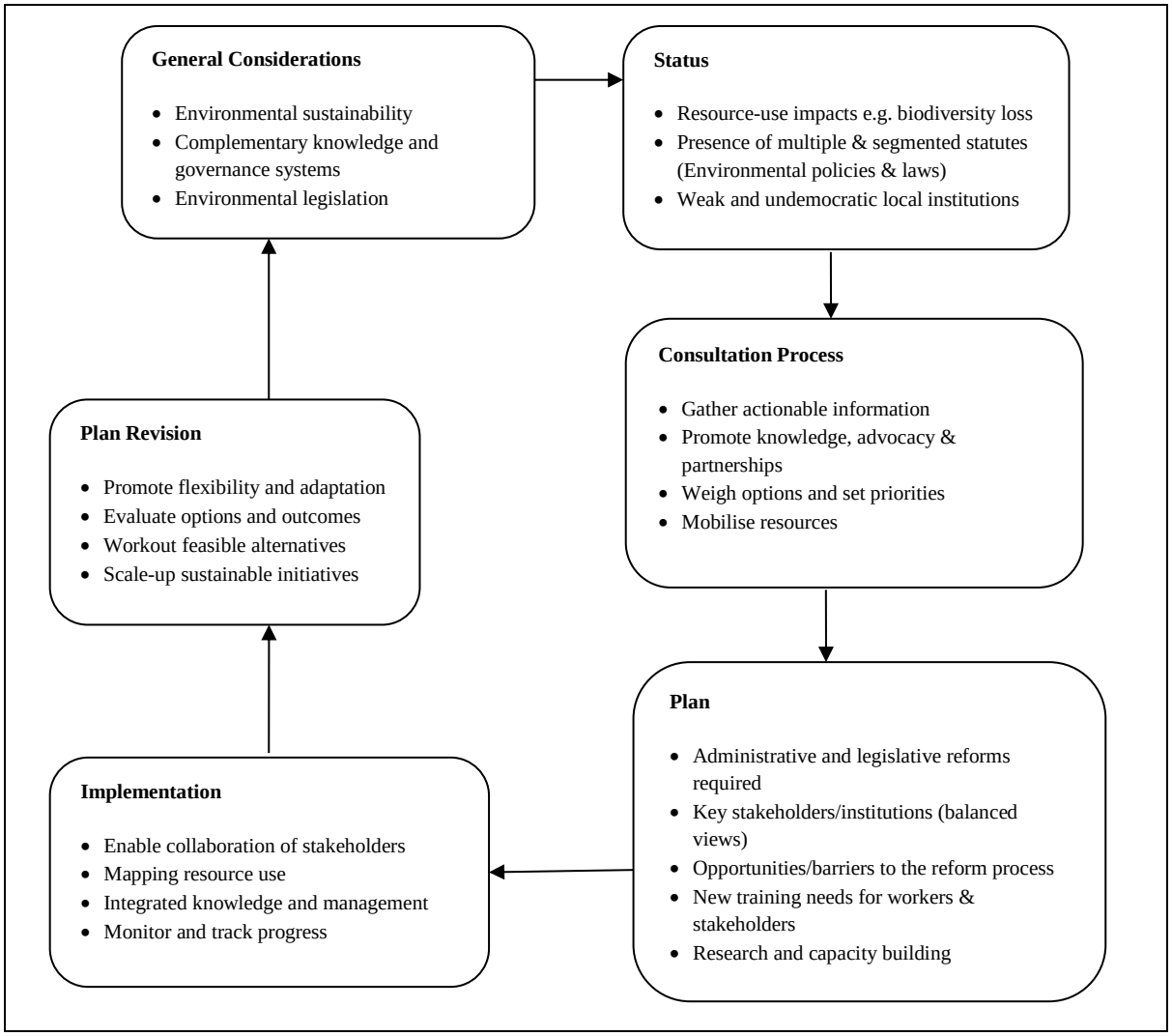

Figure 4.32: Institutional and Legislative Framework for Sustainability-based Environmental Management.

The suggested framework seeks to identify and prioritise institutions and laws that promote knowledge integration, biotic resource co-management and ecological sustainability. The new framework's overall goal is to bolster systematic integration of central planning and local community-led collaborative actions. The poor rural people suffer immensely due to continued environmental degradation and erosion of the natural capital base which subsequently rob them of their livelihoods (Department of Environment Food and Rural Affairs 2011, IFAD 2012). The failure to tap into the rich indigenous and Western scientific knowledge systems, technologies and practices as well as the segmented applications of the customary and modern governance approaches towards the management of biotic natural resources, has been globally condemned. The proposed framework is directed towards a revised approach that reconciles and make compatible the complementary knowledge systems and management approaches.

The stakeholders need to do an inventory of the natural and man-made resources they do have in communal lands. The effort would compel them to appreciate the significance of these resources in promoting rural livelihoods and ensuring environmental sustainability. Who are the main biotic resource users in communal lands? The framework identifies the impacts of biotic resource exploitation by the local people and assesses their severity. Which are the environmental laws regulating the exploitation and encouraging the conservation of biotic resources in communal lands of Zimbabwe? The Environmental Management Act (CAP 20:27 of 2002) is the denominator environmental law that has repealed and realigned a number of laws that have sought to promote the management of biotic resources albeit in some segmented and piecemeal approach. The laws that have been realigned include the Water Act, Communal Lands Forest Produce Act, Forest Act, Rural District Councils Act, National Parks and Wildlife Act, Traditional Leaders Act and others. However, the new framework is based on the need to forge partnerships, as well as ensuring inclusivity and participation by all stakeholder organisations so that the natural resource conservation statutes are popular among the local people and attract compliance. Again the local institutions, especially the traditional leadership, need to be capacitated, empowered and invigorated in order to be proactive in promoting more-productive and resilient ecosystems.

The proposed framework identifies specific administrative and legislative reforms required. The aim is to come up with balanced views from key institutions on how to avoid net biodiversity loss but rather attain net gain. The convergence of ideas, intent of purpose and collective effort shall both create opportunities and eradicate barriers to co-management. Where there are inadequacies or knowledge gaps, training programmes and workshops need to be provided. The scientists and community based organisations (CBOs) have to embark on research and capacity building programmes to generate actionable information. The best ideas need to be implemented in well-coordinated, resourced and supported priority programmes that seek to reconcile divergent approaches under a coherent management plan. The new environment should promote collaboration of stakeholders, who should view each other as natural partners in rural development discourse. Those tasked with implementing the priority programmes need to meticulously do resource inventory and mapping for enhanced management of biotic resources. The local people depend on TEK for action-oriented practices while state resource managers draw mainly from Western scientific knowledge. If not well coordinated, this may result in competing customary and modern management approaches (and missed opportunities). The new framework promotes integrated knowledge and management

for environmental sustainability. It is critical that the key players monitor and track progress in the status of both biodiversity and the abiotic environment. There should be flexibility among institutions, workers and local people to allow for the effective implementation of a co-management approach. In the event that some challenges are encountered or outcomes are undesirable in these processes, the new framework paves way for the swift crafting of some feasible alternatives that shall promote environmental sustainability.

4.6 Chapter Summary

The data collected from the study area were presented, analysed and paved way for the study main findings to be discussed. The main TEK practices, technologies and promoters were documented, while opportunities and barriers to the integration of the two knowledge systems were assessed. The study crafted an alternative administrative and legislative framework that seeks to promote collaborative management of biodiversity and ensure environmental sustainability. The study findings underscored that a holistic approach that integrates traditional and modern scientific ecological knowledge systems is unparalleled in guaranteeing sustainable biodiversity co-management on public lands. The last chapter summarises the main conclusions of the study and raises some recommendations to specific parties on the best way forward in as far as sustainable biodiversity management, enhancement of sustainable rural livelihoods and environmental sustainability are concerned.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.0 Summary of Findings

The overall goal for the study was to assess the feasibility of integrating traditional and scientific ecological knowledge systems in some practice-based approach to achieve sustainable biodiversity co-management in semi-arid communal areas of Zimbabwe. The purpose of the research was to document the key institutions, analyse renewable natural resource management approaches in use and proffer strategies for the adoption of some co-management approach towards biotic resources occurring in communal lands of Zimbabwe. In order to satisfy the study primary goal, a case study approach was used, focusing on communal lands of Masvingo province. Both quantitative and qualitative data were gathered using varied research instruments to allow for data corroboration and triangulation. The processing of results enabled some sound conclusions to be arrived at.

The study documented key traditional and scientific ecological knowledge practices common in Zimbabwe. The traditional ecological practices that were applauded for the conservation and safe harvesting of biotic resources are sacredness, customary laws, totems, rituals, taboos, selective harvesting, harvesting quotas, and local lore, among others. The rural societies have largely remained cohesive and built a shared understanding of the worldview and it is these attributes that account for the preservation of traditions. On the other hand, the formal system (modern science) relies on fines, environmental educational and awareness, jailing offenders, participatory planning and management, policing, competitions and in extreme cases, killing (poachers) for conservation. The general tendency in the study area was a segmented practice of the duo management approaches. The local people naturally respect the traditional institutions hence do not feel coerced to adopt the traditional governance system. However, the state natural resource managers, who seem to impose themselves on local communities, prefer using formal (science) knowledge and rarely combine it with local knowledge. The selective applications of the two knowledge systems prevalent in communal areas of Zimbabwe open up gaps often treacherously exploited by environmental offenders. The study noted the

unfortunate and faulty administrative and legislative framework which is rightfully blamed for environmental unsustainability.

The study established that Zimbabwe has a National Environmental Policy that offers a broad-based environmental management system. The policy is being implemented via a multiple environmental legislative system which when not carefully coordinated has demonstrated duplicity, antagonism and conflict over the years it has existed (1927 to date). In theory, various governmental and civic organisations at national, regional and local levels hold mandates relating to the environment. It is the findings of this study that the implementation of the sustainability-based environmental policy is riddled with challenges due to competing rather than complementary knowledge systems and institutions, selective applications of TEK and generally insufficient political will by various government agencies. The study noted the following limitations as hindering co-management of biotic resources in the study area:

- rigid civil servants who regard science to be superior to TEK hence prefer the former and treat it as prescribed;
- TEK is not documented, varies across cultures and is generally considered inferior to science;
- the exclusion of both traditional leadership and local people from decision making and benefit sharing processes which often activates resistance and sabotages from local stakeholder organisations. The local resource users are only included in conservation programmes as a window-dressing gesture, they actually have little voice and influence over the initiation and practical management of conservation programmes.

Invariably, the study also unveiled the following opportunities as available for the integration of the competing knowledge systems and management approaches:

- training of key players in the management of natural biotic resources;
- empowerment of traditional leadership and local people;
- public participation in decision making and benefit sharing;
- better coordination of institutions, state agencies workers and beneficiaries;
- capacity building initiatives to level the practicing field;
- committed budget to financially equip players to fund their management initiatives and activities.

It is after effectively dealing with the barriers and fully exploiting the opportunities for integration that sustainable biodiversity co-management can be attained. The study noted that

the challenges to integration were not invincible while opportunities were abound for the prudent integration of the two approaches to add to biodiversity co-management practice. What is required though is a couple of administrative and legislative reforms in the country at large and attitudinal adjustments amongst state workers and the local people in particular. The study came up with an institutional and legislative framework that is robust, flexible and largely facilitates the integration of the modern and traditional natural resource governance systems. The proposed framework aims to go beyond the abundant and positive rhetoric evident in the established administrative and legislative framework which is exceedingly riddled with barriers to real and successful implementation. Once improved upon and efficiently implemented, the suggested framework shall guide the country's management of natural biotic resources on communal lands into the future. The new framework would largely draw from the positives of the integrated institutional and landscape-scale approach to biodiversity management. This management approach benefits much from the close interconnectedness of institutions, land and biodiversity in the rural environment. It is this study's conclusion that the careful integration of the duo knowledge systems and management approaches encapsulates many of the greatest challenges facing 21st century natural resource conservation in the country and beyond.

5.1 Conclusions

Firstly, the present study aimed to assess the feasibility of integrating traditional and scientific ecological knowledge systems in some practical way for sustainable biodiversity co-management in semi-arid communal areas of Zimbabwe. The findings of the study are that there are more of opportunities for state resource managers and local communities to collaborate and combine traditional ecological knowledge and western science for sustainable biodiversity management than challenges. Already there is significant progress demonstrating willingness to integrate the two knowledge systems, as evidenced by the mainstreaming of indigenous knowledge systems in the Zimbabwe National Environment Policy. Again, state natural resource managers have spearheaded the formation of varied environment management committees in which members of the local communities are active players albeit in the day to day running of the conservation programmes but not in the decision-making and benefit sharing realms. However, the arrangement is weak in that the local communities who have lived alongside the natural resources for generations and generations are considered and treated as junior partners. Therefore the study concluded that with political will, it is feasible to integrate

TEK and Western science or traditional governance and modern scientific management approaches for the sustainable co-management of biodiversity on public lands.

Secondly, the study sought to compare key traditional and scientific management principles (approaches, concepts and methods) for sustainable biodiversity utilisation and conservation. The key traditional ecological knowledge systems used in the study area were mainly sacredness and traditional beliefs anchored in spirituality, use of totems, taboos, rituals, customary laws and selective harvesting. These methods derived authenticity from collectivism, respect of traditional authority and societal cohesion. On the other hand, the modern scientific management was mainly through 'command and control', whereby environmental education and awareness campaigns were formerly offered, and strict access laws were enacted for which environmental offenders were either fined or jailed. In recent days, the state agencies responsible for resource management have also facilitated the formation of environmental committees however with limited regulatory authorities. The study concluded that although there are significant differences between traditional and scientific management principles for sustainable biodiversity utilisation and conservation, both seek to guide local people to live in harmony with nature and guarantee sustainable livelihoods for the rural poor.

Thirdly, the study sought to analyse opportunities and barriers to bridging the divide between the two knowledge systems to enhance pragmatic co-management of biotic resources. The opportunities available for collaborative management were identified and included empowerment of and capacity building for local communities and traditional institutions, public participation, training and improved coordination. The establishment of environmental committees and the help derived from local environmental and developmental NGOs were positive and encouraging steps towards co-management and attainment of environmental sustainability. However, there were some obstacles that needed to be thoroughly dealt with if the two knowledge systems were to be co-applied for the benefit of the common property resources like biodiversity. The challenges identified were that TEK is considered inferior and undocumented, hence excluded from the curriculum given to trainee state resource managers. Also, Western science was regarded to be superior, well documented hence preferred by state resource managers. The study concluded that, notwithstanding the obstacles, indeed opportunities are available for the integration of the two knowledge systems to achieve pragmatic co-management of biotic resources on public lands.

Lastly, the study crafted an institutional and legislative framework that informs contemporary environmental policy decisions for adaptive biotic resources co-management and environmental sustainability. The suggested framework seeks to identify and prioritise institutions and laws that promote knowledge integration, biotic resource co-management and environmental sustainability while bolstering systematic integration of planning and actions. The framework allows for direct tapping by both local communities and state resource managers into the rich traditional and Western scientific ecological knowledge systems. The study concluded that if perfected and adopted, the new framework forges partnerships, as well as ensuring inclusivity and participation of all stakeholder organisations to promulgate natural resource conservation statutes which are popular among the local people and attract compliance.

5.2 Recommendations

The study forwards the following recommendations:

- the study noted that knowledge systems are complex and diverse, as such, researchers and environmental scientists need to do some further in-depth studies on the relevance of TEK in contemporary resource management systems. There is dire need to research, document, publish and teach local people about TEK in their areas and from other cultures as well. Such efforts culminate in the successful harnessing of a valuable resource that is being seriously threatened by oblivion.
- The local people and their traditional leadership should be proactive in the management of proximate biotic resources using appropriate technology. TEK need to be popularised as the appropriate technology for indigenous people and the functional way to improve governance of natural assets for the poor rural communities. Although TEK is threatened with little legitimacy within local communities, it however remains the ultimate tool for spearheading local, sustainable socio-economic development.
- The state natural resource managers and senior civil servants in ministries mandated with environmental management ought to solicit for a closer and fairer working relationship with the local people. Admittedly, civil servants have expert, professional and Western scientific ecological knowledge that is well proven; however, this should not be mistaken to imply that tribal people inhabiting communal lands are environmentally ignorant, uncaring and reckless. By instituting mechanisms of biodiversity co-management, the government raises the chances of success of most conservation initiatives in communal lands.

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APPENDICES

APPENDIX A: HOUSEHOLD QUESTIONNAIRE

The researcher, **Zinhiva Hardlife**, is a PhD student with UNISA. He is studying management of natural biological resources in communal lands of Zimbabwe in general and Masvingo province in particular. The research topic reads: **Feasibility of Integrating Traditional and Scientific Ecological Knowledge Systems for Sustainable Biodiversity Co-Management in Southeastern Zimbabwe: A Policy Perspective.** May you kindly help with information for the study by completing this questionnaire as accurately as is possible. The data collected shall be used for academic purposes only and treated with the highest possible confidentiality.

QUESTIONNAIRE NUMBER ☐

INTEGRATION OF TRADITIONAL AND SCIENTIFIC ECOLOGICAL KNOWLEDGE SYSTESMS – HOUSEHOLD SURVEY

IDENTIFICATION OF HOUSEHOLD

DISTRICT: 1=Bikita; 2=Chiredzi; 3= Chivi; 4=Gutu; 5=Mwenezi; 6=Masvingo; 7=Zaka ☐

HOUSEHOLD NUMBER:(assigned by researcher) ☐

HOUSEHOLD LOCATION COORDINATES: _____

_____

INTERVIEW STATUS: 1=Completed; 2=Refused; 3=Not at home

Date:	Time:	Status: ☐

SECTION A: INTERVIEWEE PERSONAL DATA

1. Sex: 1=Male; 2=Female ☐
2. Age: 1=Below 30years; 2=31-40years; 3=41-50years; 4=51-60years; 5=61^{+}years ☐
3. Marital Status: 1=Unmarried; 2=Married; 3=Cohabitating, 4=Divorced; 5=Separated; 6=Widowed; 7=Don't know ☐
4. Highest Educational Level Attained: 1=No formal schooling; 2=Primary; 3=secondary; 4=Tertiary ☐

5. Duration of stay in the district: 1=Below 10 years; 2= 11-30years; 3=31-50years; 4=51-70years; 5=71^{+}years 6. Occupation: 1=Formally employed; 2=Informally employed; 3=Self-employed; 4=Not employed Other (Specify): _____	☐

SECTION B: PERSONAL KNOWLEDGE AND INVOLVEMENT IN LOCAL BIOLOGICAL RESOURCES MANAGEMENT	
7. List biological resources which your local environment is endowed with. 1=grasses; 2=trees; 3=reptiles; 4=birds; 5=animals; 6=fish; 7=microorganisms; Other (Specify):…….	*Record responses by code(s).*
8. What benefits do you derive from the resources identified in (7)? 1=food; 2=building materials; 3=income/wealth; 4=fresh air; 5=aesthetics; Other (Specify):……	
9. Who authorises the use of these resources in your area? 1=traditional leaders; 2=RDC; 3=EMA; 4=forestry commission; 5=ZINWA; 6=Agritex; 7=Ward councillor; 8=DA; 9=ZRP Other (Specify):……..	
10. (a) Are you happy with the way these local resources are accessed and/or utilised? 1=Yes; 2=No	*If yes, answer 10(b) & if no, answer 10(c)*
(b) If yes, what is it that pleases you? 1=restricted access(clear user group); 2=users are strictly licensed; 3=everyone exercises self restraint; 4=authorities are firm and fair; 5=resources accorded self replenishment period Other (Specify):……..	
(c) If not, what is it that worries you? 1=free riders access/plunder; 2=users overharvest; 3=weak institutional authority; 4=weak laws/regulations; 5=poor coordination of control efforts Other (Specify):……..	*If yes, answer 11(b) & if no, answer 11(c)*
11. (a) Do you take an active part in the management of local biological resources in the district? 1=Yes; 2=No	
(b) Can you specify the roles that you play: 1=chase away free riders; 2=safe harvesting; 3=facilitate replenishment; 4=report offenders; 5=apprehend offenders; 6=partner authorities; 7=team up with others Other (specify):	

(d) What barriers are preventing you from participating? 1=ignorance; 2=not interested; 3=not important; 4=lack of expertise; 5=exclusion Other (Specify): _____ 12. (a) Which institutions are involved in the management of local biological resources? 1=Traditional leadership; 2=EMA; 3=Agritex; 4=RDC; 5=National Parks; 6=ZINWA; 7=Forestry Commission; 8=DA; 9=WADCO; 10=VIDCO; 11=NGOs Other (Specify): _____ *(Do not read out the options, mark the first five mentioned).* (b) Judging by level of involvement, rank the institutions identified in (a) in terms of importance. *(Allocate codes of 1(most important) up to 5 (not or least important) to the institutions identified in (a))* 13. Which of the identified institutions work closely with the local people? *(Rate them as 1=institution encourages wide and active participation, 5=institution has least or no community involvement.* 14. (a) In your own opinion, who should take a leading role in the management of proximate biological resources in communal lands? 1=local residents; 2=traditional leaders; 3=government natural resources managers; 4=DA; 5=RDC; 6=NGOs; 7=president Other (Specify):…….. (b) Give reason(s) for your opinion in (a) above. 1=close to resources; 2=have unparalleled knowledge/expertise/experience; 3=are naturally bestowed with authority; 4=have strict laws/regulations/control measures; 5=have resources; 6=command respect Other (Specify):…….	*(List down codes of identified institutions)* *(List down codes of identified institutions)* *Allow respondent to just state one.* ☐ *Record 1 reason* ☐

SECTION C: TRADITIONAL AND SCIENTIFIC MANAGEMENT PRINCIPLES

15. (a) Which methods were used in managing biological resources in pre-colonial Zimbabwe? 1=Totems; 2=Sacredness; 3=Folklore stories/proverbs; 4=Rituals; 5=Customary laws/rules; 6=Folk songs, dances and dramas; 7=Taboos/myths/beliefs; 8=Selective harvesting; 9=harvesting quotas and sanctions; Other (specify):…….. (b) Which of the methods identified in (a) are still being used in the district to date? *(List down the first five mentioned methods)* 16. What factors influence their continued use in your area? 1=strong social cohesion; 2=long duration of residing in same traditional lands; 3=respectful traditional leadership; 4=strong beliefs in ancestral	*(List down codes of identified methods)*

spirits; 5=they are well documented & popularised; 6=strong influences from civil elders; 7=government support; 8=NGOs support Other (Specify):……. 17. If not widely used, what factors influence limited utility? 1=modernisation; 2=demystification of traditional belief systems; 3=weak societal cohesion; 4=weak traditional authority; 5=Christianity; 6=denigration from science Other (Specify):…….. 18. In your own opinion, how effective are these methods in the management of proximate biological resources? 1=very effective; 2=satisfactory; 3=not effective *(record a single response)* 19. Who is responsible for enforcing traditional ecological management principles? 1=local residents; 2=traditional leaders; 3=RDC; 4=DA; 5=councillor; 6=government natural resources managers Others (Specify):…….... 20. a) Which management strategies are being used by government natural resources managers to enforce environmental stewardship? 1=fines; 2=jailing offenders; 3=shoot-to-kill/killing for conservation; 4=environmental awareness campaigns; 5=environmental education; 6=competitions; 7=policing; 8=participatory *(record first five)* Other (specify):…….. 21. Who are responsible for enforcing these strategies? 1=government natural resources managers; 2=DA; 3=RDC; 4=traditional leaders; 5=environmental committees; 6=local residents Other (specify):…….. 22. How effective are these strategies in the management of biological resources in communal lands? 1=very effective; 2=satisfactory; 3=not effective *(record a single response)* 23. What factors influence the wide usage of these strategies in communal lands? 1=powerful government authorities; 2=strong local traditional leadership; 3=well meaning environmental policies and laws; 4=modernity; 5=cooperating local residents Other (Specify):…….. 24. What factors influence limited adoption of scientific management strategies? 1=resistance of top down approach; 2=rigid government natural resources managers; 3=sabotage by local residents; 4=exclusion of local leadership Other (Specify):…….. 25. (a) Do we have instances when both strategies are co-applied to biological resources management? 1=Yes; 2=No (b) If yes, please rate the frequency of co-applications of the two approaches to biological resources management. 1=always; 2=sometimes; 3=rarely; 4=never; 5=do not know (c) If not, what in your opinion makes the two approaches	*Single response*

incompatible? 1=science is superior; 2=traditional is inferior; 3=traditional is not documented; 4=science is prescribed by authorities; 5=varied cultures; 6=resource managers privilege scientific knowledge Other (Specify):……..	

SECTION D: OPPORTUNITIES FOR INTEGRATING THE TWO GOVERNANCE SYSTEMS

26. How often have the traditional leadership teamed up with government natural resources managers to enforce environmental conservation programmes? 1=always; 2=frequently; 3=rarely; 4=never; 5=do not know	*(list the ratings)*
27. What is it that needs to be done to facilitate collaborative management of environmental resources? 1=training of participants; 2=empowerment of traditional leaders; 3=public participation; 4=better coordination of institutions, 5=committed budget; 6=capacity building Other(specify):……..	*(List down codes of identified strategies)*
28. Identify some resource management committees that are operational in your communities. 1=VIDCO; 2=WARDCO; 3=NGO initiatives; EMA initiatives; 4=ZFC initiatives; 5=ZINWA initiatives; 6=ZimParks initiatives; 7=Agritex initiatives Other (specify):…….....	*(List committees)*
29. What empowerment programmes have been initiated in the district to mainstream traditional ecological knowledge in the conservation of biological resources? 1=natural resources management short courses; 2=community based natural resources management (CBNRM); 3=equitable sharing of benefits from successful conservation initiatives; 4=participatory appraisal; 5=partnering government natural resources managers; 6=competitions in proximate natural resources conservation initiatives Other (specify)……	*(record codes)*
30. Identify common ground for the two governance systems.1=both advocate for safe harvesting rate; 2=both have restrictive laws/rules for access and use; 3=both have unique authorities that direct activities; 4=both deal with contemporary environmental issues Other (Specify):……..	

SECTION E: CHALLENGES IN MARRYING THE DUO KNOWLEDGES

31. Which are the major threats to natural biological resources in your area? 1=population growth; 2=climate change; 3=poaching; 4=free	*(List down codes of identified threats)*

riders; 5=commercialisation; 6=uncoordinated management; 7=sabotaging; 8=corruption Others (specify):…….	*(List down codes of identified strategies)*
32. Which strategies are best in mitigating the challenges to biological resources identified in 30? 1=birth control; 2=resettlement; 3=strict control; 4=local participation; 5=co–management; 6=education Other (specify):…….	(*List down codes of identified weaknesses)*
33. What weaknesses do you note in the traditional governance of proximate natural biological resources? 1=no written regulations; 2=unauthentic traditional leaders; 3=demystification of traditional practices and belief systems; 4=corruption; 5=ignorance of terms of reference; 6=incompetent leaders Other (specify):…….....	(*List codes of identified factors)*
34. What factors influence the utility of traditional ecological knowledge in proximate natural biological resources management? 1=dying cultural practices; 2=no records of TEK; 3=urbanisation; 4=globalisation; 5=Christian values and beliefs; 6=limited spatial and temporal scales; 7=weak traditional institutions Other (specify):…….....	(*List down codes of identified weaknesses)*
35. What are the weaknesses of the modern governance system in natural resources management? 1=weak policies and laws; 2=poorly equipped resource managers; 3=corruption; 4=exclusive use of scientific knowledge; 5=multiple government agencies; 6=few government officials Other (specify):…….	(*List codes of identified factors)*
36. What factors influence government natural resources managers' choices of conservation strategies to use? 1=availability of policy and legislation; 2=local culture; 3=nature of professional training; 4=institutional arrangement; 5=sources of knowledge Other (specify):……..	

SECTION F: INSTITUTIONAL AND POLICY REFORMS (CO-MANAGEMENT FRAMEWORK)

37. What are your views on the contemporary natural resources management framework in your area? 1=competitive system in place; 2=weak system in place; 3=dominance of traditional over modern system; 4=dominance of	

modern over traditional system; 5=perfect collaboration between traditional and modern: 6=imperfect collaboration between the duo Other (specify):……. 38. What weaknesses are apparent in the contemporary resource management framework in the province? 1=uncoordinated institutions; 2=incapacitation of institutions; 3=contradicting legislation; 4=poorly manned work stations; 5=parallel governance systems in natural resources Other (specify):…….. 39. What is it that needs to be done to ensure effective management of proximate biological resources? 1=coordinated institutions; 2=capacitating institutions; 3=overarching environment policy; 4=adequately resourced work stations; 5=allow for CBNRM Other (specify):…….. 40. What natural resource policy and institutions need to be put in place to attain long term conservation efforts and environmental sustainability? 1=incorporate traditional knowledge, practices and technologies; 2=encourage documentation and use of traditional ecological methods; 3=encourage scientific research that reflects on attitudes and experiences of indigenous people; 4=state natural resources managers who respect and consult with local resource users and custodians; Other (Specify):…….	

APPENDIX B: THEMES FOR FOCUS GROUP DISCUSSIONS

1. Who are the most active stakeholders in the management of biological resources native in your area?
2. Which government departments or natural resources agencies are active in your area?
3. The traditional institutional framework has been heralded as key in the stewardship of proximate biological resources in the pre-colonial era. Using a 10 point scale, rate the effectiveness of the traditional institution through these historical eras:
   - Pre-colonial (1890 and before)
   - Colonial (1890 – 1962)
   - Liberation struggle (1963 – 1979)
   - Post independence (1980 -1999)
   - Post independence (2000 – to date)
4. a) Lets list down the traditional methods that have been used through generations to manage native biological resources.
   b) lets comment on their effectiveness.
5. a) Which of these methods are still being used to day?
   b) Lets comment on their effectiveness.
6. a) Comment on the influence of the white colonial governance system on the long established traditional management system in natural biological resources management.
   b) Identify the pieces of legislation that have been used to manage natural biological resources.
7. a) What relationship existed between the colonial government natural resources managers and the traditional leadership?
   b) What is the relationship between post independence government natural resources managers and traditional leaders?
8. a) Identify common ground for the two governance systems (on which issues do the two naturally find each other?)
   b) What is it that facilitate the shared vision or brings the two institutions together?
9. a) Do government natural resources managers use any traditional ecological method in their extension services?
   b) If yes, list all the methods that are utilised.
   c) If no, suggest reasons why they desist from using these.
10. What challenges are encountered in marrying the two governance systems in biological resources?
11. Suggest strategies and institutional frameworks for collaborative environmental management.
12. Considering the environmental legislative framework in place, what is it that you wish could read differently or improve?
13. What is the future of biological resources management in the country?

APPENDIX C: INTERVIEW SCHEDULE FOR EMA DISTRICT OFFICIAL

1. There are a number of pieces of legislation that seek to conserve natural biological resources in the country, can you name those you know.
2. How far has EMA achieved the integration of these legislative frameworks and forge working and professional relationships with other state agencies that are mandated to manage biological resources?
3. As an environmental public watchdog, how have you incorporated local communities into your conservation programmes?
4. List strategies in place that ensure active participation of local stakeholders in the management of proximate biological resources.
5. How do you interface with the traditional leadership in the communities you operate?
6. a) Do you use some traditional ecological methods to foster environmental stewardship?
   b) If yes to (a), list the traditional ecological methods that you use.
7. a) Do you face any challenges in teaming up with traditional leadership of communities in which you practice?
   b) If yes to (a), enumerate these challenges.
8. What strategies or institutional framework do you suggest should be in place to ensure both traditional and scientific governance systems in natural biological resources are relevant?
9. What is the future of biological resources management in the country?

APPENDIX D: INTERVIEW SCHEDULE FOR TRADITIONAL LEADERSHIP

1. In the pre-colonial era, traditional leadership ensured societal cohesion and good environmental stewardship. What made that possible?
2. a) Which traditional methods were used in the management of natural biological resources?
   b) How effective were they and why?
3. a) Which of these methods are still being used in your area of jurisdiction?
   b) How effective are these methods now and why?
4. What has happened to your authority through history? (Trace this from the pre-colonial, colonial, liberation struggle, post independence eras).
5. How has your relationship been with government departments involved in biological resources management in your area of jurisdiction?
6. How have your relationship been like with your subjects?
7. a) Give an account of your present roles as the custodian of the environment.
   b) Are you satisfied with your present roles as an institution in the conservation of the environment?
8. What are your suggestions on improving the contemporary institutional framework in the management of proximate natural biological resources?
9. What is the future of biological resources management in the country?

APPENDIX E: INTERVIEW SCHEDULE FOR WARD COUNCILLOR/AGRITEX DISTRICT OFFICIAL/DISTRICT ADMINISTRATOR/FORESTRY COMMISSION/ZINWA/NATIONAL PARKS AUTHORITY

1. Which institutions are involved in the management of proximate natural biological resources in your ward/area?
2. Comment on the working relationships among the institutions that you have identified.
3. a) Do you also actively participate in the conservation of environmental resources?
   b) If yes, what are your roles?
4. If we are to consider government versus traditional institutions in proximate natural biological resources, which one do you think should have exclusive autonomy and why?
5. How do you rate the effectiveness of traditional methods used in management of environmental biological resources?
6. How do you also rate the effectiveness of environmental legislations in ensuring environmental health?
7. How do you envisage the teaming up of traditional and state institutions in collaborative management of biodiversity?
8. What institutional framework do you propose for effective and sustainable management of natural biological resources at the local scale?
9. What is the future of biological resources management in the country?